Dawood Public School
Course Outline 2017-18
Physics
Class IX

Books:

Pople, S. 2001. Fundamental Physics, GCSE edition, Oxford University Press
Chew, C. et al. 2000. GCE 'O' Level Physics (2 ed), Singapore; Marshal Cavendish Education

Introduction:

This syllabus provides a comprehensive set of progressive learning objectives for Physics.
It has been designed to support students in becoming:

• **confident**in working with information and ideas – their own and those of others
• **responsible**for themselves, responsive to and respectful of others
• **reflective**as learners, developing their ability to learn
• **innovative**and equipped for new and future challenges
• **engaged** intellectually and socially, ready to make a difference.

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. 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, organise and present information clearly and logically, using appropriate scientific terms and conventions,
- stimulate interest in and care for the local and global environment.
- promote awareness that:
- The study and practice of science are co-operative and cumulative activities, that 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 objectives:

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

- scientific instruments and apparatus, including techniques of operation and aspects of safety;
- scientific quantities and their determination;
- scientific and technological applications with their social, economic and environmental implications.
- manipulate numerical and other data;
- use information to identify patterns, report trends and draw inferences;
- present reasoned explanations for phenomena, patterns and relationships;
- make predictions and hypotheses;
- solve problems.
- carry out techniques, use apparatus, handle measuring devices and materials effectively and safely;
- make and record observations, measurements and estimates with due regard to precision, accuracy and units;
- interpret, evaluate and report upon observations and experimental data;
- identify problems, plan and carry out investigations, including the selection of techniques, apparatus,
- measuring devices and materials;
- evaluate methods and suggest possible improvements.

The assessment objectives describe the knowledge, skills and abilities that students are expected to demonstrate at the end of the course. They reflect those aspects of the aims that are assessed.

Weighting of assessment objectives
Theory papers (Papers 1 and 2)
Knowledge with understanding is weighted at approximately 65% of the marks for each paper, with approximately half allocated to recall.
Handling information and solving problems is weighted at approximately 35% of the marks for each paper.
Practical assessment (Papers 3 and 4)
This is designed to test appropriate skills in assessment objective and will carry approximately 20% of the marks for the qualification.

Monthly Syllabus

MONTH	CHAPTERS	DURATION
AUGUST	• Physical Quantities, Units and Measurement • Vectors and Scalars • Past papers • Practical	1 week 2 week
SEPTEMBER	• Kinematics • Dynamics • Past Papers • Practical	3 weeks 1 week
OCTOBER	• Mass, Weight and Density • Turning Effect of Forces • Deformation • Past papers • Practical	1 week 2 weeks 1 week
NOVEMBER	• REVISION FOR MID TERM EXAMS	
	Mid Term Exams	
JANUARY	• Energy, Energy Sources and Transfer of Energy • Pressure • Past papers • Practical	3 weeks 1 week
FEBRUARY	• Pressure • Kinetic Model of Matter (Gas Laws) • Past papers • Practical	2 weeks 2 weeks
MARCH	• Kinetic Model of Matter (Gas Laws) • Past papers • Practical	2 weeks
APRIL	• REVISION FOR FINAL TERM EXAMS • Past Papers	
MAY	**Final Term Exams**	

Syllabus Content

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1. Physical Quantities, Units and Measurement

Text Books

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

Fundamental Physics for Cambridge O level by Stephen Pople, Unit 1, Pg No. (9 - 24)

Fundamental Physics for Cambridge O level by Stephen Pople, Unit 2.11, Pg No. (46 - 48)

Content

1.1 Scalars and vectors

1.2 Measurement techniques

1.3 Units and symbols

Learning outcomes

Candidates 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) recognise and use the conventions and symbols contained in 'Signs, Symbols and Systematics', Association for Science Education, 2000.

Enhancement

- Use and describe the use of a mechanical method for the measurement of a small distance (including use of a micrometer screw gauge)
- Measure and describe how to measure a short interval of time (including the period of a pendulum)
- Demonstrate an understanding of the difference between scalars and vectors and give common examples
- Add vectors by graphical representation to determine a resultant
- Determine graphically the resultant of two vectors

Suggested activities

- Students use micrometer to find the volume of a regular solid
- Students will determine the time period of pendulum at different lengths and plot the graph between length and time period

Reference Books

- Preliminary Course Physics 1 by Michael Andriessens Graeme Lofts
- Duncan, Tom; GCSE Physics, John Murray;

2. Kinematics
Text Books:
GCE O Level Physics by Charles Chew ,Unit 2, Pg No.(16-33)
Fundamental Physics for Cambridge O level by Stephen Pople, Unit 2.01-2.05, Pg No.(25 -36)

Content

2.1 Speed, velocity and acceleration

2.2 Graphical analysis of motion

2.3 Free-fall

Learning outcomes

Candidates 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) *recognise 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 m / s2.

i) describe qualitatively the motion of bodies with constant weight falling with and without air resistance (including reference to terminal velocity).

