May 16. Paper 2A.

1 ai. by radiation

ii. dark, black since dark colours are the best absorbers of heat.

iii. by conduction, since copper is one of the best conductors of heat and will not rust. It has a no. of free electrons which allow heat to flow easily.

iv. the transparent cover allows heat of a high frequency to enter the solar heater, but then since after the heat is absorbed, the reflected heat has a smaller frequency, it would not be able to pass through the transparent cover.
∴ heat is trapped inside, causing a greenhouse effect.

v. So that the heat would not be lost through the bottom part. Insulation will stop the heat from flowing out.

b. i. $m = 30kg$.
$20°C \rightarrow 60°$, $\Delta\theta = 40°$
$c = 4200\ J/kg°C$
$E = ?$

$E = mc(\Delta\theta)$
$E = 30 \times 4200 \times 40$
$E = 5,040,000\ J.$

ii. E for 4 people: $5040000 \times 4 = 20,160,000\ J$

iii. in four months

c) i) by convection

ii) cold water enters the tank at the bottom
the heating filament at the bottom heats the cold water,
the heated water becomes less dense so it floats to the
top by convection. This keeps on going until all water is heated.

iii) shiny silver material so that the heat does not escape but is
reflected back into the tank. shiny & light surfaces
are the best reflectors of heat.

iv. Vacuum flask.

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2. a) A scalar quantity gives only size such as distance whereas a vector quantity gives both size and direction such as a force.

b) i)
$u = 0$
$v = 20 m/s$
$t = 12 s$
s
$a = ?$

$a = \frac{v - u}{t}$

$a = \frac{20 - 0}{12}$

$a = 1.7 m/s^2$

ii)
$v = 20 m/s$
$t = 10 s$
$s = ?$
constant speed

iii) deceleration
$u = 20 m/s$
$v = 0$
$t = 6 s$
s
a

$a = \frac{v - u}{t}$

$a = \frac{0 - 20}{6} = -10 m/s^2$

$\therefore dec = 10 m/s^2$

iii. total $s = s_1 + s_2 + s_3 = 120 + 200 + 60 = 380\,m$

$s_1 = \left(\frac{u+v}{2}\right)t = \left(\frac{0+20}{2}\right)12 = 120\,m$

$s_2 = vel \times t = 20 \times 10 = 200\,m$

$s_3 = \left(\frac{v+y}{2}\right)t = \left(\frac{0+20}{2}\right)6 = 60m$

iv. av. speed $= \frac{\text{total distance}}{\text{total t}} = \frac{380}{28} = 13.6\,m/s.$

ci. Principle of conservation of momentum states that when two or more bodies act on each other, the total momentum before is equal to the total momentum after, as long as there are no external forces acting on them.

ii. Since the gas goes out in one direction (downwards), then the rocket must move upwards because momentum is conserved, initially t. mom. $= 0$. $\therefore$ t. momentum on launching must also be equal to 0.

$\therefore 0 = m_{gas}v_{gas} + m_{rocket}v_{rocket}$

Hence to get a 0, velocity of rocket must oppose that of gas.

di.

before		after	
trolley 1	trolley 2	trolley 1 + trolley 2	(move together)
$m = 12kg$	$m = 12kg$	$m = 24kg$	
$v = 3.5m/s$	$v = 0$	$v = ?$	

i. init. mom$_A$ = mv = 12 × 3.5 = 42 kg m/s.

ii. t. mom bef = t. mom. after

mom$_A$ + mom$_B$ = mom$_{AB}$

42 + 0 = 24 × V

$\frac{42}{24}$ = V

V = 1.75 m/s.

iii. Δmom = Ft

mv − mu = F × 3

0 − (24 × 1.75) = F × 3

$\frac{-42}{3}$ = F

F = −14N.

(be careful, both mallets to stop)

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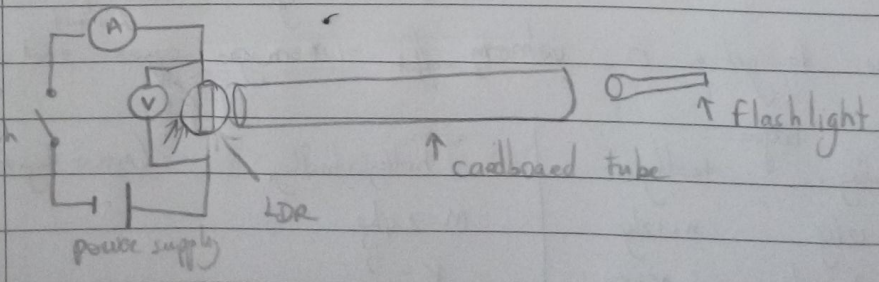
3 a. Light Dependent Resistor.

b i. LDR.

