DREAM BIG
AIM HIGH
NEVER GIVE UP

PHYSICS made EASY

Awesome physics is around you

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the success will chase you!

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PHYSICS SPM 2020

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PHYSICS DICTIONARY F4

F4 - CHAPTER 1 - INTRODUCTION TO PHYSICS

TERMS	DEFINITION / MEANING	FORMULA
Physical quantities	Quantities that can be measured	
Base quantities	Physical quantities that cannot be defined in terms of other quantities	
Derived quantities	Physical quantity obtained from the combination of base quantities through multiplication or division or both	
Base units	Units that cannot be defined in terms of other units	
Derived units	Units which are obtained from the combination of base units through multiplication or division or both	
Consistency	The ability (of a measuring instrument) to measure a quantity with **little or no deviation** among the measurements	
Accuracy	The **closeness** of a measurement to the **actual value**	
Sensitivity	The ability (of a measuring instrument) to **detect a small change** in the quantity to be measured	
Error	The difference between the measured value and the actual value.	
Systematic errors	Errors in the calibration of instruments or the non-zero reading when the actual reading should be zero	
Random error	Errors due to the mistakes made by the observer when taking measurement either through incorrect positioning of the eye or the instrument	
Parallax error	Error due to the incorrect positioning of the eye when reading a measurement	
Zero error	The non-zero reading when the actual reading should be zero that is the pointer of the instrument does not return to the zero position when it is not being used	
Vector quantity	Physical quantities that have both magnitude and direction	
Scalar quantity	Physical quantities that have magnitude only	

F4 - CHAPTER 2 – FORCE & MOTION

TERMS	DEFINITION / MEANING	FORMULA
Distance	**The total path length travelled** from one location to the other	
Displacement	The **distance between two locations** measured along the shortest path connecting them in a **specified direction**	
Speed	Rate of change of **distance** OR Distance travelled per unit time	$v = \frac{s}{t}$
Velocity	Rate of change of **displacement**	$v = \frac{s}{t}$
Acceleration	Rate of change of velocity	$a = \frac{v - u}{t}$
Deceleration	Rate of decrease in velocity	$-a = \frac{v - u}{t}$
Inertia	The tendency of the object to remain at rest or if moving to continue its motion	
Mass	The quantity of matter in an object	
Momentum	Product of mass and velocity	$p = mv$
Principle of conservation of momentum	In a closed system, the **total** momentum before collision is equal to the total momentum after collision provided there is **no external force**	
Elastic collision	A collision in which the objects do not combine after collision	$m_1u_1 + m_2u_2 = m_1v_1 + m_2v_2$
Inelastic collision	A collision in which the objects are combined after collision	$m_1u_1 + m_2u_2 = (m_1 + m_2)v$
Force	An agent that can change the shape, velocity and displacement of an object	$F = ma$
Unbalanced / net / resultant force	A single force that represents the combined effect of two or more forces with magnitude and direction	
Balanced forces / Forces in equilibrium	Situation in which forces acting on an object produces **no net force.** The object is **satationary** or moves with a **constant velocity** in a straight line.	
Impulsive force	Rate of change of momentum	$F = \frac{m(v - u)}{t}$
Impulse	Change in momentum	$impulse = mv - mu$ Impulse = Ft
Gravitational field	The region around the earth which an object experiences a force towards the centre of earth	
Gravitational field strength	The gravitational force acting on a mass of 1 kg placed at that point	g = 10 N kg $^{-1}$

Gravitational acceleration	The acceleration of an object due to the pull of the gravitational force	g = 10 m s $^{-2}$
Free fall	The motion in which the object falls due to gravitational force only	
Weight	The gravitational **force** acting on the object	$W = mg$
Newton's Second Law of Motion	The acceleration produced by a net force on an object is directly proportional to the magnitude of the net force applied and is inversely proportional to the mass of the object.	$F = \frac{m(v-u)}{t}$
Resolution of forces	The separation of a single force into two **perpendicular components** called the vertical and the horizontal component	
1 Newton	Is the force which acts on a body of mass 1 kg and causes the body to accelerate at 1 m s $^{-2}$	
Energy	The ability to do work	
Work done	The product of the applied force and the displacement in the direction of the applied force	W = Fs
Power	The rate at which work is done OR the amount of work done per second	$P = \frac{W}{t} = \frac{E}{t}$
1 watt	The power generated when 1 J of work is done in 1 s	
Kinetic energy	The energy of an object due to its motion	$E_k = \frac{1}{2}mv^2$
Gravitational potential energy	The energy of an object due to its higher position in the gravitational field	$E_p = mgh$
Principle of Conservation of energy	Energy cannot be created or destroyed. Energy can be transformed from one form to another. The **total energy** in a closed system is **constant** .	
Efficiency	The percentage of the energy input that is transformed into useful energy	$E = \frac{E_{out}}{E_{in}} x100\%$
Elasticity	The ability of an object to return to its original size / length / shape when the force that is acting on it is removed.	
Hooke's Law	The extension of a spring is directly proportional to the applied force provided the elastic limit is not exceeded	$F = kx$
Elastic limit	The maximum force which can act on an object before it loses its elasticity	
Force constant / spring constant	Force per unit extension	$k = \frac{F}{x}$
Elastic potential energy	The energy stored in an object when it is stretched or compressed	$E_p = \frac{1}{2}Fx = \frac{1}{2}kx^2$