Enhancement

• Distinguish between speed and velocity

• Recognise linear motion for which the acceleration is constant and calculate theacceleration

• Recognise motion for which the acceleration is not constant

• Describe qualitatively the motion of bodies falling in a uniform gravitational field with and without air resistance (including reference to terminal velocity)

Suggested Activities

• Students will use paper cones of different size and weight to find relation between time of fall and surface area

• Students will determine the relation between time of fall and height

Reference Books

• Pople, Stephen (2nd Edition)GCSE Edition, Explaining Physics, Oxford University Press; Unit1.2-1.4,Pg No.(12 -20)

• Preliminary Course Physics 1 by Michael Andreessen Graeme Lofts

• Duncan, Tom; GCSE Physics, John Murray;

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3. Dynamics

GCE O Level Physics by Charles Chew, Unit 3, Pg No. (36-52)
Fundamental Physics for Cambridge O level by Stephen Pople, Unit 2.06 -2.08 Pg No.(21 - 36
                                                                Unit 2.12, Pg No (48 – 50)

Content
3.1 Balanced and unbalanced forces
3.2 Friction
3.3 Circular motion

Learning outcomes
Candidates should be able to:
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, 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.

Enhancement
•   Demonstrate the acceleration
•   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.)

Suggested activities
•   Students will demonstrate Newton's First Law of Motion.
•   Students will demonstrate difference between balanced and unbalanced forces.

Reference Books
•   Pople, Stephen(2nd Edition)GCSE Edition, Explaining Physics, Oxford University Press; Unit 1.5-1.9, Pg No.(21 - 36)
•   Preliminary Course Physics 1 by Michael Andreessen Graeme Lofts
•   Duncan, Tom; GCSE Physics, John Murray;

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4. Mass, Weight and Density
GCE O Level Physics by Charles Chew, Unit 4, Pg No.(54-64)
Fundamental Physics for Cambridge O level by Stephen Pople, Unit 1.06, 2.09, Pg No.(20 -21, 42-43

Content
4.1 Mass and weight
4.2 Gravitational fields
4.3 Density

Learning outcomes
Candidates should be able to:
a) state that mass is a measure of the amount of substance in a body.
b) state that the 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.

Enhancement
• Demonstrate an understanding that mass is a property that 'resists' change in motion
• Describe, and use the concept of, weight as the effect of a gravitational field on amass
• Describe the determination of the density of an irregularly shaped solid by the method of displacement, and make the necessary calculation

Suggested activities
• Students will perform experiment to find density of a regular solid
• Students will perform experiment to find out the density of irregular solid.
• Students will perform the experiment to find out the density of liquid.
• Students will demonstrate experiments to explain inertia

Reference Books
• Pople, Stephen (2nd Edition) GCSE Edition, Explaining Physics, Oxford University Press; Unit 1.1, 1.6, 3.1, Pg No.(9, 24 -27, 90-93)
• Preliminary Course Physics 1 by Michael Andreessen Graeme Lofts
• Duncan, Tom; GCSE Physics, John Murray;

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5. Turning Effect of Forces

GCE O Level Physics by Charles Chew, Unit 5, Pg No. (65-77)
Fundamental Physics for cambridge O level by Stephen Pople, Unit 3.01-3.03, Pg No. (53 - 59)

Content
5.1 Moments
5.2 Centre of mass
5.3 Stability

Learning Outcomes

Candidates 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.

Enhancement

• Perform and describe an experiment(involving vertical forces) to show that there is no net moment on a body in equilibrium
• Apply the idea of opposing moments to simple systems in equilibrium
• Perform and describe an experiment to find the centre of mass of irregular and regular objects

Suggested Activities

• Students will perform the experiment to verify principle of moment
• Students will determine the centre of gravity of a lamina

Reference Books

• Pople, Stephen (2nd Edition)GCSE Edition, Explaining Physics, Oxford University Press; Unit 2.1-2.3, Pg No. (50 - 60)
• Preliminary Course Physics 1 by Michael Andreessen Graeme Lofts
• Duncan, Tom; GCSE Physics, John Murray;

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6. Deformation

GCE O Level Physics by Charles Chew, Unit 1, Pg No. (1-14)
Fundamental Physics for Cambridge O level by Stephen Pople, Unit 3.04, Pg No. (60 -61)

Content

6.1 Elastic deformation

Learning outcomes

Candidates 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) *recognise the significance of the term "limit of proportionality" for an elastic solid.
d) calculate extensions for an elastic solid using proportionality.

