Cambridge International Examinations 201

O-LEVEL 5054

PHYSICS

MUSTAFA ASIF

Past Paper and Test Session 2016 Onwards

CHECKLIST
EXAM TIPS
&
FORMULAE & GLOSSARY

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Sr.	Topics	A	B	C	D	E	F	Remarks
1	Scalars and Vectors							
	Measurement Techniques							
	Vernier Caliper (Reading not included)							
	Micrometer (Reading not included)							
	Stopwatch							
	Newton Meter							
	Measuring tape/Trundle Wheel							
	Units and Symbols							
2	Balance and Unbalance Forces							
	Newton Laws							
	Inertia							
	Resistive Forces							
	Friction							
	Circular Motion							
3	Mass and Weight							
	Gravitational Field							
	Density							
	Measurement of Density							
	Speed velocity, Acceleration							
	Graphical Analysis (v-t, a-t and x-t graphs)							
	Thinking, breaking and stopping Distance							
	Terminal velocity							
4	Moment							
	Principle of Moment							
	Stability							
	Equilibrium and its types							
5	Elastic Deformation							
	Hooks law							
	Limit of proportionality							
	Extension / force graph							
6	Pressure							
	Atmospheric pressure							
	Pressure in liquids and gases							
	$p_1 V_1 = p_2 V_2$							
	Barometer							
	Manometer							
	Hydraulic press							
7	Energy forms							
	Major sources of energy							
	Work							
	Efficiency							
	Power							
	Different power stations							
	Nuclear energy							
	Solar energy							
	Wind energy							
	Chemical energy							

Sr.	Topics	A	B	C	D	E	F	Remarks
	Hydro electric energy							
8	Temperature							
	Principle of thermometer							
	Liquid in glass thermometer							
	Lab and clinical thermometer							
	Thermocouple thermometer							
9	Conduction							
	Convection							
	Radiation							
	Total transfer of energy							
	Convection in terms of density change							
	Practical methods of thermal insulation							
10	Specific heat capacity							
	Melting and boiling							
	Latent heat							
	Thermal expansion of solid liquid and gases							
	Boiling and evaporation							
	Irregular expansion of water							
	States of matter							
	Molecular model							
	Cooling effect of evaporation							
11	Wave motion							
	Transverse and longitudinal							
	Waves in ripple tank							
	Reflection and refraction of waves							
	Wave front							
	Frequency, wavelength and amplitude							
	Reflection of light							
	Quality of image							
	Mirror rotation							
	Refraction of light							
	Refractive index							
	Critical angle							
	Total internal reflection							
12	Convex lens							
	Concave lens							
	Formation of Images							
	Magnification							
	Short sight and long sight							
13	Dispersion of light							
	Electromagnetic waves							
	Electromagnetic spectrum							
	Application of Electromagnetic waves							
14	Sound waves							
	Factors effecting Speed of sound							
	Sharpness, pitch, loudness							
	Quality of sound / timber							

Sr.	Topics	A	B	C	D	E	F	Remarks
	Reflection and refraction							
	Ultrasound							
	Experiment speed of sound							
15	Laws of Magnetism							
	Magnetic properties of matter							
	Permanent and temporary magnetic							
	Demagnetization							
	Magnetic field							
	Relay, circuit breaker and loud speaker							
	Magnetic field lines with magnetic compass							
	Magnetic screening							
	Audio/Video tapes							
16	Laws of electrostatics							
	Principle of electrostatics							
	Electrostatic induction							
	Advantages of static electricity							
	Hazard of static electricity							
	Photocopier and electrostatic precipitator							
17	Current electricity							
	Electromotive force							
	Potential difference / voltage							
	Resisters							
	Resisters in series and parallel							
	Electric circuit							
	Ohms law							
	Voltage – current graph							
	Ohmic and Non-Ohmic conductors							
	LDR							
18	Uses of electricity							
	Dangers of electricity							
	Safe use of electricity in the home							
	Electric energy in Joule and kWh							
	Fuse rating							
	Live, neutral and earth wire							
19	Force on current carrying conductor							
	Flaming Left hand rule							
	DC motor							
	Split ring Commutator							
	Winding of coil on the soft iron							
18	Principle of electromagnetic induction							
	Faraday law							
	Lenz law							
	AC generator							
	Transformer							
	Step-up and step-down transformer							
19	Radio activity							
	Three types of radiation							

Sr.	Topics	A	B	C	D	E	F	Remarks
	Half life							
	Radioactive decay							
	Carbon dating							
	Star formation							
	Hazards of radiation							
	Uses of radiation							
	Back ground radiation							
	Safety measures							
	Nuclear fission							
	Nuclear fusion							
	Atomic model							
	Nucleus							
	Isotope							
	Alfa particle scattering							
20	Thermionic mission							
	Cathode-ray oscilloscope							
	Thermistor							
	LED							
	LDR							
	Capacitor							
21	**Optional**							
	Switching							
	Logic gates							
	Bistable and astable							
	Transistor							

CHOOSE ONE OPTION OF EACH TOPIC

A=Fully Understood

B-Understood

C= Standard

D=Acceptable

E=Average

F=Poor

Categorization of marks

The marking scheme categorizes marks on the MACB scheme.

B marks: These are awarded as independent marks, which do not depend on other marks. For a B- mark to be scored, the point to which it refers must be seen specifically in the candidate's answer.

M marks: These are method marks upon which A-marks (accuracy marks) later depend. For an M-mark to be scored, the point to which it refers must be seen in the candidate's answer. If a candidate fails to score a particular M-mark, then none of the dependent A-marks can be scored.

C marks: These are compensatory method marks which can be scored even if the points to which they refer are not written down by the candidate, providing subsequent working gives evidence that they must have known it. For example, if an equation carries a C-mark and the candidate does not write down the actual equation but does correct working which shows he/she knew the equation, then the C-mark is awarded.

A marks: These are accuracy or answer marks which either depend on an M-mark, or allow a C-mark to be scored.

Conventions within the marking scheme

BRACKETS
Where brackets are shown in the marking scheme, the candidate is not required to give the bracketed information in order to earn the available marks.

UNDERLINING
In the marking scheme, underlining indicates information that is essential for marks to be awarded.

GCE O Level Physics Exam Tips

How to Use These Tips

These tips highlight some common mistakes made by students. They are collected under various subheadings to help you when you revise a particular topic.

General Advice

- There is no escaping it; thorough and careful revision is the best way to prepare for a physics examination.
- Make your revision productive by making it interesting and fun. Make notes, revision cards or mind maps. Revision should be an active process, i.e. you should be 'doing things', not just sitting and reading a book.
- Do not try to learn it all in one go! Take regular breaks and review what you have learnt regularly.
- Learning equations is essential; put them on small pieces of paper and stick them somewhere you will see them every morning.
- Revise with a friend so you can test each other or try explaining the physics of a topic to a friend – as if you were a teacher!
- Working through past paper questions is the best way to complete your revision. This helps you to know the type and style of questions to expect in the examination.
- Try timed questions so you can learn to answer quickly.
- Get your answers checked so you know you are correct!

