

PHYSICS PAPER 1

SECTION A (25 MARKS)

Answer all the questions in this section in the spaces provided.

1. Figure 1 shows a vernier callipers being used to measure the internal diameter of a tube

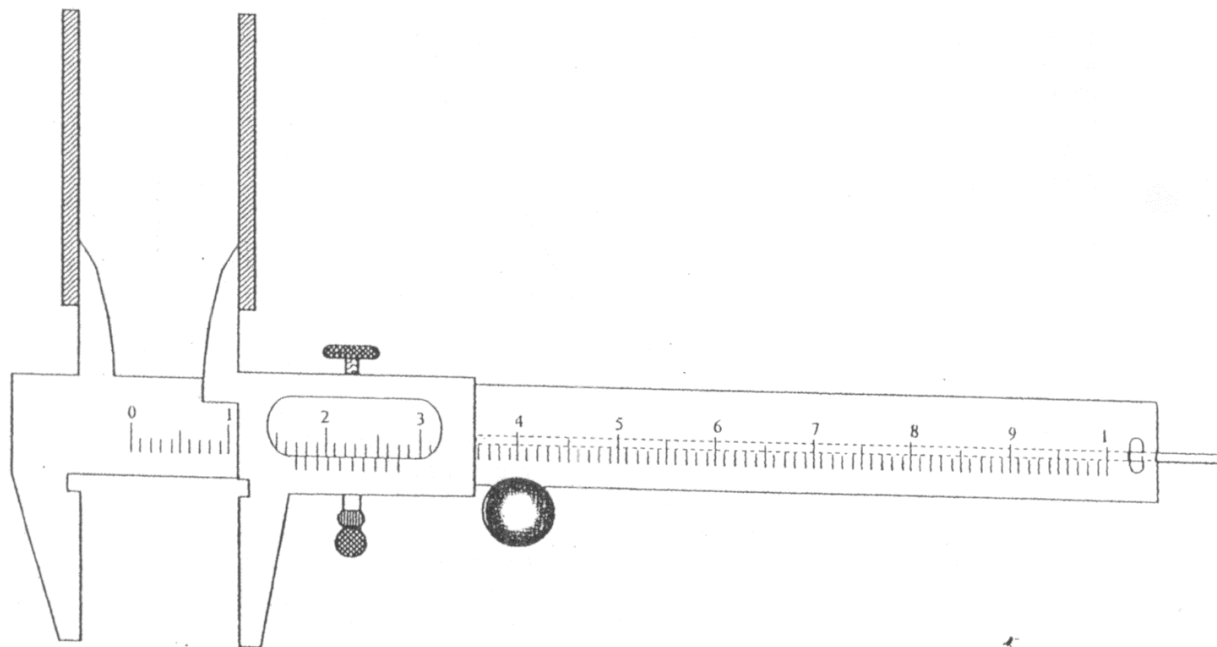
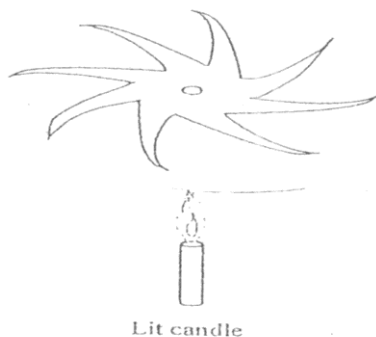


Figure 1

Record the diameter of the tube. (1 mk)

1.62cm / 1.62

2. A stopwatch started 0.50s after the start button was pressed. The time recorded using the stopwatch for a ball bearing falling through a liquid was 2.53s. Determine the time of fall. (1 mk)
- $2.53 + 0.5 =$ (working must be shown)
3. Some water in a tin can was boiled for some time. The tin was then sealed and cooled. After sometime it collapsed. Explain the observation. (2 mks)
- Air (molecules) expelled by heating
- Pressure inside is less than atmospheric pressure
4. A paper windmill in a horizontal axis was placed above a candle as shown in figure 2.



When the candle was lit the paper windmill began to rotate. Explain this observation

(2 mks)



- Flame heats air which/becomes less dense (expands) /and move upwards expand
- This will push the blade upwards/creates convection currents hence rotate.

5. When liquid is heated in a glass flask, its level at first falls, then rises. Explain this observation.(2 mks)
- Flask which is in intact with heat expands first
 - Liquid expands more than glass.
6. Figure 3 shows a uniform metre rule pivoted at the 30cm mark. It is balanced by a weight of 20 suspended at the 5cm mark.

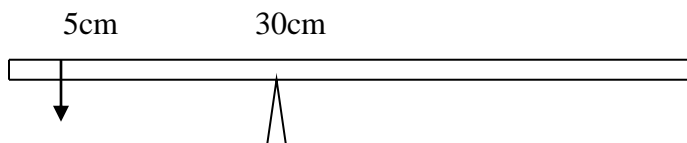


Figure 3

Determine the weight of the metre rule

Clockwise moments = anticlockwise moments } either
 OR $W_1d_1 = w_2d_2$ / $f_1d_1 = F_2d_2$

$$W \times 0.2 = 2 \times 0.25$$

$$W = 2.5N$$

7. Figure 4 shows a horizontal tube with two vertical tubes x and y. Water flows through the horizontal tube from right to left. The water level in tube x is higher than water level in tube y.

