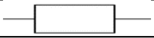
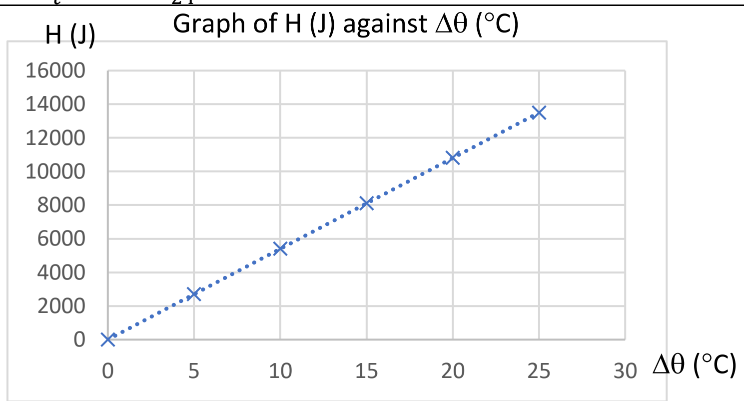
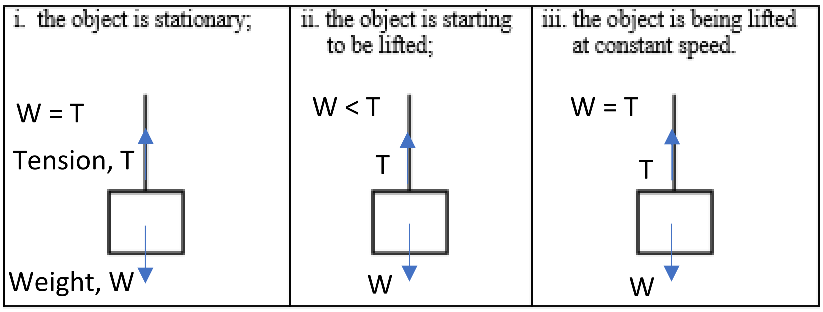
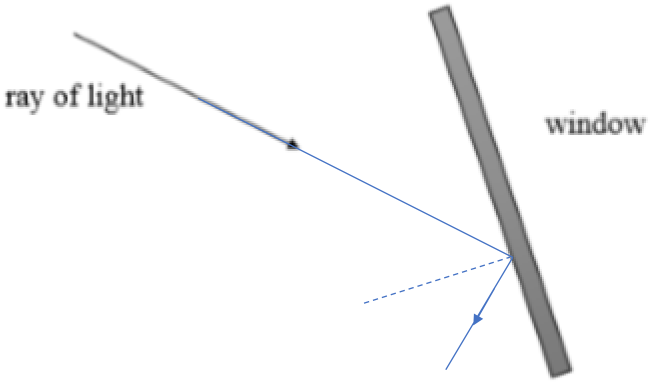
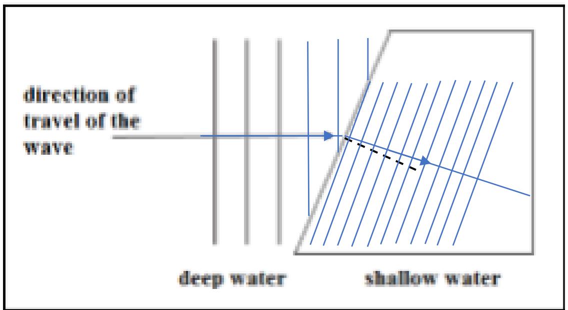
May 17 Paper 1