Reference Books

• Pople, Stephen(2nd Edition)GCSE Edition, Explaining Physics, Oxford University Press; Unit 2.4, Pg No. (61 -63)
• Preliminary Course Physics 1 by Michael Andreessen Graeme Lofts
• Duncan, Tom; GCSE Physics, John Murray;

Enhancement
• Interpret extension/load graphs
• State Hooke's Law and recall and use the expression F = k x
• Recognise the significance of the term 'limit of proportionality' for an extension/load graph
• Recall and use the relation between force, mass and acceleration (including the direction)
• Describe qualitatively motion in a curved path due to a perpendicular force(F = mv ^{2}/r is not required)

Suggested activities
• Students will perform the experiment to find relation between load and extension.

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7. Pressure

GCE O Level Physics by Charles Chew,   Unit 7, Pg No.(98-111)
Fundamental Physics for Cambridge O level by Stephen Pople, Unit 3.05 – 3.10Pg No.(62 - 72)

Content
7.1 Pressure
7.2 Pressure changes

Learning outcomes
Candidates 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 = ρgh.
(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 p1V1 = p2V2.

Enhancement
• Recall and use the equation p = F/A
• Recall and use the equation p = hρg

Suggested activities
• Students will show how the change in atmospheric pressure can affect the movement of the object using egg, bottle and burning paper,
• Students show how height of liquid effects the pressure of liquid using bottle with holes and water.
• Students will watch the video on hydraulic car brake system
• Link: https://www.youtube.com/watch?v=VxLTDtaRCZk

Reference Books

- Pople, Stephen(2nd Edition)GCSE Edition, Explaining Physics, Oxford University Press; Unit 3.2 – 3.4, Pg No.(94 – 103,105,110)
- Preliminary Course Physics 1 by Michael Andreessen Graeme Lofts
- Duncan, Tom; GCSE Physics, John Murray;

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8. Energy Sources and Transfer of Energy

GCE O Level Physics by Charles Chew,   Unit 6, Pg No.(79-95)
Fundamental Physics by Stephen Pople, Unit 4 ,Pg No.(77 – 92)

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

Learning outcomes
Candidates should be able to:
(a) list the different forms of energy with examples in which each form occurs.
(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 is given by $E_k = \frac{1}{2}mv^2$ and that gravitational potential energy is given by $E_P = mgh$, 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) describe the process of electricity generation and draw a block diagram of the process from fuel input to electricity output.
(h) discuss the environmental issues associated with power generation.
(i) calculate work done from the formula work = force × distance moved in the line of action of the force.
(j) calculate the efficiency of an energy conversion using the formula efficiency = energy converted to the required form/total energy input.
(k) discuss the efficiency of energy conversions in common use, particularly those giving electrical output.
(l) discuss the usefulness of energy output from a number of energy conversions.
(m) calculate power from the formula power = work done/time taken.

Enhancement
- Recall and use the expressions k.e. = $\frac{1}{2} mv^2$ and p.e. = mgh
- Show an understanding that energy is released by nuclear fusion in the Sun
- Recall and use the equation: efficiency = energy output/ energy input × 100%

- Describe energy changes in terms of work done
- Recall and use $\Delta W = Fd = \Delta E$
- Recall and use the equation $P = E/t$ in simple systems

Reference Books
- Pople, Stephen (2nd Edition) GCSE Edition, Explaining Physics, Oxford University Press; Unit 3.2 – 3.4, Pg No.(94 – 103,105,110)
- Preliminary Course Physics 1 by Michael Andreessen Graeme Lofts
- Duncan, Tom; GCSE Physics, John Murray;

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9. Kinetic Model of Matter

GCE O Level Physics by Charles Chew, Unit 9, Pg No. (130-139)
Fundamental Physics for Cambridge O level by Stephen Pople, Unit 5.01, Unit 5.04 – 5.05, Pg No.(98-99, 104- 107)

Content
9.1 States of matter
9.2 Molecular model
9.3 Evaporation

Learning outcomes
Candidates 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.
(d) explain the pressure of a gas in terms of the motion of its molecules.
(e) describe evaporation in terms of the escape of more energetic molecules from the surface of a liquid.
(f) describe how temperature, surface area and draught over a surface influence evaporation.
(g) explain that evaporation causes cooling.

Enhancement
- Relate the properties of solids, liquids and gases to the forces and distances between molecules and to the motion of the molecules
- Show an appreciation that massive particles may be moved by light, fast-moving molecules
- Recall and use the equation pV= constant at constant temperature
- Show an appreciation of the relative order of magnitude of the expansion of solids, liquids and gases
- Demonstrate an understanding of how temperature, surface area and draught over a surface influence evaporation

Reference Books
- Pople, Stephen(2nd Edition)GCSE Edition, Explaining Physics, Oxford University Press; Unit 4.1,4.2, 4.4-4.6 , Pg No.(116 – 121, 126 - 139)
- Preliminary Course Physics 1 by Michael Andreessen Graeme Lofts
- Duncan, Tom; GCSE Physics, John Murray;

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.