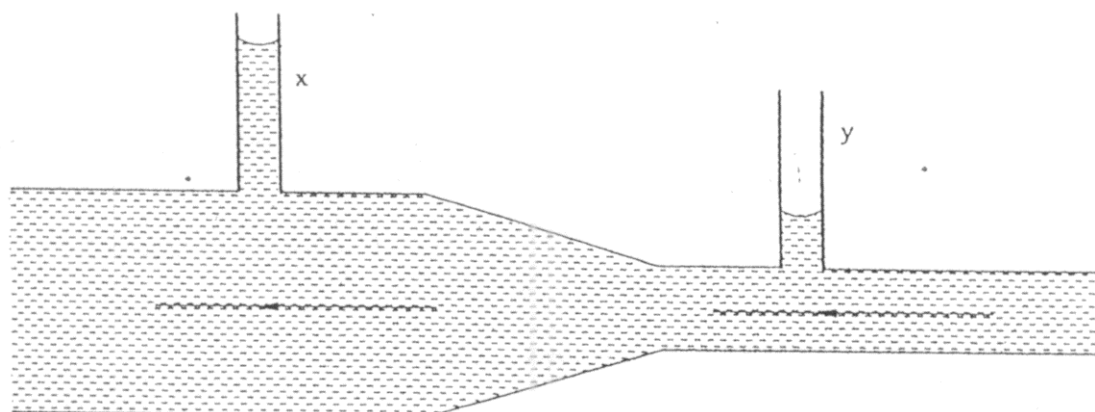


Figure 4

Explain this observation

- Water flows faster in Y than X hence pressure is lower at Y than X
 (i.e 1st mark - compare velocity)

2nd - compare pressure

8. A cart of mass 30kg is pushed along a horizontal path by a horizontal force of 8N and moves with constant velocity. The force is then increased to 14N. Determine



a) The resistance to the motion of the cart. (1 mark)

- 8N

b) The acceleration of the cart. (2 mks)

$$14 - 8 = 30n \text{ or } F = ma$$

$$a = \frac{6}{30} = 0.2 \text{ m/s}^2$$

9. When a drop of aloeic acid of known volume is dropped on the surface of water in a large trough, it spreads out to form a large circular patch. State one assumption made when the size of the molecule of aloeic acid is estimated by determining the area of the patch. (1 mark)

- Patch is one molecule thick or monolayer

10. The weight of a solid air is 50N. When it is fully immersed in a liquid of density 800 Kg m^3 its weight is 4.04N.

Determine:

i) The upthrust in the liquid (1mk)

$$u = 5.0 - 4.0 \text{ (working must be shown)}$$

$$u = 0.96 \text{ N}$$

b) The volume of the solid. (2 mks)

$$\text{Weight of liquid displaced} = 0.96 \text{ N}$$

$$\text{Mass of liquid displaced} = 0.096 \text{ kg}$$

$$V = \frac{M}{\rho} = \frac{0.096}{800} = 1.2 \times 10^{-4} \text{ m}^3$$

$$1.2 \times 10^2 \text{ cm}^3$$

$$120 \text{ cm}^3$$

11. When a bicycle pump was sealed at the nozzle and the handle slowly pushed towards the nozzle, the pressure of the air inside increased.

Explain this observation. (1 mk)

- Volume decreases so more collisions per second.

12. Figure 5 shows a mass of 200g connected by a string through a hollow tube to a mass of 0.5kg. The 0.5kg mass is kept stationary in the air by whirling the 200g mass round in a horizontal circle of radius 1.0 metre.



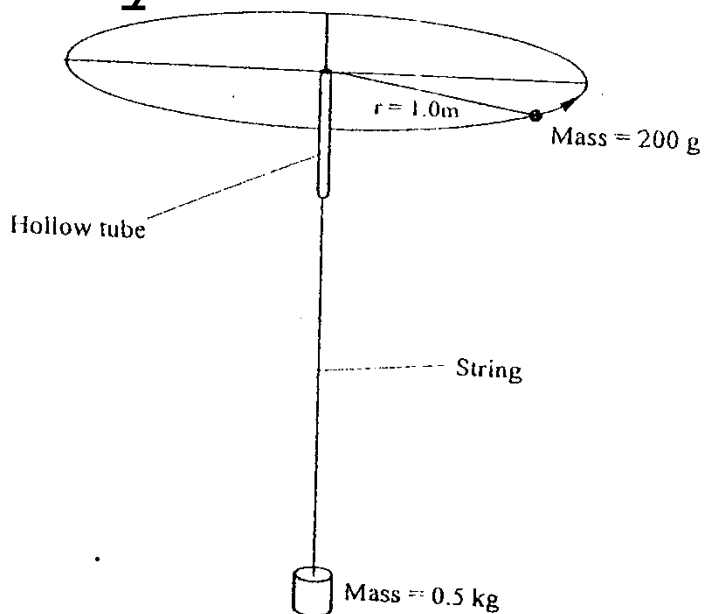


Figure 5

Determine the angular velocity of the 200g mass. (3 marks)