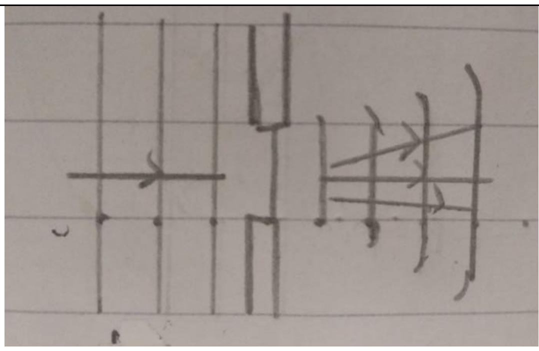
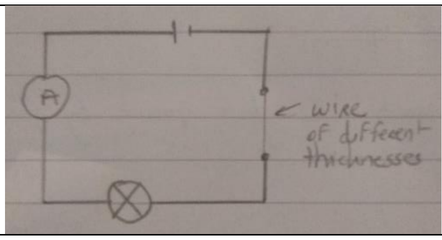
1a	The force caused by the pull of gravity on an object which has a mass
1b	The force of gravity keeps an object orbiting around a bigger mass. The mass of the moon keeps it orbiting around the Earth.
1c	ii, i, v, iii, iv
1d	It is believed that the universe started from the big bang, an explosion which occurred years ago, and up to this very day the remains from the explosion are still moving away from its centre, thus the universe is expanding.
2a	Density is the mass per unit volume which differs from one material to another but is constant for a particular material.
2b	V = l x b x h = 4.5 x 3.5 X 4 = 63 m^3
2c	$\rho = \frac{m}{V}$, 1.1 = $\frac{m}{63}$, m = 1.1 x 63 = 69.3 kg
2d	The heated air becomes less dense, hence floats above the colder air which is more dense. This causes convection currents.
2e	Carbon dioxide collects at the bottom of the room, hence it is denser than the air in the room.
3ai	P = Weight of car, Q = reaction from the ground on tyres, S = driving force, T = Opposing forces such as friction and air resistance
3aii	Constant velocity, S = T
3aiii	Car moving forward, S > T
3aiv	Newton’s first law of moments which states that an object at rest remains at rest and an object moving will continue to move at the same constant velocity as long as there are no external forces acting on it.
3e	Resultant Force = 677000 – 676000 = 1000N F = ma, 1000 = 1815a, a = 1000/1815 = 0.55 m/s^2
4a	
4b	Decreases, heat
4ci	In series : Total T = $R_1 + R_2$ = 400 + 250 = 650 Ω
4cii	For 400 Ω: V = IR, 20 = I x 400, I = $\frac{20}{400}$ = 0.05 A For 0.25 kΩ, I remains 0.05 A since in series, V = IR = 250 x 0.05 = 12.5V
4di	In parallel, total resistance is always less than each of the resistors. Hence, decreases
4dii	Since V in parallel remains costant, V across the 400 Ω resistor is 32 V.
5a	$\Delta\theta$ = 40 – 20 = 20 °C, P = $\frac{E}{t}$, 450 = $\frac{E}{24}$, E = 450 x 24 = 10,800 J
5b	
5c	Grad = $\frac{\Delta y}{\Delta x} = \frac{13500-0}{25-0}$ = 540 J/°C