Spelling

The spelling of technical terms is important, so make sure your writing is legible as well as spelt correctly. Some words are very similar, such as *reflection* and *refraction*, *fission* and *fusion*. If the examiner cannot tell which one you have written, then you will lose the mark. Make a list of technical terms and definitions in each section of the syllabus, checking the spellings carefully.

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General Tips for CIE Physics 5054

In O Level Physics examinations you have to be able to complete a variety of tasks; always read the question carefully to make sure you have understood what you are expected to do.

In descriptive answers, you should:

Check the number of marks available and make sure you give sufficient points.

Plan your answer first so that you don't repeat yourself or contradict yourself.

Read your answer through carefully afterwards to check you have not missed out important words.

Use sketches and diagrams wherever you can to help your explanation.

Add labels when referring to a diagram, e.g. *point X*, so that you can refer to it easily in your explanation. This can save many words and much confusion.

In numerical answers, you should:

Quote any **formulae** you are going to use and show **clearly all the steps** in your working. It may be tempting to use your calculator and just write down the answer; but if you write down one figure wrongly then you may lose all the marks for the calculation.

If the examiner can see the formula and the numbers you have used then you will lose only a little credit. Some questions ask for a formula to be quoted; even if you get the right answer, failure to quote the formula will lose you a mark.

Check the units are consistent, e.g. if the distance is given in *km* and the speed in *m/s*, then you must convert the *km* to *m*.

Be careful when you are converting minutes and seconds: 1 minute 30 seconds is not 1.3 minutes and 150 seconds is not 1.5 minutes. These are common mistakes, so always double check any conversion of units of time.

State the answer clearly at the end.

Give your answer as a decimal to an appropriate number of significant figures. Don't leave your answer as a fraction unless specifically asked to do so.

Check that you have given the **unit** of your final answer.

Look at your final answer and see that it is reasonable. If you have calculated the cost of using an electrical appliance such as a kettle for a few minutes and found it to be hundreds of dollars, then check the powers of ten in your calculation.

Tips for Paper 1 MCQ's

Multiple Choice Question Paper

When reading the question, you should:

- Read the question carefully. If you know you tend to jump to a quick conclusion, cover up the answers while you read the stem of the question.
- Avoid rushing the questions. Some will be very quick to answer, others take more time.
- Check whether a positive or negative answer is being asked for, i.e. does the question say "which of the following *is* or *is not* ...?" For example, when asked for an incorrect ray diagram it is easy to pick a correct diagram as your answer.
- Never leave a question unanswered; marks are not deducted for incorrect answers.
- Try to eliminate some of the possible answers if you are not sure of the answer.
- Write out your working to numerical questions clearly (on the question paper, near the question) so you can check it later.
- Be aware of the topics which occur frequently, such as *potential difference* and *potential dividers*. The theory here just has to be learnt!

When taking readings from a diagram, you should:

- Check you are using the correct distance; for example in moments questions, remember you need to use the perpendicular distance from the force to the pivot.
- Draw on the diagram to help you understand what is happening; for example in deciding the direction of the magnetic field at a point near a bar magnet, draw in the shape of the field.

Choosing the right response:

When several answers seem correct, re-read the stem of the question. You must choose the answer that is not only a correct statement, but also answers the question; for example swapping the live and neutral wires in a plug is a fault, but will not cause the fuse to blow. The live wire touching the metal case of a kettle is a fault which will cause the fuse to blow!

Choosing the right equation:

Many equations are very similar, e.g. $E = mc^2$ (energy equivalence of mass) and $E = \frac{1}{2} mv^2$ (kinetic energy) so make sure you know when to use each one.

Tips for Paper 2 - Structured Questions

Read all the three questions in section B before you make your choice of which two questions to answer. Some students find it better to read through the whole paper before they start writing any answers at all to start answering section B with the question they think they can answer best. Whatever you do, you must plan your answers to section B briefly, perhaps writing brief notes but be sure to **include all the material** you want to be marked in the correct place on your script.

Read all the parts of a question before you start. It is often tempting to write too much in the first part and then realise you have answered the second and third parts as well but in the wrong place.

Only answer the question asked. Don't be tempted to give more detail than is required. This wastes time and gains you no extra marks!

If you are asked for two points (e.g. *name two materials that are magnetic ....*) then don't give three. If you give three and one is incorrect, you will only get one mark out of two.

Your answer should fit the space available. If it doesn't, you are writing too much! The number of lines given is a clue as to how much to write. Practice the size of your writing: if it is too big, it will not fit in the space; if it is too small, then the examiner will not be able to read it.

Failure to give enough detail is a common cause of lost marks; for example If the question asks you to describe the movement of electrons, then you must mention electrons; if the direction of the current in a solenoid is reversed, then just saying that the magnetic field changes is not enough - you need to say that the field reverses or changes *direction*. If you describe the motion of molecules in a liquid then linking the temperature to the average *kinetic* energy of the molecules is important. Molecules of a gas exert a pressure on the walls of a container by colliding with the walls. Collisions between the molecules themselves do not explain the pressure on the walls. To increase the pressure, molecules can hit the walls harder or more often, i.e. at a greater speed or more frequently. Take care to explain this clearly and without contradiction!

Make sure you know where to put ammeters and voltmeters in a circuit. Ammeters are in series and voltmeters in parallel with other components. If you need to vary the current, make sure you include a variable resistor or use a variable power supply.

If the question asks you to" state and explain" you need state the answer then give a clear explanation. The amount of detail depends upon the number of marks.

Make sure that you link your answer to the question, rather than just quoting learnt facts. For example, just stating that paper stops alpha is not enough if the question asks why a radioactive tracer emitting alpha particles is not used inside the body.

If you are asked to draw forces on a diagram, draw them through the point where they act. Do not draw them floating in mid-air to the side of a diagram! Remember to **label** them. Add an arrow to show the direction, e.g. if the question asks for "the force exerted by the Sun on the Earth", then since it is a force of attraction, the force arrow must go from the Earth towards the Sun.

Some incorrect physics statements will lose a mark even if followed or accompanied by a correct statement.

Examples of such statements are:

Renewable energy sources can be used again and again. Use the explanation that there is an infinite supply or renewable energy sources will not run out.

Heat rises. Note that it is either hot air or hot liquids that rise, carrying the heat energy with them.

Acceleration at a constant speed. This is a contradiction as if you travel at a constant speed, you cannot be accelerating! When describing uniform acceleration, you can say constant acceleration or accelerating at a constant rate.

Plotting graphs can be tested in Papers 2 or 4.

When drawing graphs, you should:

Remember to label the axes with both quantity (e.g. *distance* or *d*) and unit (e.g. *metres* or *m*). Then write it as *distance / metres* or even just *d / m*.

Make sure the axes are the correct way round. You are usually told, for example, to plot distance on the x-axis, so make sure you know that x is the horizontal axis!