$$F = mw^2r = mg$$

$$0.2 \times 1 \times w^2 = 0.5 \times 10$$

$$w^2 = \frac{5}{0.2}$$

$$w = \sqrt{2.5} = 5 \text{ rad/s}$$

Or $F = \frac{mv^2}{r}$ but $V = wr$

$$w^2 = \frac{f}{mr} = \frac{0.5 \times 10}{0.2 \times 1}$$

$$w = 5 \text{ rad/s}$$

13. State the SI unit of a spring constant (NB in words) (1 mk)

- Newton per metre

14. Figure 6 shows an athlete lifting weights while standing with the feet apart.

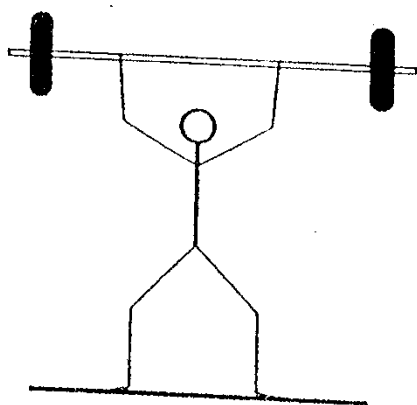


Figure 6

Explain why standing with the feet apart improves an athlete's stability. (1 mk)

- Increases the base area or lowers the centre of gravity



SECTION B(Marks)

Answer all the questions in their section in the spaces provided

15. a) A cyclist initially at rest moved down a hill without pedalling. He applied brakes and eventually stopped. State the energy changes as the cyclist moved down the hill. (1 mk)

Potential energy - Kinetic energy - heat + sound (sound not a must)

- b) Figure 7 shows a mass of 30kg being pulled from point P to point Q with a force of 200N parallel to an inclined plane. The distance between P and Q is 22.5m. In being moved from P to Q the mass is raised through a vertical height of 7.5m.

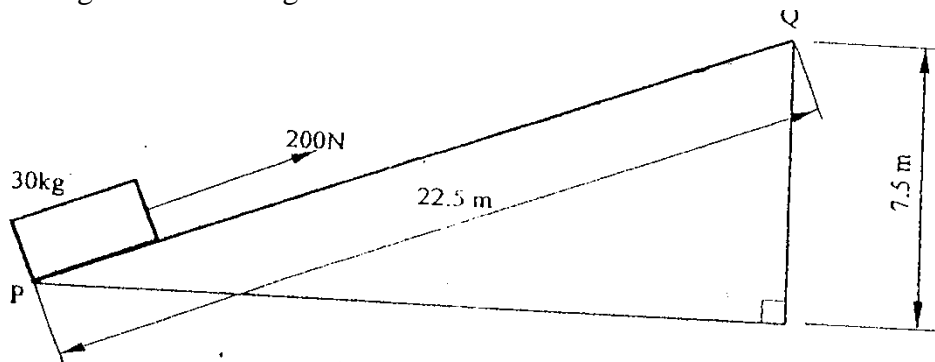


Figure 7

- i) Determine the work done:

I by the force (2mks)

$$\begin{aligned} \text{work done by force} &= fd = 200 \times 22.5 \\ &= 4500\text{J} \end{aligned}$$

II on the mass (2 mks)

$$\begin{aligned} &= mgh = 30 \times 10 \times 7.5 \\ &= 2250\text{J} \end{aligned}$$

III to overcome friction (2 mks)

$$\begin{aligned} \text{Work done by force} - \text{work done on mass} &= 4500 - 2250 \\ &= 2250\text{J} \end{aligned}$$

- ii) Determine the efficiency of the inclined plane. (2 mks)

$$\text{eff} = \frac{\text{work output}}{\text{work input}} \times 100\%$$

$$\frac{2250}{4500} \times 100\% = 50\%$$

$$\text{OR } \text{eff} = \frac{\text{work output}}{\text{work input}}$$

$$\frac{2250}{4500} = 0.5$$

$$\text{i.e. eff} = \frac{MA}{VR} \times 100\% = \frac{1.5}{22.5/7.5} \times 100\% = 50$$

- c) Suggest one method of improving the efficiency of an inclined plane. (1 mk)

- Reduce friction by use of rollers/smoothening (polishing/oiling surface)
- Method of reducing friction must be stated.



16. In an experiment to determine the density of sand using a density bottle, the following measurements were recorded:

Mass of empty density bottle - 43.2g

Mass of density bottle full of water = 66.4g

Mass of density bottle with some sand = 67.5g

Filled up with water = 82.3g

Use the above data to determine the:

- a) Mass of the water that completely filled the bottle: (2 mks)

$$= 66.4 - 43.2$$

$$= 23.2\text{g}$$

- b) Volume of water that completely filled the bottle: (1 mk)

$$\frac{23.2\text{g}}{1\text{gcm}^3} = 23.2\text{cm}^3$$

(Nb: working must be shown)

- c) Volume of the density bottle: (1 mk)

$$23.2\text{cm}^3$$

- d) Mass of sand

$$(67.5 - 43.2) \text{ g} = 24.3\text{g} \text{ (working must be shown)}$$

- e) Mass of water that filled the space above the sand. (1mk)

$$82.3 - 67.5 = 14.8\text{g} \text{ (working a must)}$$

- f) Volume of the sand:

$$\text{Volume of the sand} = \text{volume of bottle} - \text{volume of added water}$$

$$= 23.2 - 14.8$$

$$= 8.4\text{cm}^3$$

- g) Density of the sand (2 mks)

$$\rho = M/V = 24.3\text{g} / 2.893\text{cm}^3$$

$$8.4\text{cm}^3$$

(NB: at least 2 dec places)

17. a) Explain why it is advisable to use the pressure cooker for cooking at high altitudes (2 mks)

- At high altitudes pressure is low so boiling point is low
- So pressure cooker pressure inside it which raises boiling point
- Pressure inside the cooker is higher raising the boiling point.