F4 - CHAPTER 3 – FORCES & PRESSURE

TERMS	DEFINITION / MEANING	FORMULA
Density	Mass per unit volume	
Pressure	Magnitude of force acting perpendicularly to a surface per unit area of the surface OR Force per unit area	$P = \frac{F}{A}$ $P = \rho gh$
1 Pascal or 1 N m $^{-2}$	The pressure exerted on a surface when a force of 1 N acts perpendicularly to an area of 1 m ^{2}	
Atmospheric pressure	The pressure due to the weight of the air acting per unit area on the earth's surface	
Pascal's Principle	The pressure applied to an enclosed fluid is transmitted uniformly to every part of the liquid.	$P = \frac{F_1}{A_1} = \frac{F_2}{A_2}$ $P = A_1 h_1 = A_2 h_2$
Buoyant force	The **upward force** exerted by a fluid when an object is wholly or partially immersed in the fluid	$F_B = \rho V g$
Archimedes' Principle	For a body wholly or partially immersed in a fluid, the buoyant force is equal to the **weight of the fluid it displaces**	
Bernoulli's Principle	In a moving fluid, where the speed is low, the pressure is high and where the speed is high, the pressure is low	

"DON'T WATCH THE CLOCK; DO WHAT IT DOES. KEEP GOING."

SAM LEVENSON

F4 - CHAPTER 4 – HEAT

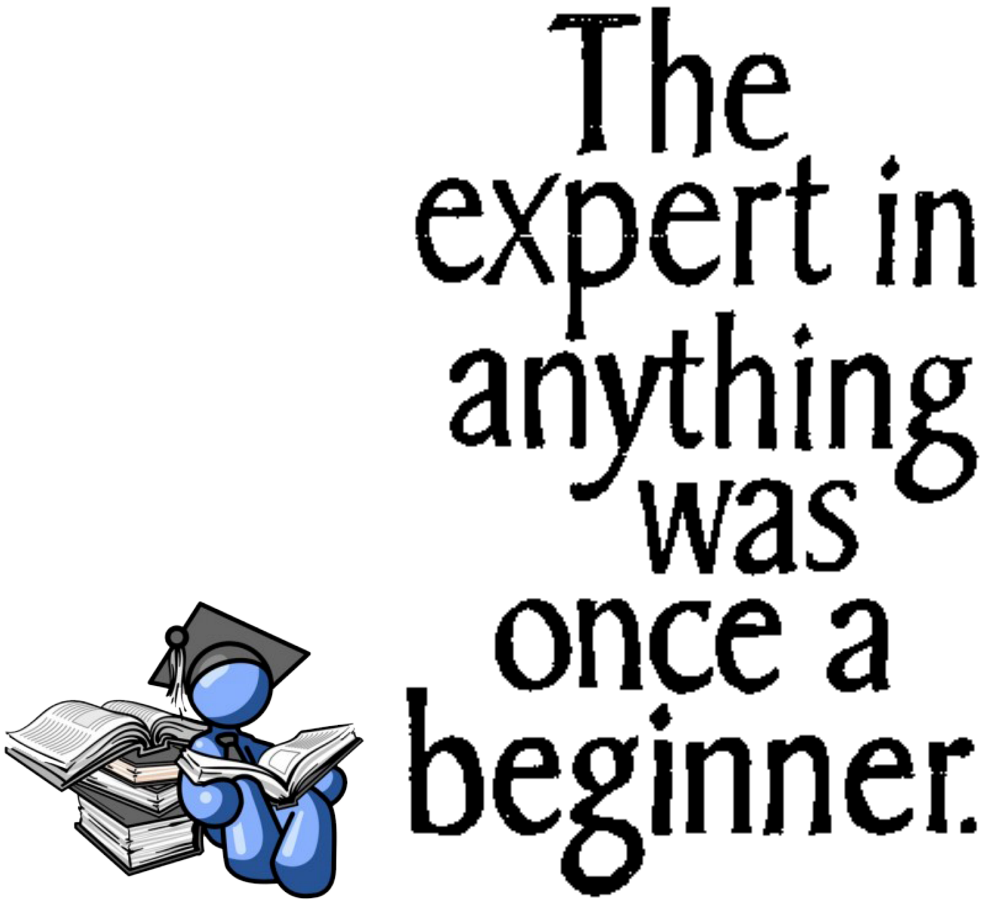
TERMS	DEFINITION / MEANING	FORMULA
Thermal equilibrium	The situation in which two objects which are in thermal contact have the same rate of heat transfer and the same temperature The **NET heat flow** between the two objects is **zero**	
Lower fixed point // ice point	The temperature at which pure ice melts under the standard atmospheric pressure	
Upper fixed point // Steam point	The temperature of steam from pure water that is boiling under standard atmospheric pressure	
Heat capacity	The amount of heat required to increase the temperature of an object by 1°C	
Specific heat capacity	The amount of heat that must be supplied to an object of mass 1 kg to increase its temperature by 1°C	$c = \frac{Q}{m\theta}$
Specific latent heat of fusion	The amount of heat required to change 1 kg of a substance from solid to liquid without any change in temperature	$l = \frac{Q}{m}$
Specific latent heat of vaporisation	The amount of heat required to change 1 kg of a substance from liquid to gas without any change in temperature	$l = \frac{Q}{m}$
Boyle's Law	For a fixed mass of gas, the pressure of the gas is **inversely proportional** to its volume when the temperature is kept constant	$P_1V_1 = P_2V_2$
Charles' Law	For a fixed mass of gas, the volume of the gas is directly proportional to the **absolute** temperature of the gas when the pressure is kept constant	$\frac{V_1}{T_1} = \frac{V_2}{T_2}$
Pressure Law	For a fixed mass of gas, the pressure of the gas is directly proportional to the **absolute** temperature of the gas when the volume is kept constant	$\frac{P_1}{T_1} = \frac{P_2}{T_2}$
Absolute zero	The lowest temperature in theory in which the pressure and the kinetic energy of gas molecules are zero	