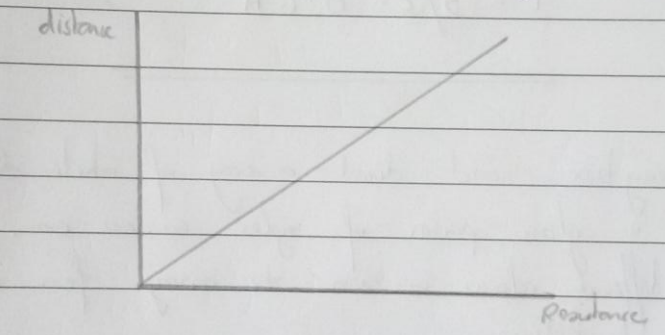
ii. To concentrate the light on the LDR.

iii.



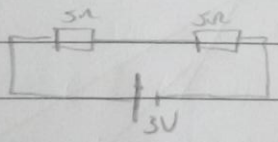
iv
- Set up apparatus as shown.
- Close the switch of circuit.
- Take reading of voltage + current from voltmeter + ammeter respectively.
- Find the Resistance R from $R = V/I$.
- Measure the length of cardboard, using a measuring tape.
- Tabulate in a table.
- Use a shorter tube, repeat the procedure.
- List all values in a table
- Plot a graph of distance against Resistance.

v.



vi. So that no other light affects the light intensity falling on the LDR.

ci.



$T.R = 5 + 5 = 10\ \Omega$

$\therefore V = IR$

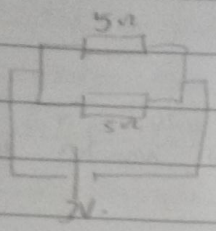
$3 = I \times 10$

$\frac{3}{10} = I$

$I = 0.3\ A.$

ii. $V_{5\Omega} = IR = 0.3 \times 5 = 1.5\ V.$

d. i.



V across each resistor = 3V.

ii. $\frac{1}{TR} = \frac{1}{5} + \frac{1}{5} = \frac{2}{5}$

$\therefore TR = 5/2 = 2.5\ \Omega$

$V = IR$

$3 = I \times 2.5$

$I = 3/2.5 = 1.2$ Amp

not necessary.

$\therefore V = IR = 5 \times I = 3$

$I = 3/5 = 0.6\ A$

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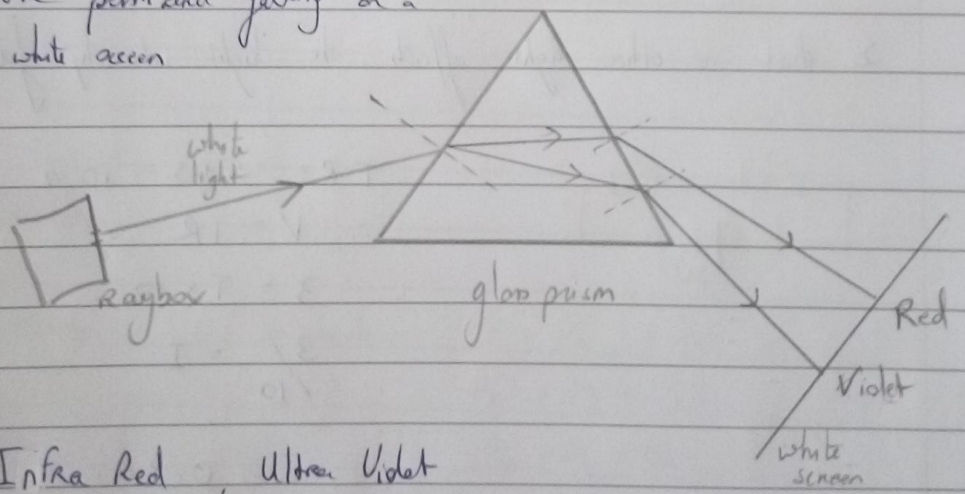
4. a. i. - Use a ray box and direct a ray of white light towards a glass prism of angles 60-60-60.

