

**Dawood Public School**  
**Course Outline 2020-21**  
**Cambridge O Level Physics 5054**  
**Grade X**

**Text 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

Month	Content	DURATION
<b>August</b>	• Thermal Properties of Matter Heat and Specific Heat Capacity, Melting and Boiling	2 weeks
	• Transfer of Thermal Energy Conduction, Convection, Radiation	1 week
	• Past Papers	
	• Practicals	
<b>September</b>	• Transfer of Thermal Energy	1 week
	• Light (Reflection and Refraction)	2 weeks
	• Past Papers	1 week
	• Practicals	
<b>October</b>	• Light (Reflection and Refraction)	1 week
	• Light (Converging Lens)	2 weeks
	• Electromagnetic Spectrum	1 week
	• Past Papers	
	• Practicals	
<b>November</b>	<b>Revision for Mid-Year Examination</b> <b>Past papers</b>	
<b>December</b>	<b>MID YEAR EXAMINATION</b>	
<b>January</b>	• General Wave Properties	3 weeks
	• Sound	1 week
	• Past Papers	
	• Practicals	
<b>February</b>	• Sound	1 week
	• Static Electricity	2 weeks
	• Past Papers	1 week
	• Practicals	
<b>March</b>	<b>Revision for Mock Examination</b>	
	<b>MOCK EXAMINATION</b>	

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

Assessment:

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

<b>Paper 1</b>	<b>Multiple Choice</b>	<b>1 hour</b>
40 compulsory multiple choice questions of the direct choice type. The questions involve four response items.		
<b>40 marks</b>		

<b>Paper 2</b>	<b>Theory</b>	<b>1 hour 45 minutes</b>
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 <b>two</b> 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.		
<b>75 marks</b>		

<b>Paper 4</b>	<b>Alternative to Practical</b>	<b>1 hour</b>
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.		
<b>30 marks</b>		

## **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 develop knowledge and understanding for:

- 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.

**Additional Resources:**

- 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

**Online Resources:**

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



## Monthly Course Distribution

### August

#### 1. Thermal Properties of Matter

GCE O Level Physics by Charles Chew, Unit 10, 11, Pg No. (141 - 149) & (151 - 170)

Explaining Physics by Stephen Pople, Unit 4.10 - 4.13, Pg No. (144 - 159)

#### Content

2.1 Specific heat capacity

2.2 Melting and boiling

2.3 Thermal expansion of solids, liquids and gases

#### Learning outcomes

*Students should be able to:*

- Describe a rise in temperature of a body in terms of an increase in its internal energy (random thermal energy).
- Define the terms *heat capacity* and *specific heat capacity*.
- Calculate heat transferred using the formula  $thermal\ energy = mass \times specific\ heat\ capacity \times change\ in\ temperature$ .
- Describe melting/solidification and boiling/condensation in terms of energy transfer without a change in temperature.
- State the meaning of *melting point* and *boiling point*.
- Explain the difference between boiling and evaporation.
- Define the terms *latent heat* and *specific latent heat*.
- Explain latent heat in terms of molecular behaviour.
- Calculate heat transferred in a change of state using the formula  $thermal\ energy = mass \times specific\ latent\ heat$ .
- Describe qualitatively the thermal expansion of solids, liquids and gases.
- Describe the relative order of magnitude of the expansion of solids, liquids and gases.
- List and explain some of the everyday applications and consequences of thermal expansion.
- Describe qualitatively the effect of a change of temperature on the volume of a gas at constant pressure.

#### Enhancement

- Show an appreciation of the relative order of magnitude of the expansion of solids, liquids and gases.
- Describe an experiment to measure the specific heat capacity of a substance.
- Distinguish between boiling and evaporation.
- Use the terms latent heat of vaporization and latent heat of fusion and give a molecular interpretation of latent heat.
- Describe an experiment to measure specific latent heats for steam and for ice.

#### Reference Books

- Pople Stephen, Fundamental Physics for Cambridge O level, Oxford University Press; Unit 5.04, 5.09 - 5.11, Pg No.(104 - 105, 116 - 119)
- Sang, David, Physics 1 & 2, Cambridge University Press
- Duncan, Tom ,GCSE Physics, John Murray
- Abbott, A.F., Physics, Heinemann Educational

#### Learning Resources:

Heat capacity:

[http://chemwiki.ucdavis.edu/Physical\\_Chemistry/Thermodynamics/Calorimetry/Heat\\_Capacity](http://chemwiki.ucdavis.edu/Physical_Chemistry/Thermodynamics/Calorimetry/Heat_Capacity)

Specific heat capacity:

[www.bbc.co.uk/schools/gcsebitesize/science/aqa/heatingandcooling/buildingsrev3.shtml](http://www.bbc.co.uk/schools/gcsebitesize/science/aqa/heatingandcooling/buildingsrev3.shtml)

[www.youtube.com/watch?v=BclB8UaSH4g](http://www.youtube.com/watch?v=BclB8UaSH4g)

Melting and boiling:

[www.bbc.co.uk/schools/gcsebitesize/science/ocr\\_gateway\\_pre\\_2011/energy\\_home/0\\_heating\\_houses2.shtml](http://www.bbc.co.uk/schools/gcsebitesize/science/ocr_gateway_pre_2011/energy_home/0_heating_houses2.shtml)

<https://sites.google.com/site/gcserevision12/physics/physics-1/melting-and-boiling>

Evaporation and boiling:

<http://hyperphysics.phy-astr.gsu.edu/hbase/kinetic/vappre.html#c2>

Vaporisation:

<http://hyperphysics.phy-astr.gsu.edu/hbase/thermo/phase2.html>

<http://olevelphysicsblog.blogspot.co.uk/2010/11/latent-heat.html>

Latent heat:

[www.cyberphysics.co.uk/Q&A/KS4/SHC/questionsSHC\\_GCSE.html](http://www.cyberphysics.co.uk/Q&A/KS4/SHC/questionsSHC_GCSE.html)

[www.bbc.co.uk/bitesize/standard/physics/energy\\_matters/heat\\_in\\_the\\_home/revision/3/](http://www.bbc.co.uk/bitesize/standard/physics/energy_matters/heat_in_the_home/revision/3/)

Specific latent heat:

[www.s-cool.co.uk/a-level/physics/temperature-and-thermal-properties/revise-it/specific-latent-heat](http://www.s-cool.co.uk/a-level/physics/temperature-and-thermal-properties/revise-it/specific-latent-heat)

<http://physicsnet.co.uk/a-level-physics-as-a2/thermal-physics/thermal-energy/>

## August-September

### 2. Transfer of Thermal Energy

GCE O Level Physics by Charles Chew, Unit 12, Pg No. (172-188)

Explaining Physics by Stephen Pople, Unit 4.8-4.9, 5.12, Pg No. (140 - 143, 208 - 209)

#### Content

- 3.1 Conduction
- 3.2 Convection
- 3.3 Radiation
- 3.4 Total transfer

#### Learning outcomes

*Students should be able to:*

- Describe how to distinguish between good and bad conductors of heat.
- Describe, in terms of the movement of molecules or free electrons, how heat transfer occurs in solids.
- Describe convection in fluids in terms of density changes.
- Describe the process of heat transfer by radiation.
- Describe how to distinguish between good and bad emitters and good and bad absorbers of infra-red radiation.
- Describe how heat is transferred to or from buildings and to or from a room.
- State and explain the use of the important practical methods of thermal insulation for buildings.

#### Enhancement

- Give a simple molecular account of heat transfer in solids.
- Describe experiments to show the properties of good and bad emitters and good and bad absorbers of infra-red radiation.

- Describe how heat is transferred to or from buildings and to or from a room.

**Reference Books**

- Pople Stephen, Fundamental Physics for Cambridge O level, Oxford University Press; Unit 5.06 - 5.08, Pg No.(108 - 113)
- Sang, David, Physics 1 & 2, Cambridge University Press
- Duncan, Tom ,GCSE Physics, John Murray
- Abbott, A.F., Physics, Heinemann Educational

**Learning Resources:**

Heat transfer:

[www.lanly.com/heating.htm](http://www.lanly.com/heating.htm)  
[www.mansfieldct.org/schools/mms/staff/hand/convcondrad.htm](http://www.mansfieldct.org/schools/mms/staff/hand/convcondrad.htm)  
[www.bbc.co.uk/schools/gcsebitesize/science/aqa\\_pre\\_2011/energy/heatrev1.shtml](http://www.bbc.co.uk/schools/gcsebitesize/science/aqa_pre_2011/energy/heatrev1.shtml)

Thermal conduction:

<http://phun.physics.virginia.edu/topics/thermal.html>  
[www.youtube.com/watch?v=XbOQCIGHaZE](http://www.youtube.com/watch?v=XbOQCIGHaZE)

Conduction by molecules:

[www.schoolphysics.co.uk/age11-14/glance/Heat%20energy/Conduction\\_of\\_heat/index.html](http://www.schoolphysics.co.uk/age11-14/glance/Heat%20energy/Conduction_of_heat/index.html)

Convection:

[www.bbc.co.uk/schools/gcsebitesize/science/aqa\\_pre\\_2011/energy/heatrev1.shtml](http://www.bbc.co.uk/schools/gcsebitesize/science/aqa_pre_2011/energy/heatrev1.shtml)  
[www.youtube.com/watch?v=6sAFtRQS9XY](http://www.youtube.com/watch?v=6sAFtRQS9XY)

IR radiation:

[www.gcse.com/energy/radiation.htm](http://www.gcse.com/energy/radiation.htm)  
[www.bbc.co.uk/schools/gcsebitesize/science/aqa/heatingandcooling/heatingrev1.shtml](http://www.bbc.co.uk/schools/gcsebitesize/science/aqa/heatingandcooling/heatingrev1.shtml)

Absorption/emission:

<http://hyperphysics.phy-astr.gsu.edu/hbase/thermo/absrad.html>

Insulation:

[www.bbc.co.uk/bitesize/standard/physics/energy\\_matters/heat\\_in\\_the\\_home/revision/1/](http://www.bbc.co.uk/bitesize/standard/physics/energy_matters/heat_in_the_home/revision/1/)  
[www.school-for-champions.com/science/thermal\\_insulation.htm](http://www.school-for-champions.com/science/thermal_insulation.htm)

**September - October**

<p><b>3. Light</b></p> <p>GCE O Level Physics by Charles Chew, Unit 14 &amp; 15, Pg No.(206-226) &amp; (228-238)  Explaining Physics by Stephen Pople, Unit 5.1- 5.7, Pg No. (166 -190)</p>
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**Content**

- 4.1 Reflection of light
- 4.2 Refraction of light
- 4.3 Thin converging and diverging lenses

**Learning outcomes**

*Students should be able to:*

- Define the terms used in reflection including *normal*, *angle of incidence* and *angle of reflection*.
- Describe an experiment to illustrate the law of reflection.



- Describe an experiment to find the position and characteristics of an optical image formed by a plane mirror.
- State that for reflection, the angle of incidence is equal to the angle of reflection and use this in constructions, measurements and calculations.
- Define the terms used in refraction including *angle of incidence*, *angle of refraction* and *refractive index*.
- Describe experiments to show refraction of light through glass blocks.
- Do calculations using the equation  $\sin i / \sin r = \text{constant}$ .
- Define the terms *critical angle* and *total internal reflection*.
- Describe experiments to show total internal reflection.
- Describe the use of optical fibres in telecommunications and state the advantages of their use.
- Describe the action of thin lenses (both converging and diverging) on a beam of light.
- Define the term *focal length*.
- \*Draw ray diagrams to illustrate the formation of real and virtual images of an object by a converging lens, and the formation of a virtual image by a diverging lens.
- Define the term *linear magnification* and \*draw scale diagrams to determine the focal length needed for particular values of magnification (converging lens only).
- Describe the use of a single lens as a magnifying glass and in a camera, projector and photographic enlarger and draw ray diagrams to show how each forms an image.
- Draw ray diagrams to show the formation of images in the normal eye, a short-sighted eye and a long-sighted eye.
- Describe the correction of short-sight and long-sight.

#### Enhancement

- Perform simple constructions, measurements and calculations.  
\*Experiment to verify Reflection of light.
- Recall and use the definition of refractive index  $n$  in terms of speed.
- Recall and use the equation  $\sin i / \sin r = n$ .
- Describe the action of optical fibres particularly in medicine and communications technology.  
\*Experiment to find the refractive index.
- Draw ray diagrams to illustrate the formation of a virtual image by a single lens.
- Use and describe the use of a single lens as a magnifying glass.  
\*Experiment to find focal length of the lens.

#### Reference Books

- Pople Stephen, Fundamental Physics for Cambridge O level, Oxford University Press; Unit 7.01 - 7.10, Pg No. (139 - 159)
- Arnold.Brian Woolley.Steve, Longman GCSE Physics Pearson Education Ltd;
- Avison.John,The World Of Physics, Thomas Nelson & Sons Ltd;
- Sang, David, Physics 1 & 2, Cambridge University Press
- Duncan, Tom ,GCSE Physics, John Murray

#### Learning Resources:

Law of reflection:

<http://hyperphysics.phy-astr.gsu.edu/hbase/phyopt/fermat.html>

Diffuse and specular reflection:

[www.khanacademy.org/science/physics/waves-and-optics/v/specular-and-diffuse-reflection](http://www.khanacademy.org/science/physics/waves-and-optics/v/specular-and-diffuse-reflection)

Experiment:

[www.youtube.com/watch?v=9aWE4rDw\\_ks](http://www.youtube.com/watch?v=9aWE4rDw_ks)

Plane mirror images:

[www.youtube.com/watch?v=2ek0EsEMTBc](http://www.youtube.com/watch?v=2ek0EsEMTBc)  
[www.youtube.com/watch?v=A8AfxcUNvYw](http://www.youtube.com/watch?v=A8AfxcUNvYw)

Refraction:

[www.youtube.com/watch?v=OdcHCRF00jM](http://www.youtube.com/watch?v=OdcHCRF00jM)  
[www.bbc.co.uk/bitesize/higher/physics/radiation/refraction/revision/1/](http://www.bbc.co.uk/bitesize/higher/physics/radiation/refraction/revision/1/)

Reflection and refraction:

[https://www.o2learn.co.uk/o2\\_video.php?vid=398](https://www.o2learn.co.uk/o2_video.php?vid=398)

Total internal reflection:

[www.cyberphysics.co.uk/topics/light/TIR.htm](http://www.cyberphysics.co.uk/topics/light/TIR.htm)  
[www.youtube.com/watch?v=PrEF9UN98cE](http://www.youtube.com/watch?v=PrEF9UN98cE)

Critical angle:

[www.youtube.com/watch?v=CF7CJb8XQHw](http://www.youtube.com/watch?v=CF7CJb8XQHw)

Fish-eye view:

[www.physicsclassroom.com/mmedia/optics/bp.cfm](http://www.physicsclassroom.com/mmedia/optics/bp.cfm)

Retroreflectors:

[www.youtube.com/watch?v=ktqWZZydijY](http://www.youtube.com/watch?v=ktqWZZydijY)

Optical fibres:

[www.bbc.co.uk/schools/gcsebitesize/science/edexcel\\_pre\\_2011/waves/sendinginformationrev1.shtml](http://www.bbc.co.uk/schools/gcsebitesize/science/edexcel_pre_2011/waves/sendinginformationrev1.shtml)  
[www.cyberphysics.co.uk/topics/light/FiberOptics/FibreOptics.htm](http://www.cyberphysics.co.uk/topics/light/FiberOptics/FibreOptics.htm)

Converging lenses:

[www.physicsclassroom.com/class/refrn/u14l5da.cfm](http://www.physicsclassroom.com/class/refrn/u14l5da.cfm)  
[http://dev.physicslab.org/Document.aspx?dNovtype=3&filename=GeometricOptics\\_ConvergingLenses.xml](http://dev.physicslab.org/Document.aspx?dNovtype=3&filename=GeometricOptics_ConvergingLenses.xml)  
[www.youtube.com/watch?v=b2h7lc2epWA](http://www.youtube.com/watch?v=b2h7lc2epWA)

Focal length:

[www.youtube.com/watch?v=AoGDOT6U9pQ](http://www.youtube.com/watch?v=AoGDOT6U9pQ)  
<http://hyperphysics.phy-astr.gsu.edu/hbase/geoopt/foclen.html>

Image formation:

[www.nuffieldfoundation.org/practical-physics/image-formation-lens](http://www.nuffieldfoundation.org/practical-physics/image-formation-lens)  
[www.physicsclassroom.com/class/refrn/u14l5c.cfm](http://www.physicsclassroom.com/class/refrn/u14l5c.cfm)

Linear magnification:

<http://hyperphysics.phy-astr.gsu.edu/hbase/geoopt/lensdet.html>  
[www.youtube.com/watch?v=ZJn7nSPe9\\_Y](http://www.youtube.com/watch?v=ZJn7nSPe9_Y)

Magnifying glass:

[www.physics.pomona.edu/sixideas/labs/LRM/LR07.pdf](http://www.physics.pomona.edu/sixideas/labs/LRM/LR07.pdf)

Camera:

<http://science.howstuffworks.com/camera1.htm>  
[www.schoolphysics.co.uk/age11-14/Light/text/Camera/index.html](http://www.schoolphysics.co.uk/age11-14/Light/text/Camera/index.html)

Enlarger:

<http://en.wikipedia.org/wiki/Enlarger>

The eye:

[www.physicsclassroom.com/class/refrn/u14l6a.cfm](http://www.physicsclassroom.com/class/refrn/u14l6a.cfm)

[www.cyberphysics.co.uk/topics/medical/Eye/eye.html](http://www.cyberphysics.co.uk/topics/medical/Eye/eye.html)

Short sight:

[www.physicsclassroom.com/class/refrn/u14l6e.cfm](http://www.physicsclassroom.com/class/refrn/u14l6e.cfm)

[www.youtube.com/watch?v=AsKeu4wm3XI](http://www.youtube.com/watch?v=AsKeu4wm3XI)

Long sight:

[www.cyberphysics.co.uk/topics/medical/Eye/sightCorrection.html](http://www.cyberphysics.co.uk/topics/medical/Eye/sightCorrection.html)

[www.youtube.com/watch?v=AsKeu4wm3XI](http://www.youtube.com/watch?v=AsKeu4wm3XI)

Correcting problems:

[www.bbc.co.uk/health/physical\\_health/conditions/visionproblems1.shtml](http://www.bbc.co.uk/health/physical_health/conditions/visionproblems1.shtml)

Prisms:

[www.physicsclassroom.com/class/refrn/u14l4a.cfm](http://www.physicsclassroom.com/class/refrn/u14l4a.cfm)

[www.youtube.com/watch?v=NU2r-ECmPr4](http://www.youtube.com/watch?v=NU2r-ECmPr4)

Rainbows:

[www.cord.edu/faculty/manning/physics215/studentpages/genamahlen.html](http://www.cord.edu/faculty/manning/physics215/studentpages/genamahlen.html)

<http://eo.ucar.edu/rainbows/>

## October

### 4. Electromagnetic Spectrum

GCE O Level Physics by Charles Chew, Unit 13, Pg No. (199 - 201)

Explaining Physics by Stephen Pople, Unit 5.8, 5.10 -5.11, Pg No. (191 - 194, 200 - 209)

### Content

5.1 Dispersion of light

5.2 Properties of electromagnetic waves

5.3 Applications of electromagnetic waves

### Learning outcomes

*Students should be able to:*

- Describe the dispersion of light as illustrated by the action on light of a glass prism.
- State the colours of the spectrum and explain how the colours are related to frequency/wavelength.
- State that all electromagnetic waves travel with the same high speed in air and state the magnitude of that speed.
- Describe the main components of the electromagnetic spectrum.
- Discuss the role of the following components in the stated applications:
  - Radio waves – radio and television communications,
  - microwaves – satellite television and telephone,
  - infra-red – household electrical appliances, television controllers and intruder alarms,
  - light – optical fibres in medical uses and telephone,
  - ultra-violet – sunbeds, fluorescent tubes and sterilisation,
  - X-rays – hospital use in medical imaging and killing cancerous cells, and engineering applications such as detecting cracks in metal,
  - gamma rays – medical treatment in killing cancerous cells, and engineering applications such as detecting cracks in metal.