Make the scales go up in sensible amounts, i.e. not 0, 3, 6... or 0, 7, 14 ... but 0, 5, 10 ... or 0, 2, 4 ....

Make sure that the plotted points fill at least half the graph paper. This means if you can double the scale and still plot all the points then you should double the scale

Check if you have been told to start the scales from the origin. If not, then think carefully about where to start the axes.

Use a sharp pencil to plot the points and draw the line.

Plot the points carefully. It is best to use small neat crosses. Every point will be checked by the marker, and you will lose the mark if any are wrongly plotted.

Draw either a straight line or a smooth curve. In physics we never join the dots!

Remember that a best fit line (curve or straight) should have some points above and some points below the line.

When taking readings from a graph, you should:

Draw a large triangle when measuring the gradient of a line. It must be at least half the length of the line. Examiner's tip – draw a triangle the full size of the graph! It is best to show the numbers on the sides of the triangle when finding the gradient,

Always use points on the line, not your plotted points, when calculating the gradient.

Draw a tangent to find the gradient of a curve. Make sure it is at the right place on the curve. Again, use a large triangle.

Make sure you read the scales correctly when reading a value from a graph. It may be that they are in *m A* rather than *A* or *km* rather than *m*.

When describing the shape of a graph, remember that:

- Directly proportional means a straight line *through the origin*. In this case, doubling one quantity will cause the other to double; alternatively if two quantities *F* and *l* are directly proportional then if you find several values of *F/L* they should be the same.
- If the straight line does not go through the origin, then it is just called a linear graph.
- If doubling one quantity causes the other to halve, then they are inversely proportional.
- If increasing one quantity causes the other to decrease, it is called an inverse relationship.

Tips for Paper 4 – ATP
Alternative to Practical

When asked to take a single reading, make sure you include the unit.

- Do not write anything you are not asked for – you are not expected to write an account of the experiment unless asked to do so.
- If you are asked to "use your results" to explain something, then quote them, do not just mention the theory you know!
- If you are reading a measuring instrument, give all the values on the scale,
- e.g. on a hundredth of a second stopwatch, write *9.24 s* - not 9 or *9.2* s (not *09:24 s*)
- Significant figures are important in the practical papers. Do not quote too many – or too few! Give just the right number. Many marks are lost by giving too few significant figures. This usually occurs when reading a scale where the value is on a major mark, e.g. *6 V*. If the scale measures to *0.1 V*, then the reading is *6.0 V*, and you must include the point zero! There are usually 2 or 3 significant figures in most readings. Think carefully if you ever use more or less.
- In calculated values, you should never give more significant figures then were used in the data, e.g. the average of 27.95, 26.54 and 27.36 is actually 27.28333333 but should be given as either 27.28 to the four significant figures given in the data or 27.3 as the variation of the readings suggests that four significant figures are too many.
- Normally you can measure an instrument to the accuracy shown by the smallest scale division. However
- If using a liquid in glass thermometer, you should be able to estimate within the degree markings, e.g. to 0.5ºC or even 0.25ºC.
- If using a ruler you can usually measure to about 0.3-0.5 mm even though the smallest division is a mm.

- Make sure you understand technical terms used in the question; for example *extension* means the *increase in length* of a spring when a load is added; *calibration* means "*to put a scale on a measuring instrument*", which applies to any measuring instrument.
- When measuring vertical heights, a setsquare should always be used to ensure the ruler is vertical. The setsquare can be shown correctly positioned in a diagram.
- Make sure you can explain the difference between the source of error and what you could do to reduce it, e.g. in transferring a hot object from one place to another: the source of error is the heat it loses during the transfer and you could reduce this error by reducing the distance it has to be moved.
- If a question asks for the effect of changing something such as "the length of the wings" then make sure your answer shows a comparison, e.g. "the long***er*** the wings, the long***er*** the time to fall".
- When measuring time or length be careful to explain the meaning clearly; for example "longer" can mean either a longer time or a longer length. There is no confusion if you use the words "a longer time" or "a shorter time".
- This paper asks you questions about how you would perform practical's in the laboratory at your school. So you need experience of actual practical's not just alternative to practical papers.

- When you *observe your teacher* demonstrating experiments, you should:
- Watch closely how the apparatus is set up.
- Think about any problems with the apparatus that occur during the experiment.
- Think about any sources of error in taking the readings.
- When *you* do practical work at school, you should:
- Handle the apparatus carefully.
- Think about how the apparatus is set up.

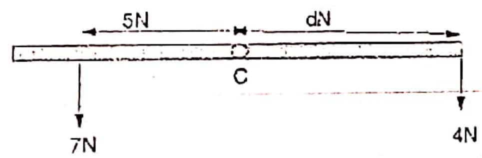
- Ask your teacher for help if you are not sure.
- Think about how you take down the readings in a clear table – never just write numbers on a page, as you may well forget what they were later!
- Think about the number of significant figures in your readings.
- Answering the examination Paper
- When answering questions about sources of error in an experiment, just writing "more
- Accurate" is usually not enough - more detail is required
- Sometimes the answers appear too obvious, but they are good practical points; .for example
- When choosing a measuring cylinder of the correct size to measure the volume of some marbles, the measuring cylinder must be large enough to hold all the marbles!
- If a question involves familiar equipment used in a novel way, e.g. circuits or ray diagrams:
- Take time to look at the equipment used in the question; do not assume that it is the same as an experiment you have seen before.
- Follow round the circuit or the rays of light to be sure you understand what is happening

When recording your readings in a table:

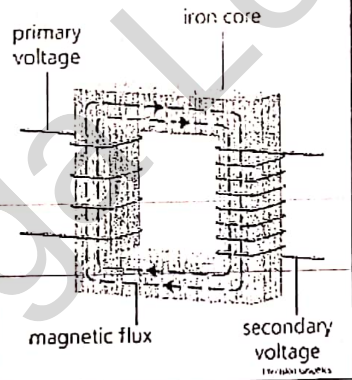
Write down **all** your readings clearly.

Write the quantity and unit in the heading a heading should say *current / ampere* or just *I / A*.