- b) Water of mass 3.0kg initially at 20°C is heated in an electric kettle rated 3.0KW. The water is heated until it boils at 100°C. (Take specific heat capacity of water 4200Jkg⁻¹K⁻¹. Heat capacity of the kettle = 450JK⁻¹, Specific latent heat of vaporization of water = 2.3MJkg⁻¹)



Determine

- i) The heat absorbed by the water. (1 mk)

$$Q = Mc\Delta\theta \text{ or } Mc\theta \text{ or } Mc\Delta T$$

$$= 3 \times 4200 \times 80 = 1008000\text{J}$$

- ii) Heat absorbed by the electric kettle (2 mks)

$$Q = c\theta / c\Delta\theta / c\Delta T = 450 \times 80$$

$$= 36000\text{J}$$

- iii) The time taken for the water to boil (2 mks)

$$PL = Mc\Delta\theta / c\Delta\theta \quad t = 34.8\text{J}$$

$$3000t = 1008000 + 36000$$

$$3000t = 1044000$$

- iv) How much longer it will take to boil away all the water. (2 mks)

$$Mlv = Pt \quad \text{OR} \quad Mlv = Pt$$

$$3 \times 2.3 \times 10^6 = 3000t \quad 3 \times 2.3 \times 10^{-3} = 3000t$$

$$t = 2300\text{s} \quad t = 2.3 \times 10^{-6}\text{s}$$

(38.3 minutes)

18. Figure 8 shows a stone of mass 4.0kg immersed in water and suspended from a spring balance with a string. The beaker was placed on a compression balance whose reading was 85N. The density of the stone was $3000\text{kg}\cdot\text{m}^{-3}$ while the density of the liquid was $800\text{kg}\cdot\text{m}^{-3}$.

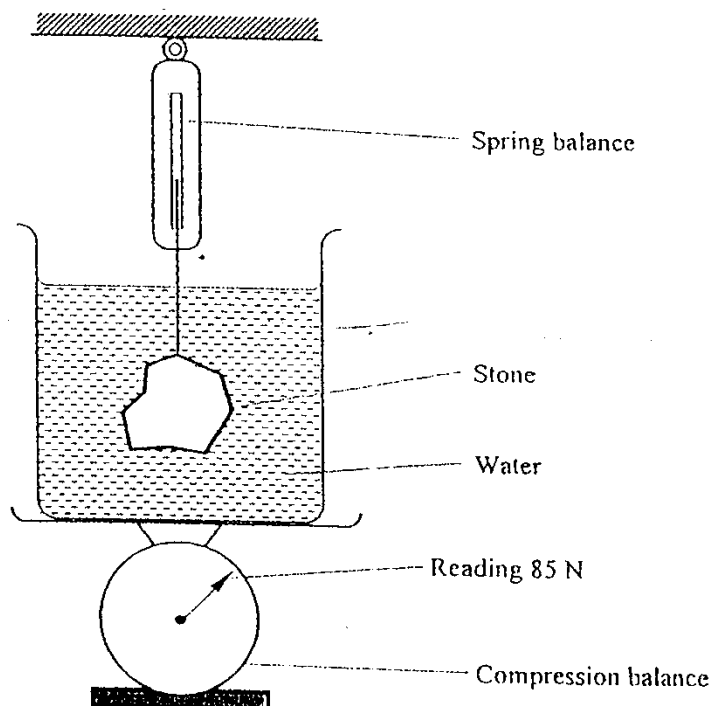


Figure 8



Determine the:

- a) Volume of the liquid displaced. (2 mks)

$$V = m/\rho \text{ or } V = 4/3000$$

$$V = 1.33 \times 10^{-3} \text{m}^3$$

(at least 2 dec places)

- b) Upthrust on the tone (4 mks)

$$\text{Upthrust} = \text{weight of liquid disp} = \rho V g$$

$$= 800 \times 1.33 \times 10^{-3} \times 10$$

$$= 10.64 \text{N}$$

$$\text{upthrust} = \text{weight of liquid displaced} = \rho V g$$

$$= 1000 \times 1.33 \times 10^{-3} \times 10$$

$$= 13.33 \text{N}$$

- c) Reading of the spring balance: (2 mks)

$$\text{Weight of stone air} = 4 \times 10 = 40 \text{N}$$

$$\text{Reading of spring balance} = 40 - 10.64 = 29.36 \text{N}$$

$$40 - 13.33 = 26.67 \text{N}$$

- d) Reading of the compression balance when the stone was removed from the water. (2mks)

$$85 - 10.64 = 74.36 \text{N or } 85 - 13.33 = 71.76 \text{N}$$

19. a) Figure 9 shows a velocity-time graph for the motion of a certain body.