### Enhancement

- State the approximate value of the speed of electromagnetic waves.
- Use the term monochromatic.

### Reference Books

- Pople Stephen, Fundamental Physics for Cambridge O level, Oxford University Press; Unit 7.11 - 7.13, Pg No.(160 - 164)
- Sang, David, Physics 1 & 2, Cambridge University Press
- Abbott, A.F., Physics , Heinemann Educational

### Learning Resources:

The electromagnetic spectrum:

[http://imagine.gsfc.nasa.gov/docs/science/known\\_l1/emspectrum.html](http://imagine.gsfc.nasa.gov/docs/science/known_l1/emspectrum.html)

[www.bbc.co.uk/learningzone/clips/the-electromagnetic-spectrum/10676.html](http://www.bbc.co.uk/learningzone/clips/the-electromagnetic-spectrum/10676.html)

<http://scienceaid.co.uk/physics/waves/emspectrum.html>

Uses of e.m. radiation:

[www.s-cool.co.uk/gcse/physics/uses-of-waves/revise-it/electromagnetic-spectrum](http://www.s-cool.co.uk/gcse/physics/uses-of-waves/revise-it/electromagnetic-spectrum)

[www.youtube.com/watch?v=snNwE6ttxP0](http://www.youtube.com/watch?v=snNwE6ttxP0)

### November

Revision for Mid-Year Examination

### December

Mid-Year Examination

### January

#### 5. General Wave Properties

GCE O Level Physics by Charles Chew, Unit 13, Pg No. (190 - 204)

Explaining Physics by Stephen Pople, Unit 5.9, Pg No. (195 - 199)

### Content

6.1 Describing wave motion

6.2 Wave terms

6.3 Wave behaviour

### Learning outcomes

*Students should be able to:*

- Describe what is meant by wave motion as illustrated by vibrations in ropes and springs and by experiments using a ripple tank.
- State what is meant by the term *wavefront*.
- Define the terms *speed*, *frequency*, *wavelength* and *amplitude* and do calculations using  $velocity = frequency \times wavelength$ .
- Describe transverse and longitudinal waves in such a way as to illustrate the differences between them.
- Describe the use of a ripple tank to show
  - reflection at a plane surface

- refraction due to a change of speed at constant frequency
- Describe simple experiments to show the reflection and refraction of sound waves.

### Enhancement

- Recall and use the equation  $v = f\lambda$ .
- Interpret reflection, refraction and diffraction using wave theory.

### Reference Books

- Pople Stephen, Fundamental Physics for Cambridge O level, Oxford University Press; Unit 6.01 - 6.02, Pg No. (123 - 127)
- Rnold. Brian Woolley. Steve, Long man GCSE Physics Pearson Education Ltd;
- Avison. John, The World of Physics, Thomas Nelson & Sons Ltd;
- Sang, David, Physics 1 & 2, Cambridge University Press
- Duncan, Tom ,GCSE Physics, John Murray

### Learning Resources:

Waves:

[www.kettering.edu/~drussell/Demos/waves/wavemotion.html](http://www.kettering.edu/~drussell/Demos/waves/wavemotion.html)

[www.youtube.com/watch?v=JXaVmUvwxww](http://www.youtube.com/watch?v=JXaVmUvwxww)

[www.bbc.co.uk/schools/gcsebitesize/science/add\\_ocr\\_pre\\_2011/wave\\_model/whatarewavesrev1.shtml](http://www.bbc.co.uk/schools/gcsebitesize/science/add_ocr_pre_2011/wave_model/whatarewavesrev1.shtml)

Ripple tanks simulation:

[www.falstad.com/ripple/](http://www.falstad.com/ripple/)

Longitudinal waves:

[www.bbc.co.uk/schools/gcsebitesize/science/aqa/waves/generalwavesrev2.shtml](http://www.bbc.co.uk/schools/gcsebitesize/science/aqa/waves/generalwavesrev2.shtml)

[www.youtube.com/watch?v=f66syH8B9D8](http://www.youtube.com/watch?v=f66syH8B9D8)

[www.youtube.com/watch?v=aguCWnbRETU](http://www.youtube.com/watch?v=aguCWnbRETU)

Transverse waves:

[www.youtube.com/watch?v=AtlxBODxWHc](http://www.youtube.com/watch?v=AtlxBODxWHc)

[www.youtube.com/watch?v=P0Fi1VcbpAI](http://www.youtube.com/watch?v=P0Fi1VcbpAI)