GREAT THINGS NEVER CAME FROM COMFORT ZONES
KEEP MOVING FORWARD
WITH THE GREAT MOMENTUM....

F4 - CHAPTER 5 – LIGHT

TERMS	DEFINITION / MEANING	FORMULA
Law of reflection	i) The incident ray, the reflected ray and the normal all lie in the same plane ii) The angle of incidence is equal to the angle of reflection	
Principal axis of a curved mirror	The line passing through the vertex, P and the centre of curvature, C	
Centre of curvature, C	The centre of the sphere that forms the curved mirror	
Focal point, F of a concave mirror	The point on the principal axis where the reflected rays converge that is meet and intersect	
Focal point, F of a convex mirror	The point on the principal axis where the reflected rays diverge that is appear to spread out from behind the mirror	
Real image	The image that can be formed / displayed on a screen	
Virtual image	The image that cannot be formed on a screen	
Reflection of light	The **return** of light waves when they hit a reflector (mirror)	
Refraction of light	The **bending** of light ray at the boundary as it travels from one medium to another of different **optical densities**	
Law of refraction	The incident ray, the refracted ray and normal all lie in the same plane. The ratio of sin i / sin r is a constant (Snell's Law)	
Refractive index, n	The value of the constant (sin i / sin r) for a light ray passing through a vacuum into a given medium	$\eta = \frac{\sin i}{\sin r}$ $= \frac{\text{speed in air}}{\text{speed in medium}}$ $= \frac{H\,(\text{Real})}{h\,(\text{Apparent})}$
Real depth	The distance of the real object from the surface of a medium (eg: water, glass)	
Apparent depth	The distance of the virtual image from the surface of the medium (eg: water, glass)	
Critical angle, c	The angle of incidence in the denser medium when the angle of refraction in the less dense medium is 90°	
Total internal reflection	The condition in which the light ray from a **denser medium to a less dense** medium is reflected back into the denser medium when the **angle of incidence is greater than the critical angle**	
Focal point, F of a lens	A common point on the principal axis where all the rays parallel to the axis converge to it after passing through a convex lens or appear to diverge from it after passing through a concave lens	

Power of lens	The reciprocal of the focal length	$P = \frac{1}{f}$
Focal length, f	The distance between the focal point and the optical centre	
Linear magnification	The ratio of the image size to the object size OR the ratio of the image distance to object distance	$m = \frac{v}{u}$



PHYSICS DICTIONARY F5

F5 - CHAPTER 1 – WAVES

TERMS	DEFINITION / MEANING	FORMULA
Wave	A travelling disturbance from a vibrating or oscillating source which carries energy along with it in the direction of the propagation	
Vibration / oscillation	A uniform to –and-fro motion of an object / particle from a vibrating source	
Transverse wave	A wave in which the particles of the medium oscillate in the direction **perpendicular** to the direction in which the wave moves (eg: water, light, all EM waves)	
Longitudinal wave	A wave in which the particles of the medium oscillate in the direction **parallel** to the direction in which the wave moves (eg: sound)	
Wavefront	An imaginary line that joins all identical points on a wave	
One complete oscillation	The to-and-fro motion of an object / particle from one particular point	
Amplitude, a (SI unit : m)	The **maximum displacement** from the mean position of a wave	
Period, T (SI unit :s)	The time taken to complete **one oscillation**	$T = \frac{1}{f}$
Frequency, f (SI unit : Hz)	The number of complete oscillations made **in 1 second**	$f = \frac{1}{T}$
Wavelength, λ	The horizontal distance between two successive equivalent points on a wave	$\lambda = v / f$ $v = f \lambda$
Damping	Energy loss from an oscillating system to the surrounding in the form of heat energy	
Natural frequency	The frequency in which an oscillating system vibrates when no external force is applied	
Resonance	The phenomena in which an oscillating system is driven at its **natural frequency** by a periodic force. Maximum energy transfer occurs to the system and it oscillates at a **large amplitude**	
Reflection of waves	The phenomena when all or part of the wave **return** after they encounter an obstacle known as reflector	
Refraction of waves	The phenomena in which there is a **change of direction of propagation** due to a **change of speed** when water waves travel one area to another **of different depths**	