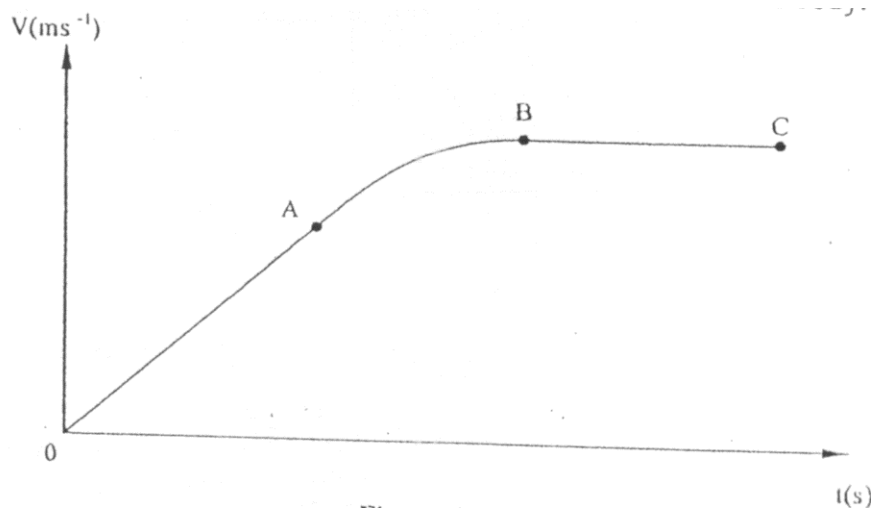


Figure 9

Describe the motion of the body in the region.

- i) **OA** (1 mk)

Body moves with constant acceleration

Increasing velocity



or velocity increasing uniformly with time.

i) **AB** (1 mk)

Bodies moving with / decreasing or reducing / acceleration

iii) **BC** (1 mk)

Constant (uniform) velocity / zero acceleration

b) A car moving initially at 10ms^{-1} decelerates at 2.5ms^{-2}

i) Determine

I its velocity after 1.5s:

$$V = u + at \quad \left. \begin{array}{l} \\ \\ \end{array} \right\} \text{either}$$

$$V = 10 - 2.5 \times 1.5$$

$$V = 6.25\text{m/s}$$

II the distance travelled in 1.5s (2 mks)

$$S = ut + \frac{1}{2}at^2$$

$$S = 10(1.5) - \frac{1}{2}(2.5)(1.5)^2 = 12.1875\text{m}$$

$$= 12.19\text{m}$$

III the time taken for the car to stop (2 mks)

$$V = u + at$$

$$0 = 10 - 2.5t$$

$$t = \frac{10}{2.5} = 4\text{s}$$

ii) Sketch the velocity-time graph for the motion of the car up to the time the car stopped. (1 mk)

iii) From the graph, determine the distance the car travelled before stopping. (2 mks)

Distance = Area of triangle

$$= \frac{1}{2} \times 4 \times 10 = 20\text{M}$$

or

$$S = ut + \frac{1}{2}at^2$$

$$a = \text{gradient} = -2.5\text{m/s}$$

$$S = 10 \times 4 - \frac{1}{2} \times 2.5 \times 4^2$$

$$S = 40 - 20$$

$$S = 20\text{m}$$

or

$S = \text{average velocity} \times \text{time}$

$$= \frac{(10 + 0)4}{2}$$

$$= 20\text{m}$$



K.C.S.E YEAR 2010 PAPER 2 MARKING SCHEME

1. - Reflected ray rotates $2 \times 20 = 20^\circ$. ✓1
- Find deviation $= (80^\circ + 20^\circ) = 100^\circ$ ✓1
2. - Any slight deviation of the N-pole to the right ✓1
3. - Correct poles. ✓1 Correct direction + pattern ✓1

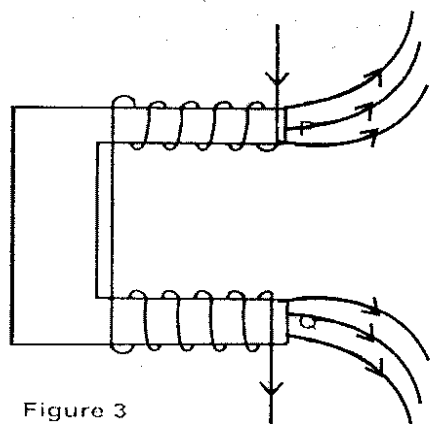


Figure 3

4. Initially attracted because of opposite charge. ✓1
(+ve or -ve)
Then neutralised and charged positive and hence repel ✓1.
Charging by contact and law of electrostatics. ✓1

5. - Distance $= 2f = 2 \times 25 = 50\text{cm}$. ✓½

Alternative

Just 50cm ✓1

Or

$$2 \times 25 = 50\text{cm} \quad \checkmark \frac{1}{2}$$

Or

6. Implies low current ✓1 So reduces ✓1 heat losses/
power loss. Or
 I^2R loss reduced.

$P = I^2R$ should be accompanied by power loss

NB: Heat losses/ Power Loss

7. - More practice/ relationship between f and t .