Wave formula:

[www.gcse.com/waves/wave\\_speed.htm](http://www.gcse.com/waves/wave_speed.htm)

Wave parts:

[www.bbc.co.uk/schools/gcsebitesize/science/aqa\\_pre\\_2011/radiation/anintroductiontowavesrev2.shtml](http://www.bbc.co.uk/schools/gcsebitesize/science/aqa_pre_2011/radiation/anintroductiontowavesrev2.shtml)

[www.physicsclassroom.com/class/waves/u10l2c.cfm](http://www.physicsclassroom.com/class/waves/u10l2c.cfm)

Ripple tank reflection:

[www.schoolphysics.co.uk/age11-14/Wave%20properties/text/Waves\\_in\\_a\\_ripple\\_tank/index.html](http://www.schoolphysics.co.uk/age11-14/Wave%20properties/text/Waves_in_a_ripple_tank/index.html)

[www.youtube.com/watch?v=HFckyHq594I](http://www.youtube.com/watch?v=HFckyHq594I)

Ripple tank refraction:

[www.youtube.com/watch?v=stdi6XJX6gU](http://www.youtube.com/watch?v=stdi6XJX6gU)

Refraction:

[www.nuffieldfoundation.org/practical-physics/marching-model-refraction](http://www.nuffieldfoundation.org/practical-physics/marching-model-refraction)

[www.youtube.com/watch?v=Tyzci1qTVL8](http://www.youtube.com/watch?v=Tyzci1qTVL8)

## 6. Sound

GCE O Level Physics by Charles Chew, Unit 16, Pg No. (240 - 257)

Explaining Physics by Stephen Pople, Unit 5.13-5.14, Pg No. (210 - 216)

### Content

7.1 Sound waves

7.2 Speed of sound

7.3 Ultrasound

### Learning outcomes

*Students should be able to:*

- Describe the production of sound by vibrating sources.
- Describe the longitudinal nature of sound waves and describe compression and rarefaction.
- State the approximate range of audible frequencies.
- Explain why a medium is required in order to transmit sound waves and describe an experiment to demonstrate this.
- Describe a direct method for the determination of the speed of sound in air and make the necessary calculation.
- State the order of magnitude of the speeds of sound in air, liquids and solids.
- Explain how the loudness and pitch of sound waves relate to amplitude and frequency.
- Describe how the reflection of sound may produce an echo.
- Describe the factors which influence the quality (timbre) of sound waves and how these factors may be demonstrated using a cathode-ray oscilloscope (c.r.o.).
- Define *ultrasound*.
- Describe the uses of ultrasound in cleaning, quality control and pre-natal scanning.

### Enhancement

- Describe compression and rarefaction.
- State the order of magnitude of the speed of sound in air, liquids and solids.

### Reference Books

- Fundamental Physics for Cambridge O level by Stephen Pople, Unit 6.03 – 6.06, Pg No. (128 - 135)
- Rnold. Brian Woolley. Steve, Longman GCSE Physics Pearson Education Ltd;
- Avison. John, The World Of Physics, Thomas Nelson & Sons Ltd;
- Sang, David, Physics 1 & 2, Cambridge University Press
- Duncan, Tom, GCSE Physics, John Murray
- Abbott, A.F., Physics , Heinemann Educational

### Learning Resources:

Production of sound:

[www.bbc.co.uk/learningzone/clips/understanding-sound-and-vibrations/1604.html](http://www.bbc.co.uk/learningzone/clips/understanding-sound-and-vibrations/1604.html)

[www.youtube.com/watch?v=MFLeGJclQil](http://www.youtube.com/watch?v=MFLeGJclQil)

Guitar strings:

[www.youtube.com/watch?v=v-sARWEXReY](http://www.youtube.com/watch?v=v-sARWEXReY)

Drum:

[www.youtube.com/watch?v=v4ELxKKT5Rw](http://www.youtube.com/watch?v=v4ELxKKT5Rw)

Sound and the ear:

[www.bbc.co.uk/science/humanbody/body/factfiles/hearing/hearing\\_animation.shtml](http://www.bbc.co.uk/science/humanbody/body/factfiles/hearing/hearing_animation.shtml)  
<http://hyperphysics.phy-astr.gsu.edu/hbase/sound/ear.html>

Loudness:

[www.engineeringinteract.org/resources/oceanodyssey/flash/concepts/loudness.htm](http://www.engineeringinteract.org/resources/oceanodyssey/flash/concepts/loudness.htm)  
[www.youtube.com/watch?v=8i6hTU0jw-g](http://www.youtube.com/watch?v=8i6hTU0jw-g)

Hearing test (this will only work with loudspeakers of appropriate quality):

[www.youtube.com/watch?v=1yzrx84QWqI](http://www.youtube.com/watch?v=1yzrx84QWqI)

Sound pitch, frequency and amplitude:

[www.youtube.com/watch?v=irqfGYD2UKw](http://www.youtube.com/watch?v=irqfGYD2UKw)

Sound waves:

[www.youtube.com/watch?v=27a26e2CnuM](http://www.youtube.com/watch?v=27a26e2CnuM)  
[www.physicsclassroom.com/class/sound/](http://www.physicsclassroom.com/class/sound/)

Bell jar experiment:

[www.gcse.com/waves/sound2.htm](http://www.gcse.com/waves/sound2.htm)  
[www.youtube.com/watch?v=ce7AMJdq0Gw](http://www.youtube.com/watch?v=ce7AMJdq0Gw)

Speed of sound:

[www.sv.vt.edu/classes/ESM4714/Student\\_Proj/class95/physics/speed.html](http://www.sv.vt.edu/classes/ESM4714/Student_Proj/class95/physics/speed.html)  
[www.youtube.com/watch?v=1Er6v\\_c43I](http://www.youtube.com/watch?v=1Er6v_c43I)

Reflection in sound:

[www.bbc.co.uk/learningzone/clips/the-reflection-of-sound-to-produce-an-echo/1609.html](http://www.bbc.co.uk/learningzone/clips/the-reflection-of-sound-to-produce-an-echo/1609.html)

Refraction in sound:

[www.acs.psu.edu/drussell/Demos/refract/refract.html](http://www.acs.psu.edu/drussell/Demos/refract/refract.html)  
[www.youtube.com/watch?v=eHZJFa055Xo](http://www.youtube.com/watch?v=eHZJFa055Xo)

Speed of sound in materials:

[www.absorblearning.com/physics/demo/units/DJFPh083.html#Howfastissound?](http://www.absorblearning.com/physics/demo/units/DJFPh083.html#Howfastissound?)  
[www.physicsclassroom.com/class/sound/u11l2c.cfm](http://www.physicsclassroom.com/class/sound/u11l2c.cfm)

Timbre:

[www.youtube.com/watch?v=BLoM9bBr8lc](http://www.youtube.com/watch?v=BLoM9bBr8lc)  
[www.animations.physics.unsw.edu.au/jw/sound-pitch-loudness-timbre.htm](http://www.animations.physics.unsw.edu.au/jw/sound-pitch-loudness-timbre.htm)

Uses of ultra sound:

[www.odec.ca/projects/2003/guilh3m/public\\_html/use.html](http://www.odec.ca/projects/2003/guilh3m/public_html/use.html)  
<http://wanttoknowit.com/uses-of-ultrasound/>  
[www.youtube.com/watch?v=tluzGhzg7Ks](http://www.youtube.com/watch?v=tluzGhzg7Ks)

February

## 7. Current Electricity

GCE O Level Physics by Charles Chew, Unit 18, Pg No.(276-299)  
Explaining Physics by Stephen Pople, Unit 6.4 – 6.6, Pg No. (242 -252)

## Content

2.1 Current

2.2 Electromotive force

2.3 Potential difference

2.4 Resistance

## Learning outcomes

*Candidates should be able to:*

- State that a current is a flow of charge and that current is measured in amperes.
- Do calculations using the equation  $charge = current \times time$ .
- Describe the use of an ammeter with different ranges.
- Explain that electromotive force (e.m.f.) is measured by the energy dissipated by a source in driving a unit charge around a complete circuit.
- State that e.m.f. is work done/charge.
- State that the volt is given by  $J / C$ .
- Calculate the total e.m.f. where several sources are arranged in series and discuss how this is used in the design of batteries.
- Discuss the advantage of making a battery from several equal voltage sources of e.m.f. arranged in parallel.
- State that the potential difference (p.d.) across a circuit component is measured in volts.
- State that the p.d. across a component in a circuit is given by the work done in the component/charge passed through the component.
- Describe the use of a voltmeter with different ranges.
- State that  $resistance = p.d./current$  and use the equation  $resistance = voltage/current$  in calculations.
- Describe an experiment to measure the resistance of a metallic conductor using a voltmeter and an ammeter and make the necessary calculations.
- State Ohm's law and discuss the temperature limitation on Ohm's law.
- \*use quantitatively the proportionality between resistance and the length and the cross-sectional area of a wire.
- Calculate the net effect of a number of resistors in series and in parallel.
- Describe the effect of temperature increase on the resistance of a resistor and a filament lamp and draw the respective sketch graphs of current/voltage.
- Describe the operation of a light-dependent resistor.

## Enhancement

- Show understanding that a current is a rate of flow of charge and recall and use the equation  $I = Q/t$ .
- Distinguish between the direction of flow of electrons and conventional current.
- Show understanding that e.m.f. is defined in terms of energy supplied by a source in driving charge round a complete circuit.
- Recall and use quantitatively the proportionality between resistance and length, and the inverse proportionality between resistance and cross-sectional area of a wire.