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 +1 mm or perhaps + 0.3 mm
   - **Times**   Stopwatches measure to + 0.01s but you can't press them that accurately,

     Likely error is   + 0.1s.
   - **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 + 0.02   and B = 6.0 + 0.1

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

A+B = 8.34 + 0.12 = 8.3 + 0.1
B-A = 3.64 + 0.12 = 3.6 + 0.1

B/A = 2.56 %error = %error in A +%error in B
                 =   1   +   1.5
                 =   2.5%
actual error in B/A = 2.56 * 2.5/100 = 0.06

so B/A = 2.56 + 0.06

B.A = 14.04, again to 2.5%, which is 2.5*14.04/100 = 0.4
B.A = 14.0 + 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.

Formulae for Relationships Between Physical Quantities

The relationship below will not be provided for candidates either in the form given or in rearranged form.

the relationship between speed, distance and time:
speed = dis/time

the relationship between force, mass and acceleration:
force = mass × acceleration
acceleration = change in velocity / time

the relationship between density, mass and volume:
density = mass / volume

the relationship between force, distance and work:
work done = force × distance moved in direction of force

the energy relationships:
energy transferred = work done
kinetic energy = ½ × mass × speed^2
change in potential energy = mass × gravitational field strength × change inheight

the relationship between mass, weight and gravitational field strength:
weight = mass × gravitational field strength

the relationship between an applied force, the area over which it acts and the resulting pressure:
pressure = force / area

the relationship between the moment of a force and its distance from the pivot:
moment = force × perpendicular distance from pivot

the relationships between charge, current, voltage, resistance and electricalpower:
charge = current × time
voltage = current × resistance
electrical power = voltage × current

the relationship between speed, frequency and wavelength:
wave speed = frequency × wavelength

Glossary of terms

The glossary will prove helpful to students as a guide but it is not exhaustive. The glossary has been deliberately kept brief, not only with respect to the numbers of terms included but also to the descriptions of their meanings. Students should appreciate that the meaning of a term must depend, in part, on its context.

1. Define (the term(s) …) is intended literally. Only a formal statement or equivalent paraphrase, such as the defining equation with symbols identified, being required.

2. Explain what is meant by … normally implies that a definition should be given, together with some relevant comment on the significance or context of the term(s) concerned, especially where two or more terms are included in the question. The amount of supplementary comment intended should be interpreted in the light of the indicated mark value.

3. State implies a concise answer with little or no supporting argument, e.g. a numerical answer that can be obtained 'by inspection'.

4. List requires a number of points with no elaboration. Where a given number of points is specified, this should not be exceeded.

5. Describe requires students to state in words (using diagrams where appropriate) the main points of the topic. It is often used with reference either to particular phenomena or to particular experiments. In the former instance, the term usually implies that the answer should include reference to (visual) observations associated with the phenomena. The amount of description intended should be interpreted in the light of the indicated mark value.

6. Discuss requires candidates to give a critical account of the points involved in the topic.

7. Deduce implies that students are not expected to produce the required answer by recall but by making a logical connection between other pieces of information. Such information may be wholly given in the question or may depend on answers extracted in an earlier part of the question.

8. Suggest is used in two main contexts. It may either imply that there is no unique answer or that candidates are expected to apply their general knowledge to a 'novel' situation, one that formally may not be 'in the syllabuses.

9. Calculate is used when a numerical answer is required. In general, working should be shown.

10. Measure implies that the quantity concerned can be directly obtained from a suitable measuring instrument, e.g. length, using a rule, or angle, using a protractor.

11. Determine often implies that the quantity concerned cannot be measured directly but is obtained by calculation, substituting measured or known values of other quantities into a standard formula, e.g. the Young modulus, relative molecular mass.

12. Show is used when an algebraic deduction has to be made to prove a given equation. It is important that the terms being used by candidates are stated explicitly.

13. Estimate implies a reasoned order of magnitude statement or calculation of the quantity concerned. Students should make such simplifying assumptions as may be necessary about points of principle and about the values of quantities not otherwise included in the question.

14. Sketch, when applied to graph work, implies that the shape and/or position of the curve need only be qualitatively correct. However, students should be aware that, depending on the context, some quantitative aspects may be looked for, e.g. passing through the origin, having an intercept, asymptote or discontinuity at a particular value. On a sketch graph it is essential that students clearly indicate what is being plotted on each axis. Sketch, when applied to diagrams, implies that a simple, freehand drawing is acceptable: nevertheless, care should be taken over proportions and the clear exposition of important detail.

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)
- Avison, John, The World of Physics, Thomas Nelson & Sons Ltd
- Arnold, Brain, Longman GCSE Physics, Pearson education ltd

Websites:

- www.focuseducational.com
- www.crocodile-clips.com