Displacement

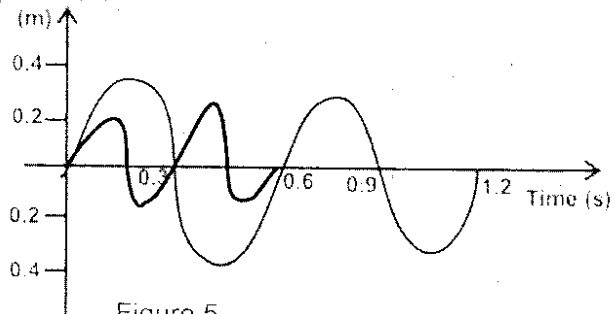


Figure 5

8. $V_1 = fT_1$ or $\eta = \frac{T_1}{T_1} \checkmark 1$
 $V_2 = fT_2$ $\eta = \frac{18}{14.4} \checkmark 1 = 1.25 \checkmark$
Accept all expression.

9. $20g \xrightarrow{5} 10g \xrightarrow{5} 5g \xrightarrow{5} 2.5g \xrightarrow{5} 1.25g \checkmark 2$
Mass remaining

10. I_0 - Initial current $I_2 = 7I_0$
 $P = I^2R = I_0^2R \checkmark 1$ $P = (7I_0)^2R = 49I_0^2R \checkmark 1$
Power is 49 times the initial value ✓1
Apply the power formula.

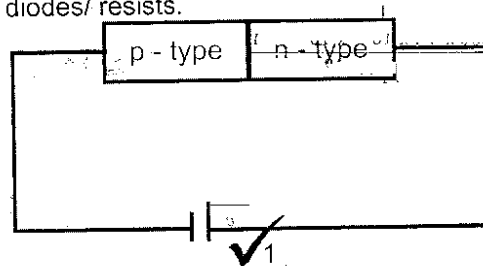
11. Motion out of paper/ moves upwards. ✓1
Or Increases in p.d increases heating effect.

12. Increasing the accelerating voltage ✓1 OR
Increase the P.d between anode and cathode.
Accept extra high tension increased.

$$13. f = \frac{v}{\lambda} = \frac{c}{\lambda}$$

$$= \frac{3.0 \times 10^8}{1000} \checkmark 1 \quad 3.0 \times 10^5 \text{ Hz}$$

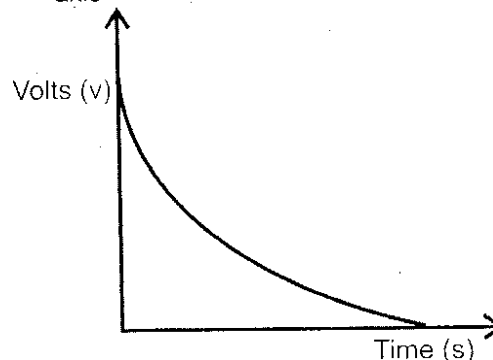
14. Look for biasing only. (any other device that does not affect the working should be ignored) e.g diodes/ resists.



15. (a) (i) Current falls off to zero ✓1/ falling to zero/
deflects to max. then zero.
Reducing gradually or after some time.
(ii) Current flows when the capacitor is charging ✓1
When fully charged current stops (No current) and P.d is equal to charging voltage ✓1.

(b) $V_C = 5V \checkmark 1$

- (c) Touch both axis, Award for no labelled axis





(d) (i) $\frac{1}{C_s} = \frac{1}{4} + \frac{1}{5} = \frac{5+4}{20} = \frac{9}{20}$

$C_s = \frac{20}{9} \mu F$

$C_1 = \frac{20}{9} + 3 \mu F = 5.22 \mu F$

Accept 5.22 μF only

(ii) Change on series section = $Q = C_v \Delta V$

$= \frac{20}{9} \times 10 \mu C$

$= 22.2 \mu C$ or

$Q_{\text{series}} = Q_T - Q_3 \mu C$

$= (5.22 - 3) \times 10 \mu C$

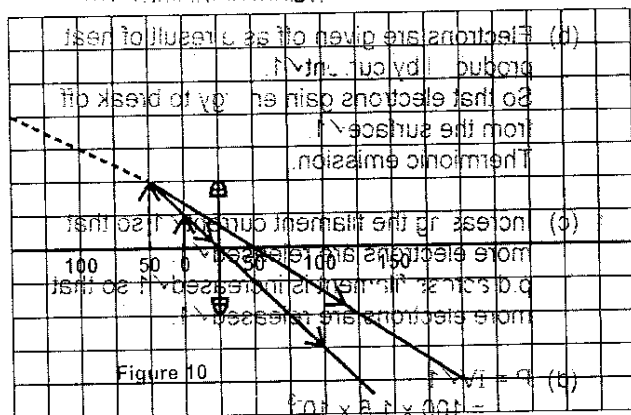
$= 22.2 \mu C$

Charge is the same on series section.

hence charge on 5.0 μF is 22.2 μC

Accept 22.2 μC only.

16. (a) (i) Each ray 1mk (Independent) 1mk for dotted extrapolation
1mk for dotted image



(ii) I. 50mm ± 5 mm

II. $M = \frac{v}{u} = \frac{h_1}{h_0} \checkmark 1 = \frac{50}{25} = 2\text{mm} \checkmark 1 \pm 0.2$

- (iii) Move the object towards F but not beyond $\checkmark 1$
Move object away from lens.

(iv) No answer

(b) $\frac{1}{f} = \frac{1}{u} + \frac{1}{v}$

$\frac{1}{50} = \frac{1}{80} + \frac{1}{v}$

$V = 400/3 \checkmark 1$

17. (a) (i) L_2 (ii) Brighter
(iii) Total resistance is less/ reduced $\checkmark 1$

(b) (i) 1.5V $\checkmark 1$

(ii) $I_r = 1.5 - 1.2 = 0.3 \checkmark 1$

$0.4r = 0.3$

$V = 0.75R \checkmark 1$

P.d and E.M.F/ more practice and practical approach.