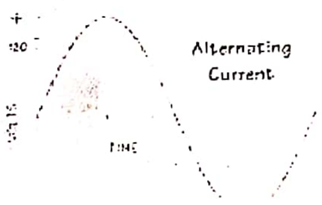
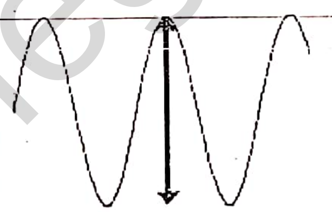
CIE Physics 5054 Formulae and Glossary

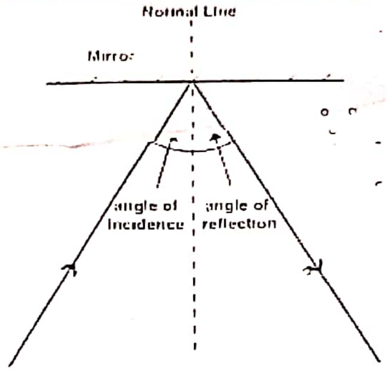
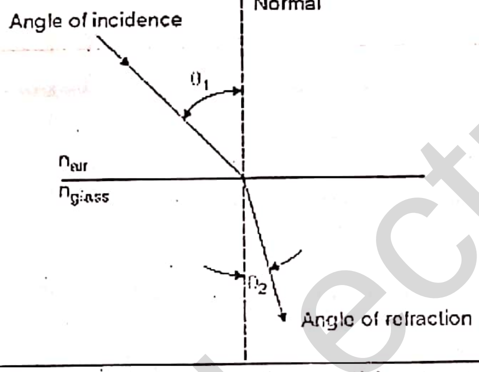
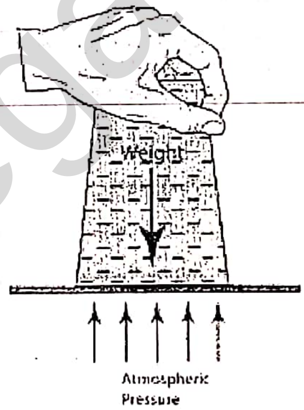
Physical Quantity	Formula	Remarks
Equations of motion at constant acceleration	$\bar{v} = \frac{v+u}{2}$ $s = \left(\frac{v+u}{2}\right)t$ $v = u + at$	$\bar{v}$ = average speed, m/s s = displacement, m v = final velocity, m/s u = initial velocity, m/s a = acceleration, m/s^2 t = time, s
Density	$\rho = \frac{m}{v}$	ρ = density, kg/m^3 m = mass, kg v = volume, m^3
Weight	W = mg	W = weight, N m = mass, kg g = gravitational acceleration, m/s^2 or N/kg
Force	F = ma	F = force, N m = mass, kg a = acceleration, m/s^2
Moment of a force about a point	$\tau = Fd$	τ = moment of a force, Nm F = force, N d = perpendicular distance from pivot to the line of action of the force, m
Object in equilibrium with parallel forces acting on it	Sum of clockwise moments = sum of anti-clockwise moments about the same pivot Sum of upward forces = sum of downward forces	
Work done	W = Fd	W = work done, J F = force, N d = displacement, m
Kinetic energy	K.E.= 1/2 mv^2	K = kinetic energy, J m = mass, kg v = velocity, m/s
Potential energy	P.E. = mgh	Ep = potential energy, J m = mass, kg g = gravitational acceleration, N/kg or m/s^2 h = gain/loss in height
Efficiency	$E = \frac{\text{useful energy converted}}{\text{total input energy}} \times 100\%$ $= \frac{\text{output powerd}}{\text{input power}} \times 100\%$	

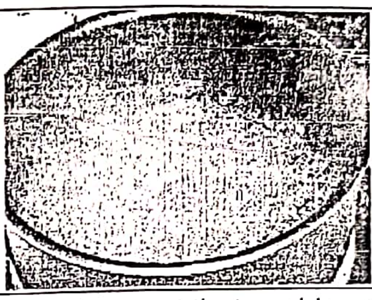
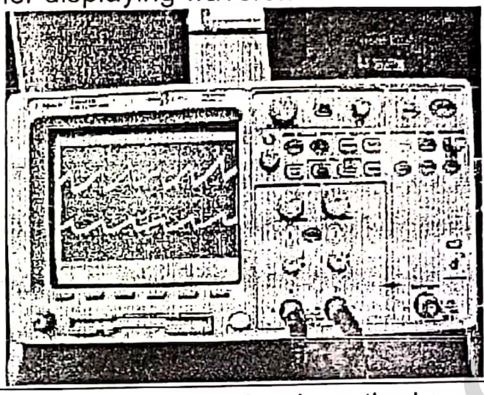
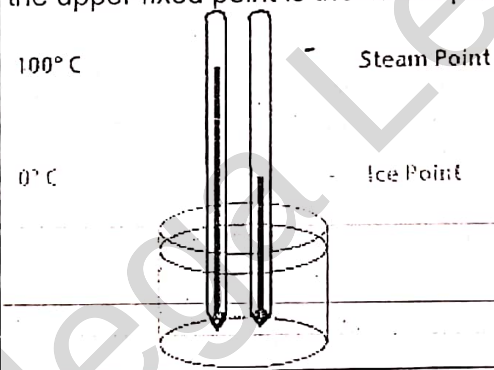
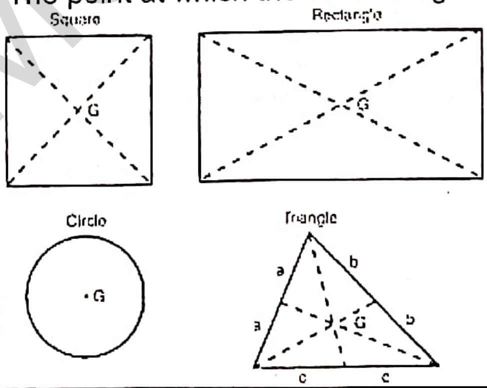
Power	$P = \frac{W}{t} = \frac{E}{t} = \frac{Q}{t}$	P = power, W W = work done or energy transferred, J t = time, s E = energy transferred/used, J Q = thermal energy transferred, J
Pressure	$P = \frac{F}{A}$	P = pressure, Pa or Nm^{-2} F = normal force, N A = area, m^2
Liquid pressure	$P = h\rho g$	P = pressure at depth h, Pa or N/m^2 ρ = density, kg/m^3 g = acceleration due to gravity, m/s^2
Boyle's Law	$P_1V_1 = P_2V_2$	P_1 = pressure of gas at state 1, Pa or cm Hg or atm P_2 = pressure of gas at state 2, Pa or cm Hg or atm V_1 = volume of a gas at state 1, m^3 or cm^3 V_2 = volume of a gas at state 1, m^3 or cm^3
Specific heat capacity	$Q = mc\theta$	Q = heat absorbed/released due to change of temperature, J m = mass, kg c = specific heat capacity, J/(kgK) θ = change in temperature, K
Specific latent heat of vaporization or fusion	$Q = ml$	Q = heat absorbed/released due to change of state, J m = mass, kg l = specific latent heat of fusion or vaporization, J/kg
Wave equation	$v = f\lambda$ $f = \frac{1}{T}$	v = wave speed, m/s f = frequency, Hz λ = wavelength, m T = period, s
Refractive index	$n = \frac{\sin i}{\sin r} = \frac{v_1}{v_2}$	n = refractive index i = angle in air/vacuum r = angle in medium c = speed of light in vacuum, m/s v = speed of light in medium, m/s
Critical angle	$\sin \hat{c} = \frac{1}{n}$	$\hat{c}$ = critical angle

