Terms & Definitions

you must know !!

It is absolutely essential that you know these terms and definitions. They form the vocabulary of the Grade 12 Physical Sciences without which it is impossible to pass the final exam. The majority of simple recall and / or comprehension questions test your knowledge of these important terms / laws – if you know them well, you already have the 30% needed to pass the final exam. But please don't limit yourself! Aim high. There is no reason you can't do well (get 70% +) in the Physical Sciences. It's not rocket science!!

Govan Mbeki Mathematics Development Centre
empowering young minds

Grade 12: Paper 1 (Physics)

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Mechanics: Newton's Laws and Application

normal force	N … the force or the component of a force which a surface exerts on an object with which it is in contact, and which is perpendicular to the surface
frictional force	f … the force that opposes the motion of an object and which acts parallel to the surface; $f = \mu N$
static frictional force	f_s … the force that opposes the tendency of motion of a STATIONARY object relative to a surface. The static frictional force is a maximum (f_s^{max}) just before the object starts to move across the surface. $f_s = \mu_s N$
kinetic frictional force	f_k … the force that opposes the motion of a MOVING object relative to a surface; $f_k = \mu_k N$
force diagram	a diagram that shows the relative magnitudes and directions of forces acting on a body/particle that has been isolated from its surroundings
free-body diagram	This is a diagram that shows the relative magnitudes and directions of forces acting on a body/particle that has been isolated from its surroundings. The body / object is represented by a dot.
Newton's 1st Law of Motion	A body will remain in its state of rest or motion at constant velocity unless a non-zero resultant/net force acts on it.
inertia	The resistance of a body to a change in its state of rest or uniform motion in a straight line. Mass is a measure of an object's inertia.
Newton's 2nd Law of Motion	When a resultant/net force acts on an object, the object will accelerate in the direction of the force at an acceleration directly proportional to the force and inversely proportional to the mass

	of the object; $F_{net} = ma$
Newton's 3rd Law of Motion	When object A exerts a force on object B, object B SIMULTANEOUSLY exerts an oppositely directed force of equal magnitude on object A. **or** When one body exerts a force on a second body, the second body simultaneously / at the same time exerts a force of equal magnitude in the opposite direction on the first body.
Newton's Law of Universal Gravitation	Each body in the universe attracts every other body with a force that is directly proportional to the product of their masses and inversely proportional to the square of the distance between their centres; $F = G\, {}^{m_1 m_2}/_{r^2}$
weight	the gravitational force the Earth (another planet) exerts on any object on or near its surface; $w = mg$
mass	The amount of matter in a body measured in kilogram (kg).
weightlessness	The sensation experienced when all contact forces are removed i.e. no external objects touch one's body.
Mechanics: Momentum and Impulse	
contact forces	Contact forces arise from the physical contact between two objects (e.g. a soccer player kicking a ball.)
non-contact forces	Non-contact forces arise even if two objects do not touch each other (e.g. the force of attraction of the earth on a parachutist even when the earth is not in direct contact with the parachutist.)
momentum	p … momentum is the product of an object's mass and its velocity. p = mv

linear momentum	the linear momentum of an object is a vector quantity with the same direction as the velocity of the object.
Newton's 2nd Law of Motion ito momentum	The resultant/net force acting on an object is equal to the rate of change of momentum of the object in the direction of the resultant/net force; $F_{net} = {}^{\Delta p}/_{\Delta t}$
Principle of the Conservation of Linear Momentum	The total linear momentum in an isolated system remains constant (is conserved). In symbols: $\Sigma p_{before} = \Sigma p_{after}$
isolated or closed system	One on which the net external force acting on the system is zero. An isolated system excludes external forces that originate outside the colliding bodies, e.g. friction. Only internal forces, e.g. contact forces between the colliding objects, are considered.
impulse	$F\Delta t$ … the product of the net force acting on an object and the time the net force acts on the object.
Impulse-momentum theorem	$F_{net}\Delta t = m\Delta v = m(v_f - v_i)$ – you must be able to deduce it.
elastic collision	A collision in which both total momentum and total kinetic energy are conserved.
inelastic collision	A collision during which kinetic energy is not conserved.
Mechanics: Vertical Projectile Motion	
1-D motion	One-dimensional motion. Linear motion. Motion in one line.

acceleration	The rate of change of velocity. Symbol: a Unit: meters per second squared ($m\cdot s^{-2}$)
gravitational acceleration	The acceleration of a body due to the force of attraction of the earth (g)
displacement	Change in position. Symbol: Δx (horizontal displacement) or Δy (vertical displacement) Unit: meters (m)
free fall	The type of motion in which the only significant vertical force acting on the body is the body's weight (i.e. the force of gravity).
gravitational force	F_g - a force of attraction of one body on another due to their masses.
position	Where an object is relative to a reference point. Symbol: x (horizontal position) or y (vertical position) Unit: meters (m)
projectile	An object in free fall.
velocity	The rate of change of position. Symbol: v Unit: meters per second ($m\cdot s^{-1}$)
Mechanics: Work, Energy and Power	
work	W … the work done on an object by a constant force F as $F\Delta x \cos \theta$, where F is the magnitude of the force, Δx the magnitude of the displacement and θ the angle between the force and the displacement. (Work is done by a force – the use of the term 'work is done against a force', e.g. work done against friction, must be avoided.) Distinguish between positive net work done and negative net work done on the system.