Diffraction of waves	The phenomena that refers to the **spreading** out of waves when they move through a **gap or round an obstacle**	
Interference of waves	The phenomena in which two sets of **coherent waves** meet / combine	
Coherent waves	Waves which maintain a constant phase difference, amplitude and frequency	
Principle of Superposition	The combined wave forms of two or more interfering waves waves is given by the **sum of the displacement** of the individual wave at each point of the medium	
Constructive interference	The combination / superposition of two coherent waves in which the vertical displacements of the two waves are in the **same direction**	
Destructive interference	The combination / superposition of two coherent waves in which a positive displacement of a wave meets a negative displacement of another wave and the **combined amplitude becomes zero**	
Audio waves	Sound waves generated between 20 Hz and 20 kHz and can be heard by normal human ears	
Infrasound	Sound with frequency below 20 Hz	
Ultrasound	Sound with frequency above 20 kHz	
Electromagnetic spectrum	Consists of a group of waves with similar natures and are arranged in increasing frequencies and decreasing wavelengths	
Electromagnetic waves	Waves which consist of a joint electric and magnetic fields which oscillate **perpendicular** to each other	

Our greatest weakness lies in giving up.
The most certain way
to succeed is
always to try just one more time

-Thomas A. Edison

F5 - CHAPTER 2 – ELECTRICITY

TERMS	DEFINITION / MEANING	FORMULA
Electric current	The rate of charge flow in a circuit	$I = \frac{Q}{t}$
1 ampere	The electric current that flows through a conductor if 1 coulomb of charge flows through the conductor in 1 second	$A = C\ s^{-1}$
Electric field	A region in which an electric charge experiences an electric force	
Potential difference	The work done or the energy that would be required to move 1 C of charge from one point to another in a circuit	$V = \frac{E}{Q}$
1 volt	The work done to move 1C of charge between two points is 1 J	$V = J\ C^{-1}$
Resistance	The ratio of potential difference across a conductor to the electric current flowing through the conductor	$R = \frac{V}{I}$
Ohm's Law	The electric current passing through an ohmic conductor is directly proportional to the potential difference between its end provided that the **temperature and other physical properties** of the conductor are **constant**	$V = IR$
Series circuit	All the components are connected one after another in a single path	
Parallel circuit	All the components are connected with their corresponding ends joined together at common points to form separate and parallel paths	
Electromotive force (emf)	The work done by a source (dry cell / battery) in driving **a unit charge** around a complete circuit	$E = I(R + r)$ $E = V + Ir$
Internal resistance, r	The resistance against the moving charge due to the electrolyte in the cell / battery	$r = \frac{E - V}{I}$
Electrical power	The rate of electrical energy dissipated or transferred	$P = \frac{W}{t}$

DON'T BE THE SAME

BE BETTER!

F5 - CHAPTER 3 – ELECTROMAGNETISM

TERMS	DEFINITION / MEANING	FORMULA
Electromagnet	A temporary magnet made by winding a coil of insulated wire round a soft iron core A temporary magnet when current flow through a conductor	
Magnetic field	A region round a current – carrying conductor in which a **magnetic force acts** A region where magnetic material experience force	
Catapult field	The **resultant magnetic field** due to the combination of the magnetic field due to the current in the conductor and the external magnetic field	
Electromagnetic induction	The setting up of an electromotive force in a conductor due to a change in the magnetix flux caused by the relative motion of the conductor and a magnetic field. The induced emf will cause induced current to flow Production of indueced current when there is a change in magnetic field / flux magnet	
Lenz's Law	The **direction of the induced current** in such that the change producing it will be **opposed**	
Faraday's Law	The **magnitude of the induced emf** is directly proportional to the rate of change of magnetic flux or the rate of cutting of the magnetic flux	
Direct current	A current that flows in one direction only in a circuit and the magnitude of the current maybe constant or changes with time	
Alternating current	A current which flows to and fro in two opposite directions in a circuit and it changes its direction periodically	
Transformer	A device which works on the principle of electromagnetic induction which steps up or steps down alternating current voltages	$\frac{Np}{Vp} = \frac{Ns}{Vs}$
Step-up transformer	A transformer where the number of turns in the secondary coil is greater than the number of turns in the primary coil, the voltage across the secondary coil is greater than the voltage across the primary coil	
Step-down transformer	A transformer where the number of turns in the secondary coil is less than the number of turns in the primary coil, the voltage across the secondary coil is less than the voltage across the primary coil	
Ideal transformer	A transformer in which the output power is equal to the input power and there is no energy loss during the process of transforming the voltage	$P_{out} = P_{in}$ $V_s I_s = V_p I_p$
Eddy current	The **current induced in the soft iron core** due to the changing magnetic field produced by the alternating current in the coils	

National Grid Network	A network system of cables which connects all the power stations and substations in the country to the consumers in a closed network to transmit electricity	