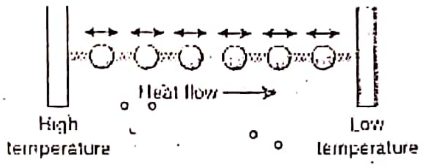
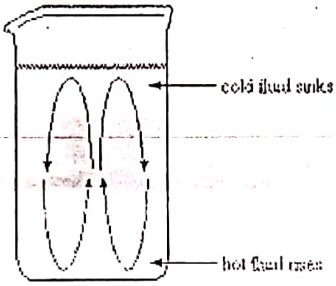
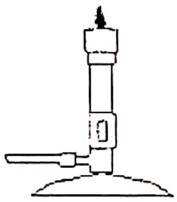
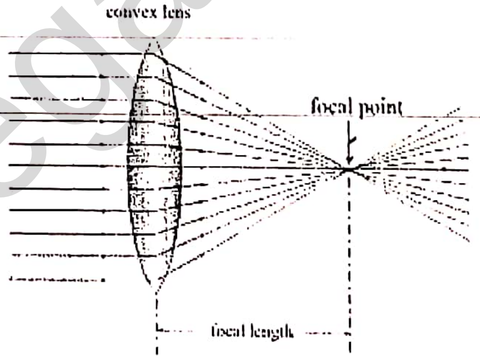
Amount of charge	Q = It	Q = charge, C t = time, s
Ohm's Law	V = IR	V = potential difference, V I = current, A R = resistance, Ω
Potential difference	V = W/Q	V = potential difference, V W = work done between two points, J Q = charge, C
emf	$\xi = \frac{\text{total work done}}{Q}$	ξ = emf, V
Electrical power	$P = IV = I^2R$	P = power, W I = current, A V = potential difference, V (voltage)
Electrical energy	E = VIT	E = electrical energy, J
Resistance	$R = \frac{\rho l}{A}$	ρ = resistivity, ohm l = length of wire, m A = cross-sectional area of wire, m^2
Transformer equations	$\frac{N_p}{N_s} = \frac{V_p}{V_s} = \frac{I_s}{I_p}$  	N_p = number of turns in the primary coil N_s = number of turns in the secondary coil V_p = voltage across primary coil, V V_s = voltage across secondary coil, V I_p = current in primary coil, A I_s = current in secondary coil, A

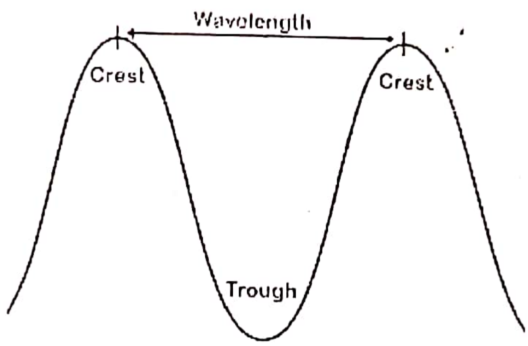
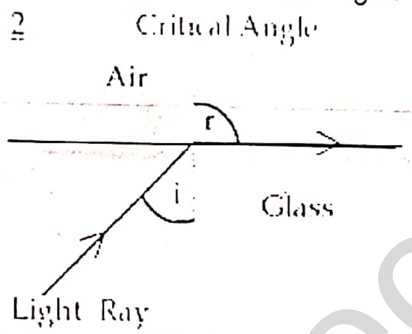
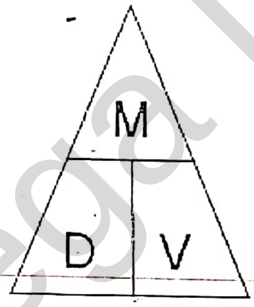
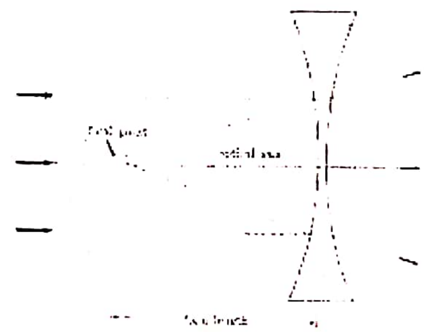
Glossary

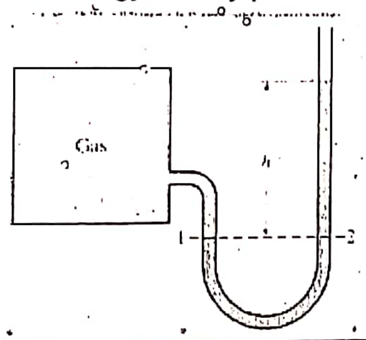
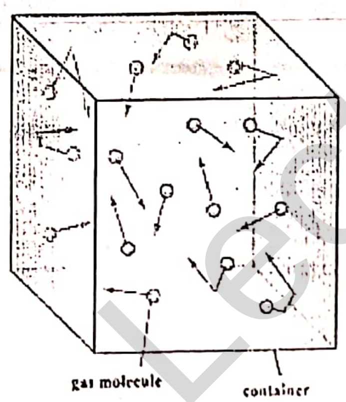
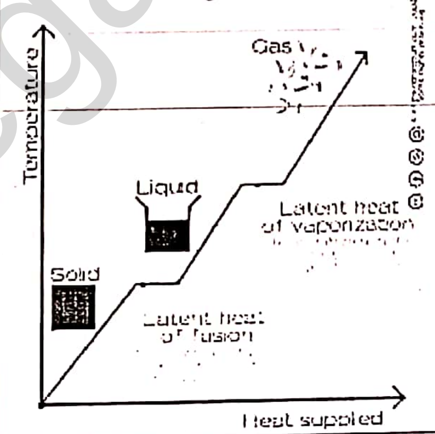
Concept	Definition
Acceleration	The rate of change of velocity. Value can be found from the gradient of a velocity-time graph. $$a = \frac{\text{change in velocity}}{\text{time}}$$ $$a = \frac{v - u}{t}$$ v= final velocity u= initial velocity **unit = m/s^2**
Gravitational acceleration	The rate at which all objects fall towards earth if there were no air resistance, about 10m/s^2 near earth's surface
Alternating current	An electric current that periodically reverses its direction in the circuit 
Ampere (A)	The SI unit for electric current. A flow of 1 coulomb per second is 1 ampere
Amplitude	The maximum displacement of a point of a wave from rest position. Height of a crest or depth of a trough measured from the undisturbed position. For a sound wave, the greater the amplitude, the louder the sound. **Amplitude** 
Angle of incidence	The angle between an incident ray and the normal to a surface