(c) $R_T = 3 + 0.75 + R \checkmark 1$, $0.15(R+3.75) = 1.5 \checkmark 1$

$R_T = R + 3.75$

$R + 3.75 = \frac{1.5}{0.15} = 10$

$E = IR_T$

$R = 10 - 3.75$

$1.5 = I(R + 3.75)$

$= 6.25 \Omega \checkmark 1$

Or

$R = \frac{E}{I} = \frac{1.5}{0.15} = 10 \checkmark 1$

$R = R_T - (V + 3) \checkmark 1 + 3.75$

$R = 6.25 \Omega \checkmark 1$

$1.5 - 0.75 \times 0.15 = I(3 + R) \checkmark 1$

$1.5 - 0.1125 = 0.15(3 + R)$

$\frac{1.3875}{0.15} \checkmark 1 = 3 + R$

$R = 6.25 \Omega \checkmark 1$

18. (a)

(i) Deflected towards +ve plate (N) $\checkmark 1$

(ii) Deflection will be greater. $\checkmark 1$

(iii) I. Spot moves back and forth $\checkmark 1$.

To and fro (Not along across)

II. There will be a horizontal line $\checkmark 1$.

(b) Electrons are given off as a result of heat produced by current $\checkmark 1$.

So that electrons gain energy to break off from the surface $\checkmark 1$.

Thermionic emission.

(c) Increasing the filament current $\checkmark 1$ so that more electrons are released $\checkmark 1$.

p.d across filament is increased $\checkmark 1$ so that more electrons are released $\checkmark 1$.

(d) $P = IV \checkmark 1$

$= 100 \times 1.5 \times 10^{-3}$

$= 1.5 \text{ J/s} \checkmark 1$

Accept J, W, J/s

19. (a) Intensity of radiation $\checkmark 1$.

(b) (i) (Min p.d)

Negative potential sufficient to just stop the movement of electrons.

(ii) I. Gradient = $\frac{h}{e} \checkmark 1$

$h = \frac{3.0 - 0 \checkmark 1}{(12 - 4.4) \times 7.6 \times 10^{14}} = \frac{3}{7.6 \times 10^{14}}$

Gradient = 0.3947×10^{-14}

$h = 0.3947 \times 10^{-14} \times 1.6 \times 10^{-19}$

$= 0.6316 \times 10^{-33} = 6.316 \times 10^{-34}$

II. $\frac{W}{e} = 1.75 \checkmark 1$,

$W_0 = Y \text{ intercept} \times e$

$= \frac{1.75 \times 1.6 \times 10^{-19}}{1.6 \times 10^{-19}} \checkmark 1$

$= 1.75 \text{ eV} \checkmark 1$

Alternative

$W_0 = hf_0 \checkmark 1$

$= \frac{6.32 \times 4.4 \times 10^{14} \times 10^{-34} \checkmark 1}{1.6 \times 10^{-19}}$

$= 1.74 \text{ eV} \checkmark 1$

OR

Range 1.7 \rightarrow 1.8 eV $\frac{W_0}{e} = Y \text{ intercept}$

$\frac{W_0}{e} = 1.75$

$-\frac{W_0}{e} = -1.75 \text{ or } \frac{W_0}{e} = 1.75$

$W_0 = 1.75 \text{ eV}$

OR

$W_0 = 1.75 \text{ v} \times e$
 $= 1.75 \text{ eV}$

$-\frac{W_0}{e} = -1.75 \text{ eV}$

OR

$W_0 = 1.75 \checkmark 2\frac{1}{2} \rightarrow \text{Reject } 1.75 \text{ v} = W_0$

Penalise -ve and units in

$W_0 = Y \text{ intercept}$

$= -1.75$



PHYSICS PAPER 3

c) With the 300g mass still at the 50cm mark, adjust the position of the knife edges so that L is now 800mm. (The knife edges should be equidistant from the centre of the metre rule). Measure and record in table 1 the height h of the edge of the metre rule at the 50 cm mark.

d) Repeat the procedure in (c) for other values of L shown in table 1. Complete the table below

Length L (mm)	900	800	700	600	500
Height h (mm)	83.0	85.0	87.0	90.0	92.0
Depression d($h_0 - h$) mm	9	7	5	2	0
Log L	2.9542	2.0931	2.8451	2.7782	2.699
Log d	0.9542	0.8451	0.694	0.301	∞