F5 - CHAPTER 4 – ELECTRONIC

TERMS	DEFINITION / MEANING	FORMULA
Thermionic emission	The process of emission of **electrons** from the surface of a **heated metal**	
Cathode ray	The stream of **electrons** which moves from **cathode to anode at high speed** across a vacuum	
Semiconductor	A material which can conduct electricity better than insulator, but not as well as conductor	
Doping	A process of adding a certain amount of specific impurities called dopants to a semiconductor to **increase its conductivity**	
n-type semiconductor	Semiconductor obtained when **pentavalent** atoms which are doped into the intrinsic semiconductor contribute extra electrons. Free **electrons become the majority charge carrier** and the holes become the minority carrier	
p-type semiconductor	Semiconductor obtained when **trivalent** atoms which are doped into the intrinsic semiconductor contribute extra holes. Free electrons become the minority charge carrier and the **holes become the majority charge carrier**	
p-n junction	Formed when pieces of n-type and p-type semiconductors are fused together	
semiconductor diode	An electronic device made from a p-n junction that allows current to flow in one direction only but blocks it in the opposite direction	
Forward bias	The connection in which the p-type (anode) of the diode is connected to the positive terminal of a battery and the n-type (cathode) is connected to the negative terminal of the battery	
Reverse bias	The connection in which the p-type (anode) of the diode is connected to the negative terminal of a battery and the n-type (cathode) is connected to the positive terminal of the battery	
Rectifier	An electrical device that converts alternating current to direct current	
Half-wave rectification	A process where only **half of every cycle** of an alternating current is made to flow in **one direction** only.	

Full-wave rectification	A process where **both halves of every cycle** of an alternating current is made to flow in the **same direction**	
Transistor	An electronic device which has three terminals labelled base, collector and emitter, made by coalescing (fusing) the n-type and p-type semiconductors	
Logic gates	A switching circuit made up of a combination of transistor switches which has one or more inputs but only one output	
Truth table	A record of all the possible combinations of inputs and the corresponding outputs for a particular logic circuit	

F5 - CHAPTER 5 – RADIOACTIVITY

TERMS	DEFINITION / MEANING	FORMULA
Proton number, Z	The number of protons in the nucleus of an atom	
Nucleon number, A	The total number of protons and neutrons in the nucleus of an atom	
Isotopes	Atoms of an element which have the same proton number but different nucleon number	
Radioactivity	The spontaneous disintegration of an unstable nucleus accompanied by the emission of an **energetic particle or a photon** (or radioactive emission)	
Radioactive decay	The process in which an unstable nucleus changes into a **more stable nucleus** by emitting **radiation**	
Radiation	The **energy** given out by an unstable nucleus in the form of energetic particles or photon	
Ionising effect	The production of charged particles called ions when the energetic particle or photon passes through a medium, it can knock electrons out of the atoms and molecules of the medium.	
Half-life	The **time** taken for the number of the undecayed nuclei in the sample to be **reduced to half** of its original number	
Radioisotopes	Unstable nuclei of an element which have the same number of protons but different number of neutrons which decay and give out radioactive emissions	

Atomic mass unit (amu or u)	$\frac{1}{12}$ of the mass of the carbon-12 atom	
Nuclear fission	The process of **splitting a heavy nucleus into two** lighter nuclei which releases emormous amount of energy	
Chain reaction	Self-sustaining reaction in which the products of a reaction can initiate another similar reaction	
Nuclear fusion	The process of **combining two lighter nuclei** to form **a heavier nucleus** which releases enormous amount of energy	
Einstein's Principle	Mass and energy are not conserved separately and can be exchanged one for the other by using this equation : $E = mc^2$ where E = energy released(J), m = mass defect(kg) c = speed of light (3×10^8 ms $^{-1}$)	$E = mc^2$

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CHARACTERISTICS, LEVEL & EXPLANATION

FORCE & MOTION

NO.	CHARACTERISTIC	LEVEL	EXPALANATION
1	**Impulsive force, F**	**LARGE**	The change in momentum is large // the time interval of interaction is small
		SMALL	The change in momentum is smaller // the time interval of interaction is longer
2	**Elastic limit of spring**	**HIGH**	Larger force can be applied provided the elastic limit has not been exceeded
		LOW	If the elastic limit exceeded, spring will not return to its original shape and size or might snap easily
3	**Diameter of coil of spring**	**SMALL**	Stronger and stiffer and able to sustain heavier weight (high spring constant, k)
		BIG	Soft Spring and not able to sustain heavier weight
4	**Diameter of wire of spring**	**SMALL**	Soft Spring and not able to sustain heavier weight
		BIG	Stronger and stiffer and able to sustain heavier weight (high spring constant, k)
5	**The spring // force constant, k or Stiffness of spring** (a larger gradient indicates a stiffer spring)	**HIGH**	Does not change its shape easily when force is exerted (Stronger spring and less elastic)
		LOW	Change its shape easily when force is exerted (Soft spring and more elastic)
6	**Strength of spring**	**STRONG**	Does not break easily // snap when force is given
		WEAK	Break easily/snap when force is given
7	**Rate of rusting**	**HIGH**	Rust quickly
		LOW	Hard to/does not/slow to rust//making a durable material not easily corroded
8	**Rate of expansion**	**HIGH**	Expand more to certain increase in temperature
		LOW	Not easily expand when temperature increases
9	**Position of the centre of gravity from the ground**	**HIGH**	Not stable
		LOW	Very stable