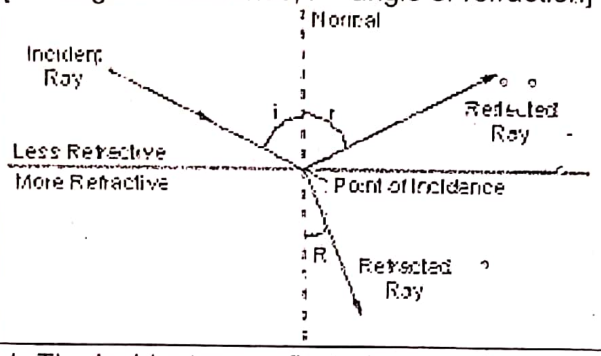
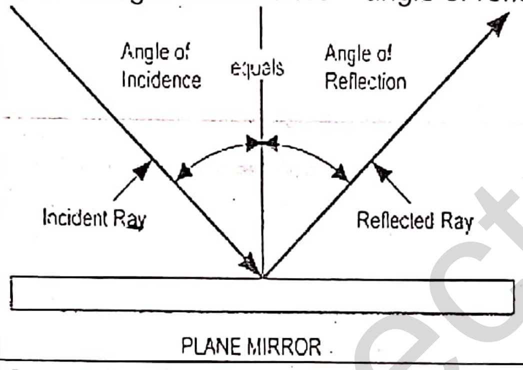
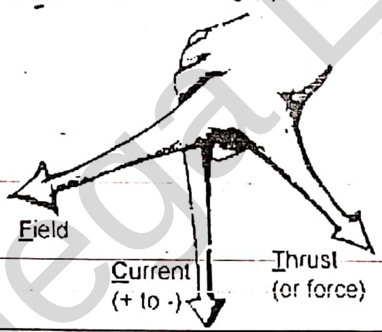
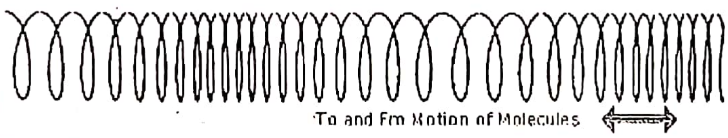
	
Angle of reflection	The angle between a reflected ray and the normal to a surface
Angle of refraction	The angle between a refracted ray and the normal to a surface 
Atmospheric pressure	The air pressure in the earth's atmosphere. Atmospheric pressure is about 10^5Pa near sea level and decreases with height above ground. 
Average speed	The total distance traveled divided by the total time taken.
Boiling	A process by which energy supplied changes a substance from liquid to gas without a change in its temperature.

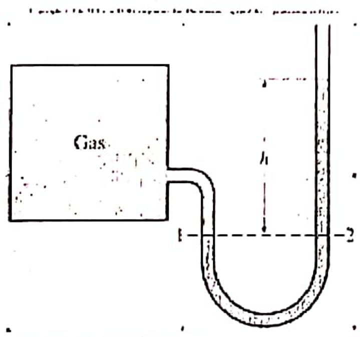
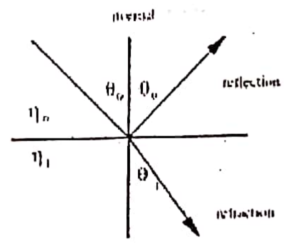
	
Cathode ray oscilloscope	An instrument that enables a variety of electrical signals to be examined visually. It is used for measuring direct current and alternating current voltages, short time intervals and frequency and for displaying waveforms 
Celsius scale	A temperature scale where the lower fixed point is the ice point and the upper fixed point is the steam point 
Centre of gravity	The point at which the entire weight of an object appears to act 
Conduction	The process by which thermal energy is transmitted through a medium from one particle to another.

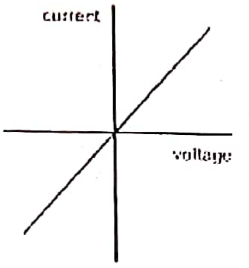
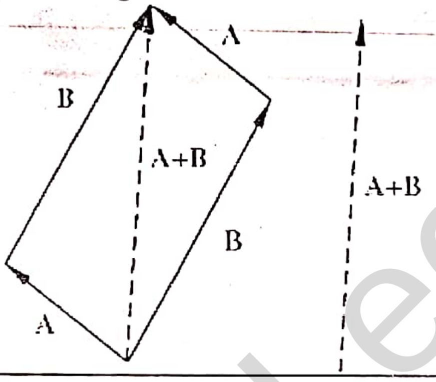
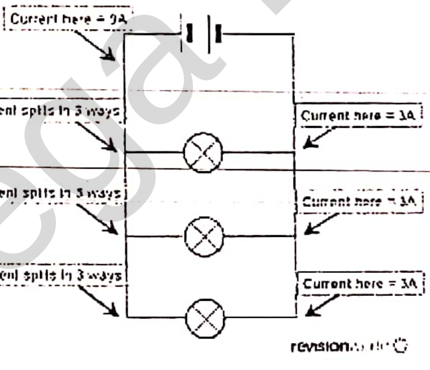
	 
Convection	The process by which thermal energy is transmitted from one place to another by the movement of the heated particles of gas or liquid.  
Converging lens	A lens that can bring a parallel beam of light passing through it focus to a point. It is thicker in the middle than at the edges. 
Coulomb (C)	The SI unit of electric charge.
Crest	The highest points on a wave

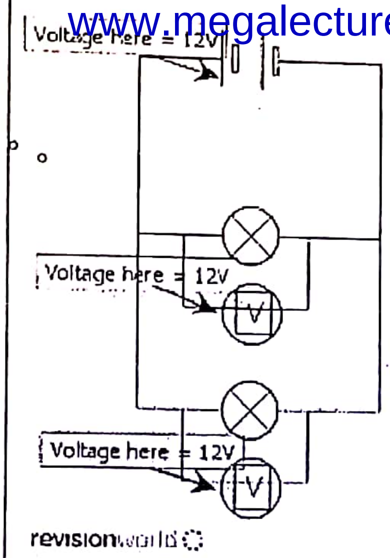
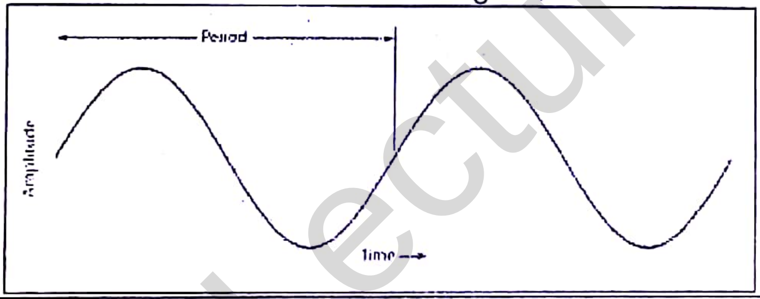
	
Critical angle	The angle of incidence in the optically denser medium for which the angle of refraction in the less dense medium is 90° Total internal reflection occurs when the angle of incidence is greater than the critical angle. 
Density	Mass per unit volume of a substance Density = Mass / Volume 
Diverging lens	A lens that causes parallel beams of light to diverge. It is thicker at the edges than at the centre. 
Echo	Reflected sound heard after an interval of silence.
Electric current	The rate of flow of charge.