positive work	The kinetic energy of the object increases.
negative work	The kinetic energy of the object decreases.
work-energy theorem	The work done on an object by a net force is equal to the change in the object's kinetic energy: $W_{net} = \Delta K = K_f - K_i$
Principle of Conservation of Mechanical Energy	The total mechanical energy (E_M)(sum of gravitational potential energy and kinetic energy) in an isolated system remains constant.
conservative force	a force for which the work done in moving an object between two points is independent of the path taken. Examples are gravitational force, the elastic force in a spring and coulombic force.
non-conservative force	a force for which the work done in moving an object between two points depends on the path taken. Examples are frictional force, air resistance, tension in a chord, etc.
power	P … the rate at which work is done or energy is expended. $P = W / \Delta t$
Waves, Sound and Light: Doppler Effect	
Doppler effect	This is the change in frequency (or pitch) of the sound detected by a listener because the sound source and / or the listener have different velocities relative to the medium of sound propagation.
red shift	Observed when light from an object increased in wavelength (decrease in frequency). A red shift occurs when a light source moves away from an observer.
blue shift	Observed when light from an object decreased in wavelength (increase in frequency). A blue

	shift occurs when a light source moves towards an observer.
frequency	The number of vibrations per second. Symbol: f Unit: hertz (Hz) or per second (s^{-1})
wavelength	The distance between two successive points in phase. Symbol: λ Unit: meter (m)
wave equation	speed = frequency × wavelength
Electricity and Magnetism: Electrostatics	
Coulomb's Law	The magnitude of the electrostatic force exerted by one point charge (Q_1) on another point charge (Q_2) is directly proportional to the magnitudes of the charges and inversely proportional to the square of the distance (r) between them; $F = kQ_1Q_2/r^2$
electric field	A region of space in which an electric charge experiences a force.
electric field at a point	The electric field at a point is the electrostatic force experienced per unit positive charge placed at that point. $E = F/q$
direction of electric field	The direction of the electric field at a point is the direction that a positive test charge would move if placed at that point.
Electricity and Magnetism: Electric Circuits	
Ohm's Law	The potential difference across a conductor is directly proportional to the current in the conductor at constant temperature.
ohmic conductors	A conductor that obeys Ohm's law. The resistance of the conductor remains constant.
non-ohmic	A conductor that does not obey Ohm's law. The resistance of the conductor does not remain

conductors	constant, but increases as the current increases. Example: A bulb
power	(in context of electricity)(same as for work): power is the rate at which work is done. $P = W / \Delta t$
kilowatt hour (kWh)	The use of 1 kilowatt of electricity for 1 hour.
internal resistance	The resistance within a battery that causes a drop in the potential difference of the battery when there is a current in the circuit.
emf	Maximum energy provided (work done) by a battery per coulomb/unit charge passing through it. (It is the potential difference across the ends of a battery when there is NO current in the circuit.)
terminal potential difference	The energy transferred to or the work done per coulomb of charge passing through the battery when the battery delivers a current. (It is the potential difference across the ends of a battery when there is a current in the circuit.)
rms	root mean square (for alternating current / voltage): The rms value of AC is the direct current/voltage, which dissipates the same amount of energy as AC.
Electricity and Magnetism: Electrical Machines	
generator	A device that transfers mechanical energy into electrical energy.
Faraday's Law of EM Induction	The magnitude of the induced emf across the ends of a conductor is directly proportional to the rate of change in the magnetic flux linkage with the conductor. (When a conductor is moved in magnetic field, a potential difference is induced across the conductor.)

Fleming's RHR	Hold the thumb, forefinger and second finger of the RIGHT hand at right angles to each other. If the forefinger points in the direction of the magnetic field (N to S) and the thumb points in the direction of the force (movement), then the second finger points in the direction of the induced current.
electric motor	A device that transfers electrical energy into mechanical energy.
Fleming's LHR	Hold the thumb, forefinger and second finger of the LEFT hand at right angles to each other. If the forefinger points in the direction of the magnetic field (N to S) and the second finger points in the direction of the conventional current, then the thumb will point in the direction of the force (movement).
conventional current	Flow of electric charge from positive to negative in the external circuit
AC	Alternating current. The direction of the current changes each half cycle.
DC	Direct current. The direction of the current remains constant. (The direction of conventional current is from the positive to the negative pole of a battery. The direction of electron current is from the negative to the positive pole of the battery.)
root-mean-square potential difference	V_{rms} … The root-mean-square potential difference is the AC potential difference that dissipates the same amount of energy (gives the same heating effect) as an equivalent DC potential difference.
peak potential difference	V_{max} … The maximum potential difference value reached by the alternating current as it fluctuates i.e. the peak of the sine wave representing an AC potential difference.
root-mean-square	I_{rms} … Root-mean-square current is the alternating current that dissipates the same amount of

current	energy (gives the same heating effect) as and equivalent DC current.
peak current	I_{max} … The maximum current value reached by the alternating current as it fluctuates i.e. the peak of the sine wave representing an AC current.
Matter and Materials: Optical Phenomena and Properties of Materials	
photoelectric effect	the process whereby electrons are ejected from a metal surface when light of suitable frequency is incident on that surface.
threshold frequency	f_o … the minimum frequency of light needed to emit electrons from a certain metal surface.
work function	W_o … The work function of a metal is the minimum energy that an electron in the metal needs to be emitted from the metal surface.
photoelectric equation	$E = W_o + K_{max}$, where $E = hf$ and $W_o = hf_o$ and $K_{max} = \frac{1}{2}mv^2_{max}$
atomic absorption spectrum	formed when certain frequencies of electromagnetic radiation that passes through a medium, e.g. a cold gas, is absorbed.
atomic emission spectrum	formed when certain frequencies of electromagnetic radiation are emitted due to an atom's electrons making a transition from a high-energy state to a lower energy state.