HEAT

NO.	CHARACTERISTIC	LEVEL	EXPALANATION
1	**Pressure of Gases**	**HIGH**	The collisions between the particles and the walls of the container per unit area increase
		LOW	The collisions between the particles and the walls of the container per unit area decrease
2	**Volume of Gases**	**LARGE**	When gas expands, the volume of the gas is allowed to increase freely
		SMALL	When gas not expands, the volume of the gas is allowed to decreases freely
3	**Temperature of gases**	**HIGH**	The average kinetic energy of the gas molecules increase
		LOW	The average kinetic energy of the gas molecules decreases
4	**Freezing point**	**HIGH**	Freeze easily // freeze at higher temperature
		LOW	Does not freeze in cold weather easily // freeze at lower temperature
5	**Boiling point**	**HIGH**	Does not evaporate// does not boil easily
		LOW	Evaporate easily /boiling easily
6	**Melting point**	**HIGH**	Does not melt easily // melting at higher temperature
		LOW	Melt easily // melting at lower temperature
7	**Specific latent heat of vaporization**	**HIGH**	Large amount of heat for boiling // Takes longer time to boil
		LOW	Small amount of heat for boiling // Takes shorter time to boil
8	**Specific latent heat of fusion**	**HIGH**	Large amount of heat for melting // Takes longer time to melt
		LOW	Small amount of heat for melting // Takes shorter time to melt
9	**Specific heat capacity**	**HIGH**	More amount of heat is absorbed to increase the temperature // Not easily heated // Making it a good insulator
		LOW	Less amount of heat is absorbed to increase the temperature // Hot quickly
10	**Thermal conductivity**	**HIGH**	More heat lost to the surrounding // Can transfer heat easily
		LOW	To avoid heat lost to the surrounding // Cannot transfer heat easily

ELECTRICITY

NO.	CHARACTERISTIC	LEVEL	EXPALANATION
1	emf cell	MORE	Supply bigger current through the same resistor
		LESS	Supply smaller current through the same resistor
2	Resistance	HIGH	less current flow
		LOW	more current flow
3	Resistivity of the wire	HIGH	More heat is produced // higher resistance for the filament in order to generate light and heat.
		LOW	A large current flow // less energy dissipated as heat
4	Electric devices power	HIGH	Use more electric energy in one second
		LOW	Use less electric energy in one second
5	Electric devices voltage	HIGH	Require smaller current to generate power
		LOW	Require bigger current to generate power
6	Voltmeter range	BIG	Have lower sensitivity level // can measure bigger potential difference (voltage)
		SMALL	Have lower sensitivity level // can measure bigger voltage
7	Ammeter range	BIG	Have lower sensitivity level // can measure bigger current
		SMALL	Have higher sensitivity level // can measure smaller current
8	Melting point of wire	HIGH	Wire can withstand the greater heat when current flows through it
		LOW	the wire easily melt // electric shock occur
9	Density of cable/wire	HIGH	Wire is more heavy
		LOW	Wire is lighter // to reduce the weight of the wire//easier to be carried around
10	Ammeter is connected in series with bulb or devices because	Has a low resistance so that its existence has little effect on the magnitude of current flowing	
11	Voltmeter is connected in parallel with bulb or devices because	Has a high resistance, current flowing through it is negligible	
12	Copper wire	Good conductor of electricity // It has low resistance and less energy is lost as heat // lower specific heat capacity	
13	Bulb/device is connected in parallel because	Voltage across each bulb or devices is the same// If one of the branches is defective, the flow of electricity will not be broken in the other branches // Can be switch on individually	
14	Bulb connected in series	One of the bulb is broken, the current flows in entire circuit ceases (stop flowing) // All voltage of bulb are not equal	

15	**Factor affecting R for metal (conductor)** $$R = \frac{\rho l}{A}$$	Length of wire, l **increases**	Resistance also increases
		Cross-sectional area, A **increases**	Resistance decreases
		Type of substance	$R_{silver} < R_{copper} < R_{constantan} < R_{nichrome} < R_{tungsten}$
		Temperature **increases**	Resistance also increases

Pressure can burst a pipe,
But… pressure also make diamonds, so…
PUSH

YOURSELF

No One Else Is Going to Do It for You

ELECTROMAGNETISM

NO.	CHARACTERISTIC	EXPALANATION
1	**Catapult field**	The magnetic field from the current in the conductor and the magnetic field from magnetic combine to produce resultant field
2	**An electromotive force produced / Induced EMF**	Is induced in a conductor when there is a relative motion that causes the conductor to cut the magnetic field lines
3	**The direction of the magnetic force**	Can be determined by **Fleming 's Left-hand rule.** (used in electric motor)
4	**The direction of the induced current**	Can be determined by **Fleming 's Right-hand rule.** (used in electric generator/ dynamo)
5	**The speed of rotation of a direct current (DC) motor depends on:**	(i) The size of the current (ii) The strength of the magnetic field from permanent magnet (iii) The number of turn of the coil (iv) The resistance of wire
6	**The magnitude of magnetic force on a current-carrying conductor depends on:**	(i) The size of the current (ii) The strength of the magnetic field from permanent magnet (iii) The resistance of wire
7	**Step-down transformer**	The secondary voltage produced is less than primary voltage (i) To reduce voltage (ii) To increase current flow
8	**Step-up transformer**	The secondary voltage produced is more than primary voltage (i) To increase voltage (ii) To reduce current flow
9	**Energy losses in a transformer because**	**Eddy's currents in the core (produce by changing magnetic field)** Can be reduced by using a laminated iron core **Magnetism and demagnetization of the core** Can be made easy by using soft iron core **Leakage of magnetic flux** Can be reduced by winding the secondary and primary coils on top of each other **Heating effect in the coils** Can be reduced using thicker wire made of good conductor like copper (by reducing the wire resistance)