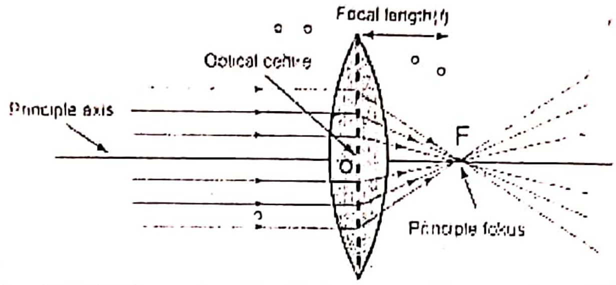
	I = Q / t [I = current, Q = charge, t = time]
Kelvin (K)	SI unit for temperature K = °C + 273
Kinetic energy	The energy a body possess due to its motion. 
Kinetic theory of matter	All matter is made up of large numbers of tiny atoms or molecules which are in continuous motion. 
Latent heat of fusion	The energy needed to change a substance from solid to liquid without a change in temperature 
Latent heat of vaporization	The energy needed to change a substance from liquid to gas without a change in temperature (See image above)
Law of charges	Like charges repel and unlike charges attract
Laws of refraction	1. The incident ray, refracted ray, and normal all lie in the same plane at the point of incidence. 2. The ration sini/sinr is constant

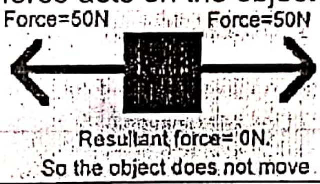
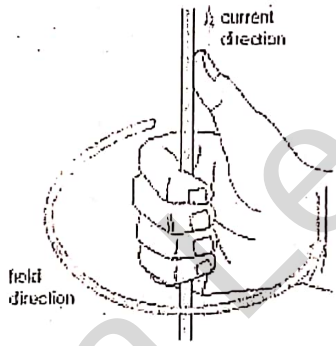
	[i = angle of incidence, r = angle of refraction] 
Law of reflection	1. The incident ray, reflected ray, and normal all lie in the same place at the point of incidence 2. The angle of incidence = angle of reflection 
Lenz's law	States that the direction of the induced e.m.f. is in a direction that opposes the change producing it. 
Liquid pressure	Pressure due to the weight of a column of liquid is given by pressure = hpg [h = height of column, p = density, g = gravitational field strength]
Longitudinal waves	Waves which travel in a direction parallel to the direction of vibration eg sound wave 
Magnetic materials	Materials that are attracted by a magnet. Iron is easier to magnetise but loses its magnetism easily - **soft magnetic material** Steel is harder to magnetise but does not lose its magnetism easily

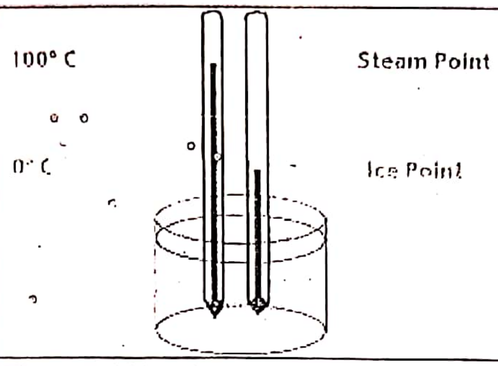
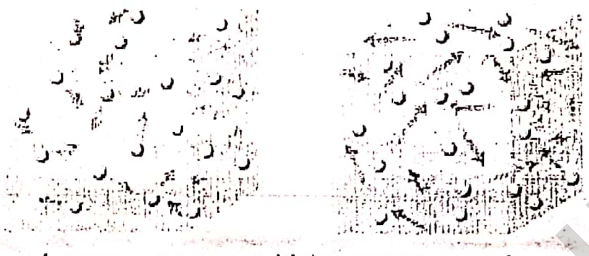
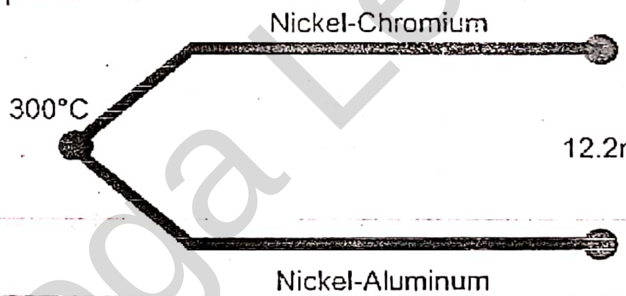
	- hard magnetic material. Hard magnetic materials are used to make permanent magnets. Soft magnetic materials are used to make temporary magnets.
Manometer	A U-tube containing liquid (mercury or water) used to measure gas pressure 
Mass	A measure of the amount of substance in an object. W = mg [W = weight, m = mass, g = gravitational acceleration] SI unit is kg
Melting	A process whereby energy supplied changes the state of a substance from solid to liquid without a change in temperature.
Moment of a force	The turning effect of a force. Moment = Force x Perpendicular distance from the line of action of the force to the pivot SI unit is Nm
Newton's Laws	1. An object at rest will remain at rest and an object in motion will continue in motion at a constant speed in a straight line if no resultant force acts on it. 2. The resultant force acting on a body is equal to the product of the mass and acceleration of the body; the direction of the force is the same as that of the object's acceleration. 3. For every action, there is an equal and opposite reaction.
Newton (N)	SI unit for force
Normal	A line that is perpendicular to a surface Used in reflection and refraction 
Ohm's law	States that current through a metal conductor is directly proportional to the potential difference across it provided that temperature and physical condition of the conductor remain unchanged. R = V / I

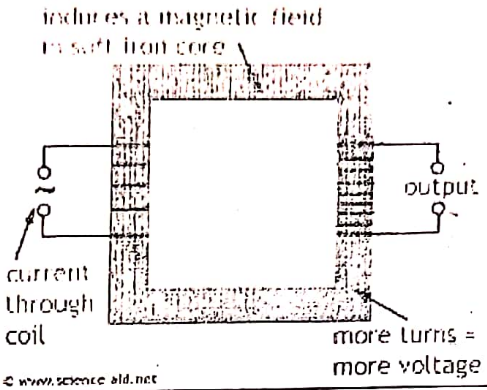
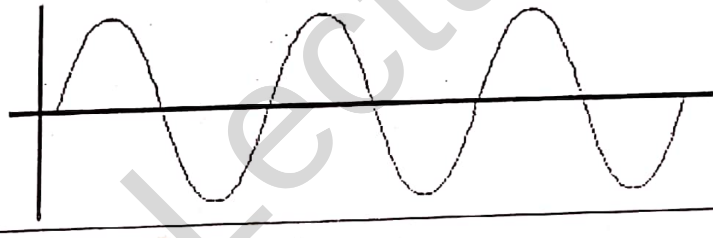
	
Optical centre	The point midway between the lens' surfaces on its principal axis. Light rays passing through the optical centre are not deviated.
Parallelogram law of vector addition	If two vectors acting at a point are represented as the sides of a parallelogram drawn from that point, their resultant force is represented by the diagonal passing through that point of the parallelogram. 
Parallel circuits	$I = I_1 + I_2 + I_3 + ...$  $V = V_1 = V_2 = V_3$