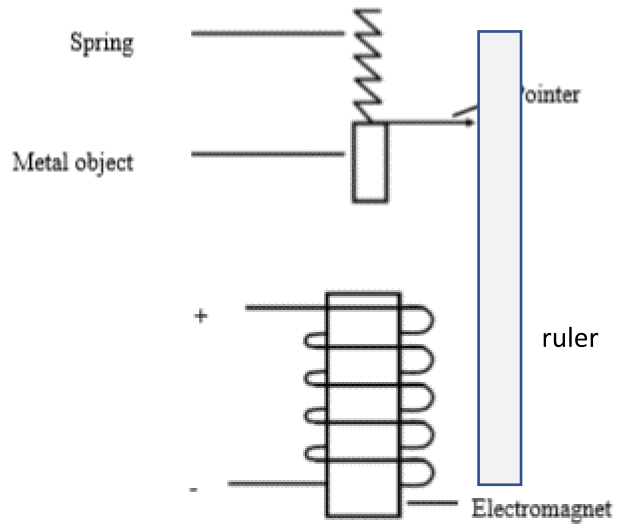
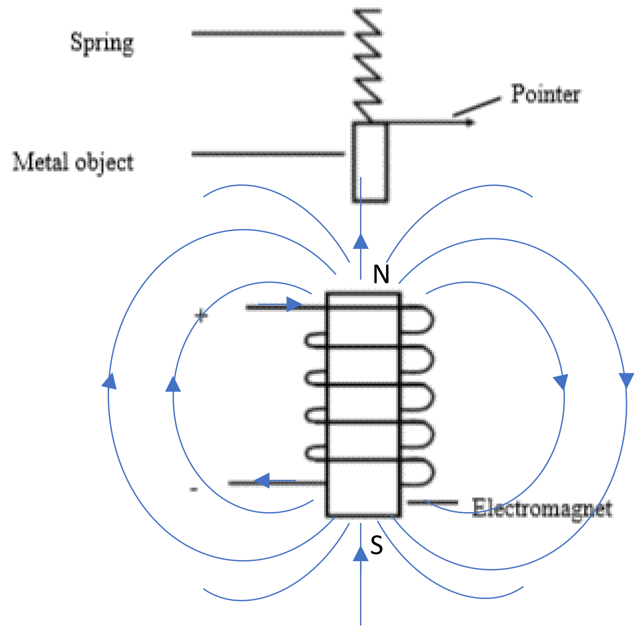
5d	The brass block was lagged to avoid energy losses.
6a	Electrical energy to heat energy
6b	For A: P = IV, 1980 = I x 220 , I = 1980 / 220 = 9 A For B: P = IV, P = 6.4 x 220 = 1408 W
6c	Kettle A, since it has the highest power. P = $\frac{E}{t}$, 1980 = $\frac{E}{12 \times 60}$, E = 12 x 60 x 1980 = 1,425,600 W
6d	Kettle A : 10 A, Kettle B : 7 A
6e	Kettle B since it has a plastic outer case and so it can do without an Earth wire.
7a	α - stopped by a thin sheet of paper β - stopped by a thin sheet of aluminium γ - slowed down by wall of lead
7b	37 the mass number (no of protons and neutrons in the nucleus) 17 the proton number
7c	Use tongs to handle them or wear protective clothing
7d	Around us there is background radiation which is always there, coming from cosmic rays of the sun, building materials, x rays
8ai	Energy cannot be created nor destroyed but it can only be changed from one form to another.
8aii	PE = mgh = 4.8 x 1.2 x 10 = 57.6 J
8aiii	P = $\frac{E}{t}$, P = $\frac{57.6}{7 \times 24 \times 3600}$ = $\frac{57.6}{60480}$ = 0.00095 W
8bi	Water is stored in very high places, then it is released and as it gradually falls through the pipes, PE is changed to KE. This will rotate turbines to generate electricity.
8bii	It can be stored and used when required.
9a	A transformer which decreases the voltage of the primary coil
9b	For a transformer to work, it needs to have continuous cutting of magnetic flux so that a current is continuously induced. And since AC is continuously alternating in direction, then the cutting of magnetic flux is continuous.
9c	$\frac{Np}{Ns} = \frac{Vp}{Vs} = \frac{2500}{150} = \frac{230}{Vs}$, $Vs = \frac{230 \times 150}{2500}$ = 13.8 V
9di	P = IV = 0.2 x 230 = 46 W
9dii	P in secondary is same as P in primary, since ideal. P = IV , 46 = I x 13.8 , I = 46 / 13.8 = 3.33 A
10ai	Force and perpendicular distance
10aii	Moment = F x s = 15 x 0.3 = 4.5 Nm
10aiii	He should apply the force the furthese possible from the fixed point, at the end of the crowbar.
W 10b	