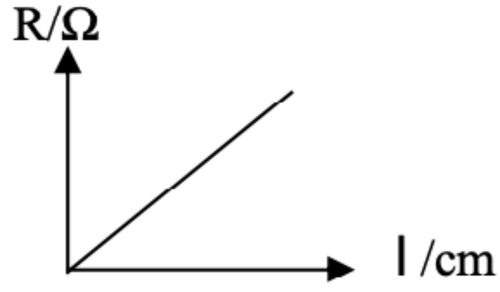
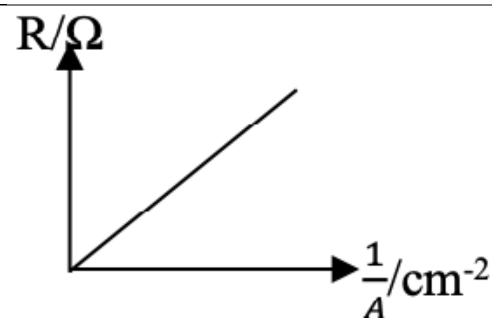
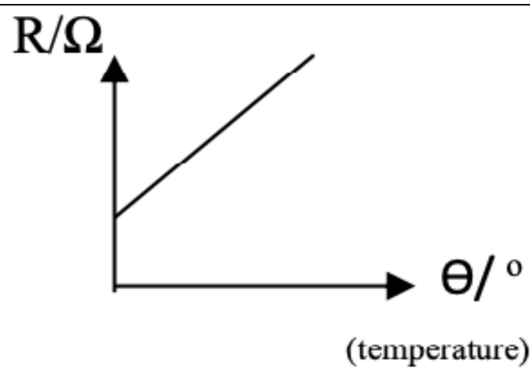
ELECTRONIC

NO.	CHARACTERISTIC	EXPALANATION
1	**Doping of semiconductor**	A process of adding a certain amount of specific impurities to semiconductor to increase their conductivity
2	**n-type semiconductor**	Is produced by replacing some of the silicon atoms in silicon with **pentavalent atoms** such as **Phosphorus, Arsenic or Antimony** (to create **extra free electrons**)
3	**p-type semiconductor**	Is produced by replacing some of the silicon atoms in silicon with ***trivalent atoms*** such as **Boron, Aluminum or Gallium** (to create **extra free holes**)
4	**Rectification**	A process to convert an alternating current (ac) into a direct current (dc) by using diode
5	**Capacitor smoothing**	The discharge current from a capacitor helps to maintain a steady output voltage across a resistor by supplying current at all time. The capacitor used for smoothing purpose only works with alternating current (ac)
6	**Diode**	Allows the current to flow easily in only **one** direction
7	**Alternating current**	Current flows in **two** directions consecutively
8	**Forward bias**	• When a p-type semiconductor is connected to the positive terminal and a n-type semiconductor is connected to the negative terminal of a cell • electrons from the n-type are pulled across the p-n junction, • this will cause the current to flow
9	**Reverse bias**	• When a n-type material is connected to the positive terminal and a p-type material is connected to the negative terminal of a cell • electrons from the n-type are pulled toward the positive terminal of cell • the junction becomes wider and the current stop to flow
10	**Function of transistor**	(i) As a **currents amplifier** (ii) As an **automatic switch** (eg. an automatic light controlled switch or an automatic heat controlled switch)

RADIOACTIVITY

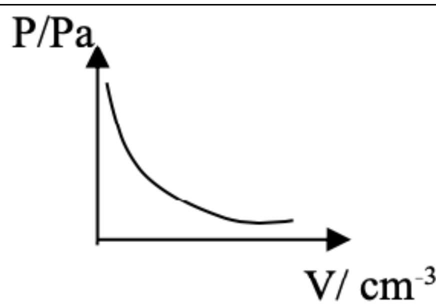
NO.	CHARACTERISTIC	LEVEL	EXPALANATION
1	**Half life**	**LONG**	Activation decrease slowly // decompose slowly // Long lasting radioactivity
		SHORT	Activation decrease faster // decompose quickly // Short radioactivity
2	**Penetrating power** **(alpha, α -stopped by a sheet of paper or a few cm of air)** **(beta, β-stopped by a few mm of aluminum)** **(gamma, ɣ -stopped by a few cm of lead)**	**LONG**	Can penetrate the body to be detected externally (gamma rays-can penetrate deep into the skin and Inflict damage onto the cells)
		SHORT	Cannot penetrate the body to be detected externally (alpha particles)
3	**Radioisotope in solid**		It is easy to handle // easily to use/stored// safer
4	**Ionizing power** **(ions per mm in air)**	**HIGH**	Alpha particles have the strong ionizing effect
		LOW	Gamma ray have weaker ionizing effect on air molecules
5	**Effect of electric field**	**HIGH**	Beta particles have the deflection is greater due to the small mass of electron // deflected towards the positive plate
		LOW	Gamma ray not deflected because has no charge
6	**Effect of magnetic field**	**HIGH**	Beta particles Greater deflection because beta particle has a very small mass
		LOW	Gamma ray no deflection because gamma has no charge
7	**Alpha particle**		High ionization power // able to ionize the air easily
8	**Beta particle**		Fast moving electrons // very small mass // lighter
9	**Gamma rays**		Its high penetrating power // less dangerous inside body // do not ionize the cells// it is less likely to be absorbed // can kill bacteria, fungi, germ