	
Period	How much time it takes for one cycle (one complete wave) to pass and the units are always in terms of time. The faster a wave moves, its wave period becomes smaller. It is also the time taken for the crests, or any point on the wave, to move a distance of one wavelength. 
Pascal	SI unit for pressure. 1 pascal = 1 N/m^2
Pitch	The pitch of a note depends on its frequency. Higher frequency --> higher pitch
Potential difference	The difference between the electrical potential (voltage) between 2 points. The potential difference across a component in a circuit is defined as the work done to drive a unit charge through the component. $V = W/Q$ [V = p.d., W = work done, Q = charge] SI unit is volt (V)
Potential divider/ potentiometer	A variable resistor used to vary voltage.
Potential energy	The energy stored in an object due to its position, state, or shape
Power	The rate of doing work Power = work done/time taken OR energy change/time taken SI unit is watt (W) 1 W = 1 Joule/s
Pressure	The force per unit area, measured in pascals or N/m^2 $P = F/A$ [P = pressure, F = force, A = area]

Principal axis	A line joining the optical centre of a lens and perpendicular to the plane of the axis 
Principal focus	The point on the principal axis whereby incident rays parallel to the principal axis onto a lens are converged to (or diverged from)
Principle of conservation of energy	States that energy cannot be created or destroyed but only changes from one form to another
Principle of moments	When an object is not rotating or in equilibrium, the sum of anticlockwise moments about any point = sum of clockwise moments about the same point
Radiation	The transfer of energy by electromagnetic waves. Factors affecting rate of energy transfer: 1. Surface temperature 2. Color 3. texture 4. Surface area - higher at higher temperatures - higher when black colour and rough surface - lower when white colour and smooth surface
Ray	a narrow beam of light
Real image	An image formed by a lens that can be captured on a screen
Rectifier	An arrangement consisting of one or more diodes for converting alternating current to direct current
Refraction	The change in direction of a light wave or water wave as it crosses a boundary at an angle Refraction occurs because the wave changes its speed in different media
Refractive index	$n = c/v$ The ratio of the speed of light in vacuum to the speed of light in the medium can be calculated using sini/sinr The greater the value of the refractive index, the greater is the bending of light towards the normal as it passes from air into the medium
Resistance	The ratio of the potential difference across a conductor to the current flowing through it. SI unit is ohm. Factors affecting resistance:

	1. length (directly proportional) 2. cross-sectional area (inversely proportional) $R = \frac{\rho l}{A}$
Resistors in series	Effective resistance = R1 + R2 + R3 +...
Resistors in parallel	Effective resistance = $\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + ...$
Resultant force	When the forces acting on an object are unbalanced, a resultant force acts on the object and it accelerates or decelerates. 
Right-hand grip rule	
Scalar quantities	Physical quantities that have magnitude only eg. mass, temperature, time, speed, distance
Specific heat capacity	The amount of thermal energy required to raise the temperature of a unit mass of a material by 1 K or 1°C $q = mc\Delta T$
Specific latent heat of fusion	The amount of energy required to change a unit mass of a substance from solid to liquid without a change in temperature $Q = mL$
Specific latent heat of vaporization	The amount of energy required to change a unit mass of a substance from liquid to gas without a change in temperature $Q = mL$
Steam point	The upper fixed point on the Celsius scale of temperature

	
Thermal energy	The total kinetic energy of the atoms or molecules in a body  Longer arrows mean higher average speed.
Thermocouple	A thermometer consisting of two wires of different metals joined together at the ends to form two junctions. If the two junctions are at different temperatures an e.m.f. is produced. The bigger the temperature difference, the larger the e.m.f. produced. 
Temperature	A measure of the degree of hotness of a body
Transformer	A device used to change the voltage of an alternating current Step-up transformer: has more turns in the secondary coil than in the primary coil --> this increases the voltage step- down transformer: has fewer turns in the secondary coil than in the primary coil --> decreases the voltage. For a transformer that is 100% efficient, output power = input power

	
Transducer	A device that transforms energy from one form to another. Input transducers transform other energy into electrical energy eg solar cells, microphones, thermistor, LDR. Output transducers transform electrical energy to other forms of energy eg loudspeakers, LED and electrical meters
Transverse wave	Waves which travel in a direction perpendicular to the direction of the vibrations. eg rope waves, water waves 

Duaas For STUDYING

Increase your recitation and listening of the Qur'an and perform more ibadah

سُبْحَانَكَ لَا عِلْمَ لَنَا إِلَّا مَا عَلَّمْتَنَا إِنَّكَ أَنْتَ الْعَلِيمُ الْحَكِيمُ

"Glory be to you, we have no knowledge except what you have taught us. Verily, it is You, the All-Knower, the All-Wise."
[Surah Al-Baqarah: 2:32]

رَبِّ اشْرَحْ لِي صَدْرِي وَيَسِّرْ لِي أَمْرِي وَاحْلُلْ عُقْدَةً مِنْ لِسَانِي يَفْقَهُوا قَوْلِي

"O my Lord! Expand me my breast; Ease my task for me; And remove the impediment from my speech, so they may understand what I say."
[Surah Ta-Ha: 20:25-28]

A du'a that Musa *alaihis salaam* made when proceeding to the court of Fir'awn (Pharoah) for the arguments (inviting him to Islam)

رَبِّ زِدْنِي عِلْمًا

"O my Lord! Advance me in Knowledge."
[Surah Ta-Ha: 20:114]

Dua after Studying:

رَبَّنَا تَقَبَّلْ مِنَّا إِنَّكَ أَنْتَ السَّمِيعُ الْعَلِيمُ

"Our Rabb! accept from us. You indeed, You are the all-Hearing, the all-Knowing."
[Surah Baqarah, 2:127]

Dua While Studying Something Difficult:

رَبِّ إِنِّي مَغْلُوبٌ فَانْتَصِرْ

O Allah! I am overpowered, so help me.

حَسْبِيَ اللهُ وَنِعْمَ الْوَكِيلُ

Allah is my availer and protector and the best of aids.

Dua For remembering something

اَللّٰهُمَّ ذَكِّرْنِي مِنْهُ وَعَلِّمْنِي مِنْهُ مَا جَهِلْتُ

O Allah! Assist me to remember it, and teach me whatever I am ignorant of it.

Study Tips:

* Offer your prayers at their correct times.
* Pray a two rakah *nafl hajat* prior to exam.
* Write بسمه تعالى - In the Name of the Most High - (instead of *Bismillah*...) at the top of the page cover.
* Say بسم الله الرحمن الرحيم (In the name of Allah the Most Merciful, the Most Kind) - before commencing the exam - indeed before anything that you do.
* Recite some du'as (like the ones listed above) and keep in constant *dhikrullah* (i.e. the daily *adhkaar* when waking, dressing, eating, sleeping, etc)
* Come home and pray two rakat *nafl* after the exam for *shukr* (offer thanks to Allah) for granting you the strength and persistence and ability to complete the exam and accomplish your goals, *Insha Allah*.
* Increase your recitation and listening of the Qur'an and perform more *ibadah*.
* Keep away from bad actions and deeds - Follow up a bad deed with a good deed, to cancel it out.