## Reference Books

- Pople, Stephen, Fundamental Physics for Cambridge O level, Oxford University Press; Unit 8.04 - 8.08, Pg No. (176 - 185)
- Arnold. Brian Woolley. Steve, Longman GCSE Physics Pearson Education Ltd; Chap 1, 2, Pg No. 1
- Avison. John, The World Of Physics, Thomas Nelson & Sons Ltd; Chap 12, Pg No 220
- Sang, David, Physics 1 & 2, Cambridge University Press
- Duncan, Tom ,GCSE Physics, John Murray



**Learning Resources:**

Electric current:

<http://hyperphysics.phy-astr.gsu.edu/hbase/electric/elecur.html>  
[www.physicsclassroom.com/class/circuits/u9l2c.cfm](http://www.physicsclassroom.com/class/circuits/u9l2c.cfm)  
[www.bbc.co.uk/schools/ks3bitesize/science/energy\\_electricity\\_forces/electric\\_current\\_voltage/revis\\_e1.shtml](http://www.bbc.co.uk/schools/ks3bitesize/science/energy_electricity_forces/electric_current_voltage/revis_e1.shtml)

Current and charge:

[www.youtube.com/watch?v=AlkT78RRM5Q](http://www.youtube.com/watch?v=AlkT78RRM5Q)  
<http://physicsnet.co.uk/a-level-physics-as-a2/current-electricity/charge-current-potential-difference/>

Using a multimeter:

[www.dNovronics.co.uk/meter.htm](http://www.dNovronics.co.uk/meter.htm)  
[www.youtube.com/watch?v=bF3OyQ3HwfU](http://www.youtube.com/watch?v=bF3OyQ3HwfU)

Difference between e.m.f and p.d:

[www.nuffieldfoundation.org/practical-physics/potential-difference-and-emf](http://www.nuffieldfoundation.org/practical-physics/potential-difference-and-emf)

Energy and voltage:

[www.bbc.co.uk/bitesize/higher/physics/elect/energy\\_volts/revision/3/](http://www.bbc.co.uk/bitesize/higher/physics/elect/energy_volts/revision/3/)  
<http://hyperphysics.phy-astr.gsu.edu/hbase/electric/elevol.html>

P.d:

[www.physicsclassroom.com/class/circuits/u9l1c.cfm](http://www.physicsclassroom.com/class/circuits/u9l1c.cfm)  
[www.youtube.com/watch?v=-2epDX0mF4I](http://www.youtube.com/watch?v=-2epDX0mF4I)

**March**

Revision for Mock Examination
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**April**

Mock Examination
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**NOTE:** The whole Syllabus of Grade IX will also be included.

## 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 stop clock. 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
3. Choose a sensible number of sig. figs. (usually 2 or 3)
4. 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
5. 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
6. 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  $n$
7. On tables and graphs the label is  $\log_{10}(y/m)$  or  $\ln(y/m)$  to show the unit of  $y$  as metres.
8. 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)

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

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

$$B/A = 2.56 \quad \% \text{error} = \% \text{error in A} + \% \text{error in B}$$

$$= 1 \quad + \quad 1.5$$

$$= 2.5\%$$

$$\text{actual error in } B/A = 2.56 * 2.5/100 = 0.06$$

$$\text{so } B/A = 2.56 \pm 0.06$$

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

$$B.A = 14.0 \pm 0.4$$

## 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.

## 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:

$$\text{speed} = \text{dis} / \text{time}$$

the relationship between force, mass and acceleration:

$$\text{force} = \text{mass} \times \text{acceleration}$$

$$\text{acceleration} = \text{change in velocity} / \text{time}$$

the relationship between density, mass and volume:

$$\text{density} = \text{mass} / \text{volume}$$

the relationship between force, distance and work:

$$\text{work done} = \text{force} \times \text{distance moved in direction of force}$$

the energy relationships:

$$\text{energy transferred} = \text{work done}$$

$$\text{kinetic energy} = \frac{1}{2} \times \text{mass} \times \text{speed}^2$$

$$\text{change in potential energy} = \text{mass} \times \text{gravitational field strength} \times \text{change in height}$$

the relationship between mass, weight and gravitational field strength:

$$\text{weight} = \text{mass} \times \text{gravitational field strength}$$

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

$$\text{pressure} = \text{force} / \text{area}$$

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

$$\text{moment} = \text{force} \times \text{perpendicular distance from pivot}$$

the relationships between charge, current, voltage, resistance and electrical power:

$$\text{charge} = \text{current} \times \text{time}$$

$$\text{voltage} = \text{current} \times \text{resistance}$$

$$\text{electrical power} = \text{voltage} \times \text{current}$$

the relationship between speed, frequency and wavelength:

$$\text{wave speed} = \text{frequency} \times \text{wavelength}$$

## 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.

- *Define (the term(s) ...)* is intended literally. Only a formal statement or equivalent paraphrase, such as the defining equation with symbols identified, being required.
- *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.
- *State* implies a concise answer with little or no supporting argument, e.g. a numerical answer that can be obtained 'by inspection'.
- *List* requires a number of points with no elaboration. Where a given number of points is specified, this should not be exceeded.
- *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.
- *Discuss* requires candidates to give a critical account of the points involved in the topic.
- *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.
- *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 syllabus'.
- *Calculate* is used when a numerical answer is required. In general, working should be shown.
- *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.
- *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.
- *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.
- *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.

- *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.