GRAPH & EXPLANATION

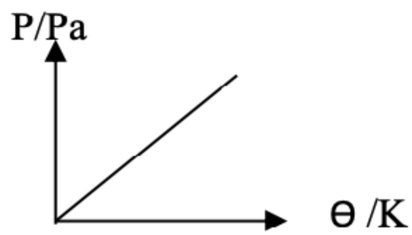
TOPIC	GRAPH	EXPLANATION
Factor affecting R for metal (conductor) $R = \frac{\rho l}{A}$		R is **directly proportional** to l (R = Resistance) (l = length) (obeying ohm's law)
		R is **directly proportional** to 1/A (R = Resistance) (A = area of wire) (obeying ohm's law)
		R increases linearly with θ

GRAPH & EXPLANATION

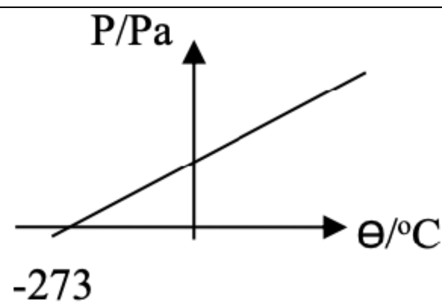
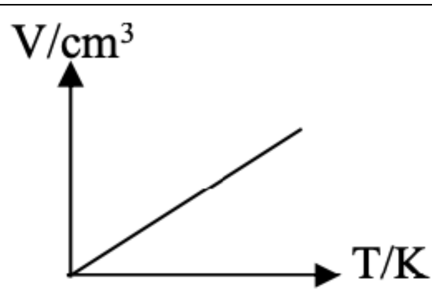
<table>
<tr><th>TOPIC</th><th>GRAPH</th><th>EXPLANATION</th></tr>
<tr><td rowspan="4">GAS LAW

$PV = nRT$</td><td>
</td><td>P is inversely proportional to V

(P = Pressure of gas)
(V = Volume of gas)

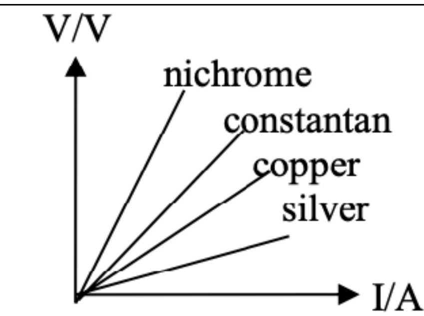
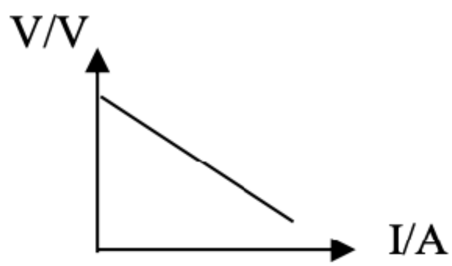
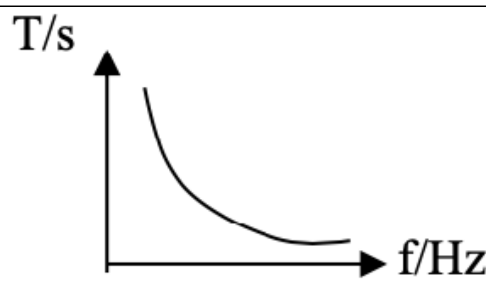
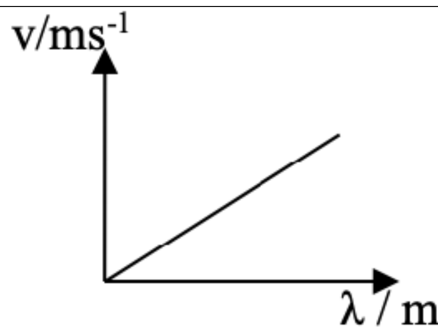
$$P_1V_1 = P_2V_2$$</td></tr>
<tr><td>
</td><td>P is directly proportional to ϴ

(P = pressure of gas)
(ϴ = Temp. in Kelvin)

$$\frac{P_1}{T_1} = \frac{P_2}{T_2}$$</td></tr>
<tr><td>
</td><td>P increases linearly with ϴ
(P = Pressure of gas)
(ϴ = temperature)</td></tr>
<tr><td>
</td><td>V is directly proportional to T
(V = Volume of gas)
(T = Kelvin)

$$\frac{V_1}{T_1} = \frac{V_2}{T_2}$$</td></tr>
</table>

GRAPH & EXPLANATION

TOPIC	GRAPH	EXPLANATION
ELECTRICITY		V is **directly proportional** to I $R_{silver} < R_{copper} < R_{constantan} < R_{nichrome}$
		V **decreases linearly** with I From the formulae: E = V + Ir So, V = -rI + E in the form of Y = mX + c (-r = gradient) (electromotive force, E = intercept on the V-axis)
WAVES		T is **inversely proportional** to f $T = \frac{1}{f}$
		Velocity ,v is **directly proportional** to wavelength, λ $V = f\lambda$