- Light of different colours is seen to emerge from one side of the prism and falling on a white screen



ii. Infra Red, Ultra Violet

iii. IR → burglar alarms

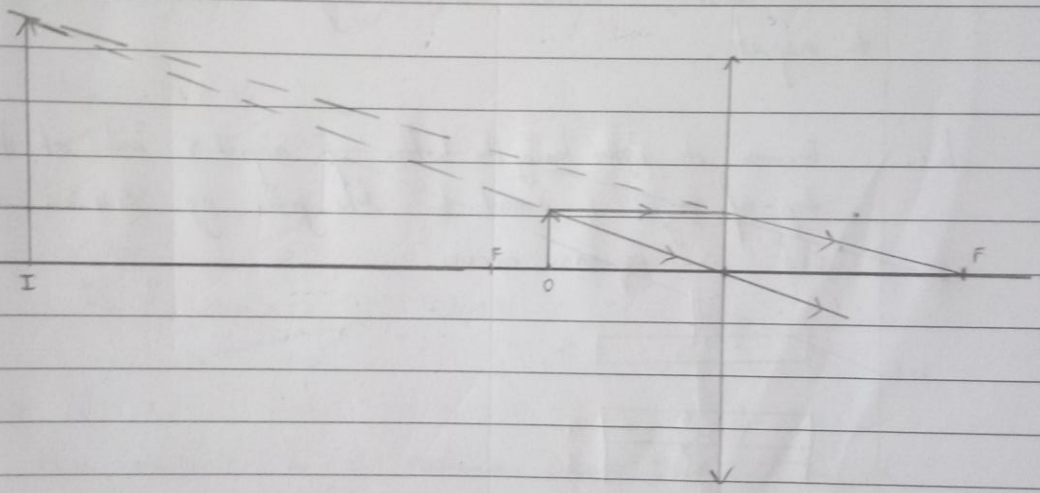
UV → for tanning.

bi the incident ray hits boundary BC at an angle of incidence greater than the critical angle of glass, and since it is moving to a less dense medium, total internal reflection occurs.

ii in periscopes

iii. the incident ray passes along the normal, ∴ normal incidence takes place, ∴ no bending occurs, ∴ ray of light enters the glass prism undeviated.

ci.



ii. virtual

iii. 11.8 cm (to check $\frac{1}{f} = \frac{1}{u} + \frac{1}{v}$

$\frac{1}{4} = \frac{1}{3} + \frac{1}{v}$

$\frac{1}{4} - \frac{1}{3} = \frac{1}{v}$

$-\frac{1}{12} = \frac{1}{v}$.

$v = -12$ cm ∴ on same side of object from mirror)

iv. mag $= \frac{h_i}{h_o}$ or $\frac{d_i}{d_o}$

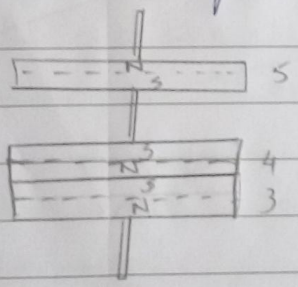
mag $= \frac{11.8}{3} = 3.9 = 4$.

5.ai. Use a bar magnet, take a piece of magnetic material and move the magnetic material along the bar magnet for a number of times, always in the same direction.

ii. magnetic materials such as steel & iron are materials which can be turned to a magnet and are attracted to a magnets.
On the other hand, non magnetic materials such as aluminium & wood, cannot become magnets and are not attracted to magnets.

b i. Because the pole at the bottom of magnet 5 and at the top of magnet 4 must be like poles eg. S+S. or N+N. and ∴ repulsion occurs.

ii.



c i. When switch is closed, a current passes through the coil because of a closed circuit. This makes the electromagnets A & B act as magnets, ∴ the soft iron armature is attracted to the electromagnets causing the hammer to move with it - ∴ hitting the metal plate. This causes the circuit to open again, demagnetising A & B. Hammer returns to original position & circuit closes again. & restart the process.

c ii. B = North
A : South

c iii soft: can be easily magnetised & demagnetised.

ii. because the armature needs to be attracted to the electromagnet hence it needs to be a magnetic material that is easily attracted

??

d.i When a voltage / current is induced due to the cutting of magnetic field lines.

ii. 1200 primary, 60 secondary, ∴ step-down transformer.

iii. $\frac{N_p}{N_s} = \frac{V_p}{V_s}$

$\frac{1200}{60} = \frac{V_p}{12}$

$V_p = \frac{1200 \times 12}{60} = 240\ V.$

iv. there wouldn't be a continuous current induced in the secondary coil.