May 17 Paper 2A

1ai	When two or more bodies act on each other, the total momentum before a collision is equal to the total momentum after the collision as long as there are no external forces acting on them.
1bi	- Set up apparatus as shown in diagram - Measure mass of each vehicle using a top pan balance - With trolley 2 at rest, let trolley one move towards trolley 2 - Using the time given by gate 1, work out the velocity of trolley 1 before collision. - Using the time given by gate 2, work out the velocity ot he two trollies when they stick together, after the collision - Compare the total momentum before to the total momentum after the collision.
1bii	Momentum before = momentum after mv1 + mv2 = (m1 + m2)v
1biii	Make sure there are no external forces like friction acting on the vehicles
1ci	Momentum = mv = 0.03 x 6 = 0.18 kg m/s
1cii	Momentum before = momentum after $mv_{ball} + mv_{tin} = (m_{ball} + m_{tin})v$ 0.18 + 0 = (0.03 + 0.05)v V = 0.18 / 0.08 = 2.25 m/s
1ciii	Momentum before = momentum after $mv_{ball} + mv_{tin} = (m_{ball} + m_{tin} + m_{tin})v$ (0.07 x u) + 0 = (0.03 + 0.05 + 0.05) 3.5 0.07 u = 0.255 u = 0.255 / 0.07 = 3.64 m/s
Iciv	Ft = mv – mu 0.4 F = 0.07 (-1 -1.5) , F = -2.5 / 0.4 = -6.25 N
2a	Temperature B is higher since the greater the temperature, the more KE the particles have and the greater the pressure of the particles. Therefore, they push more on the liquid
2bi	P = $\frac{F}{A}$ = $\frac{10}{(5 \div 100 \div 100)}$ = 20,000 Pa
2bii	20,000 Pa
2biii	P = $\frac{F}{A}$, 20 000 = $\frac{F}{0.0031}$, F = 20000 x 0.0031 = 62 N each piston $\therefore$ Total F = 62 x 2 = 124 N
2biv	The force on each piston will still remain 62N. Therefore, each wheel will experience a force of 124 N (two pistons each tyre). Therefore, total force on car would be 124 x4 = 496N on the car.

2ci	h increases, d increases ρ decreases, d decreases Container sealed with lid eliminates atmospheric pressure, so d will decrease
2cii	P = and P = hρg , hρg = $\frac{F}{A}$, 0.15 x 1000 x 10 = $\frac{F}{0.00002}$ F = 1500 x 0.00002 = 0.03 N
3a	Transverse : the particles vibrate at right angles to the direction of travel of the wave Longitudinal : the particles vibrate parallel to the direction of travel of the wave
3bi	Transverse
3bii	- The angle of incidence is equal to the angle of reflection - The normal, the incident ray and the reflected ray all lie on the same plane
3biii	
3biv	He can change the angle of inclination of the window, so as to change the angle of incidence and the angle of reflection
3ci	They all obey the equation v = fλ
3cii	Gamma waves
3ciii	v = fλ , 2.997 x 10^8 = λ x 3 x 10^{19}, λ= $\frac{2.997 \times 10^8}{3 \times 10^{19}}$ = 9.99 x 10^{-12} m
3di	 Figure 1
3dii	Refraction

3diii	 (since gap is slightly bigger than wavelength)
3div	diffraction
3dv	frequency stays the same, velocity decreases
4a	Copper, conductor, insulators
4bi	
4bii	Current
4biii	- Setup apparatus as shown. - Connect one wire using crocodile clips and read the current from the ammeter. Note results in a table. - Repeat with the different thicknesses of the wire. - Plot a graph of current and thickness of wire.
4biv	Check for loose and rusted connections or Take readings at eye level to avoid parallax errors when taking readings from the ammeter.
4ci	Thicker wire, current increases
4cii	The thicker the wire, the greater the current
4d	Current is directly α to thinkness of wire
4e	Length of wire, the longer the wire is the greater is the current and the weaker is the current
4f	Brown – Live – current passes through this wire Blue – Neutral – to complete the circuit Yellow/Green – Earth - a path for current to flow from the case of the device to the ground if there is a fault
5a	The pointer is attached to the spring, as a precaution, so the extension can be read with no parallax

5b	
5c	- Set up apparatus as shown - Switch on circuit with current set at a value. Read the current from an ammeter. - Read the extension of the spring using the pointer and the ruler. - Repeat the experiment with a different set current. - Plot a graph of current against extension.
5d	Iron because iron is a soft material which can easily be magnetised and demagnetised.
5e	
5f	This is not true. The metal object will still be attracted to the electromagnet. Since a magnetic object is attracted to any pole of the magnet.
5gi	By the stroking method: A magnetic material is strooked along a magnet in the same direction for a number of times. By the electrical method: A coil is connected to a d.c power supplt. The current is turned on and the magnetic material is inserted in the coil. Turn off the current and then withdraw the magnetic material out of the coil.
5gii	Increasing the number of turns on the coil

5hi	The spring no longer remains elastic, it becomes deformed and it no longer obeys Hooke’s law
5hii	The spring needs to obey Hooke’s law so that the Force of attraction to the electromagnet remains directly proportional to the extension.