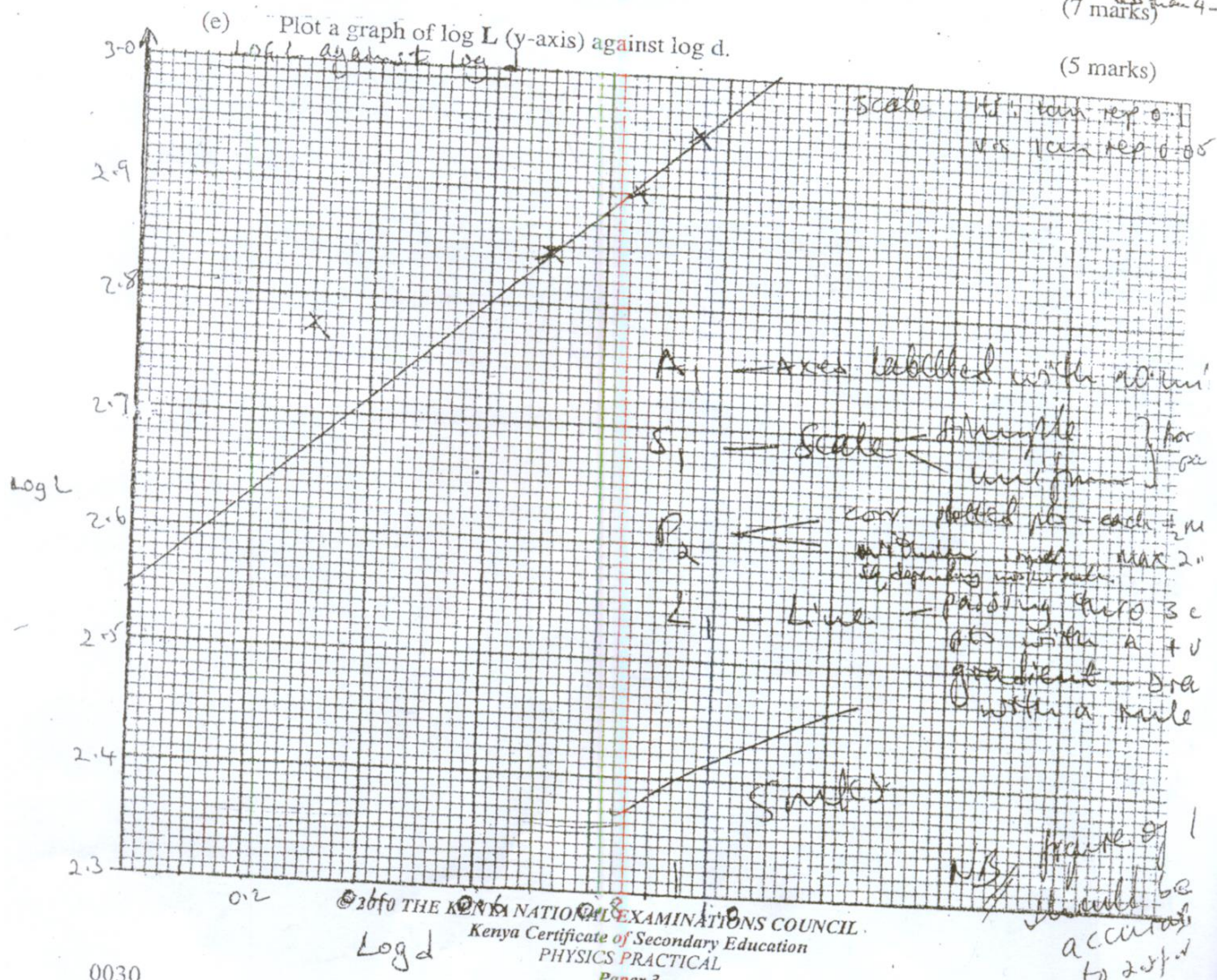
Don't mind if the values of h are increasing or decreasing

Table (7 marks)

e) Plot a graph of log L (y-axis) against log d. (5 marks)



Table 1



2. You are provided with the following:

- a 100ml beaker
- a 600 ml beaker
- 2 thermometer range - 100C to 1100C
- a measuring cylinder; (to be shared)
- some plasticine
- vernier calipers; (to be shared)
- a meter-rule or half metre rule;
- some boiling water
- some cold water; (at room temperature)
- stopwatch
- a stirrer

Proceed as follows;

- Using the vernier callipers, measure the internal diameter d_1 and the external diameter d_2 of the 100ml beaker.



$$d_1 = 4.68 \pm 0.5 \text{ to 2 d.p (a must) - } \frac{1}{2} \text{ mk (4.18 to 5.18)}$$

$$d_2 = 5.08 \pm 0.5 \text{cm to 2 d.p a must - } \frac{1}{2} \text{ mk (4.58 to 5.5) (1 mk)}$$

Determine the thickness X of the glass wall of the beaker, given that $X = \frac{d_2 - d_1}{2}$

$X = \dots\dots\dots\text{cm}$ subst of student work - $\frac{1}{2}$ mk
eval to 2 s.f or exact - $\frac{1}{2}$ mk

- b) Using the measuring cylinder provided, pour 75ml of cold water into the small beaker. Measure the height h , of the water in the small beaker.

$$h = 4.6 \pm 0.8 \text{ to 1 d.p (a must - (1 mk) 3.8 to 5.4}$$

Determine the area A of the glass walls in contact with water, given that

$$A = \pi d_1 h_1$$

$$A = \dots\dots\dots\text{cm}^2$$

Correct subst - $\frac{1}{2}$ mk

eval within 60 - 72 - $\frac{1}{2}$ mk correct to 1 d.p

$$60.0 - 72.0\text{cm}^2$$

- c) Use the plasticine provided to make a circular disc of about the same area as the bottom surface of the smaller beaker and about 1cm thick. Place this disc at the bottom of the large beaker and place the small beaker on it. Now pour boiling water into the large beaker until the levels of the water in the two beakers are same. See figure 2

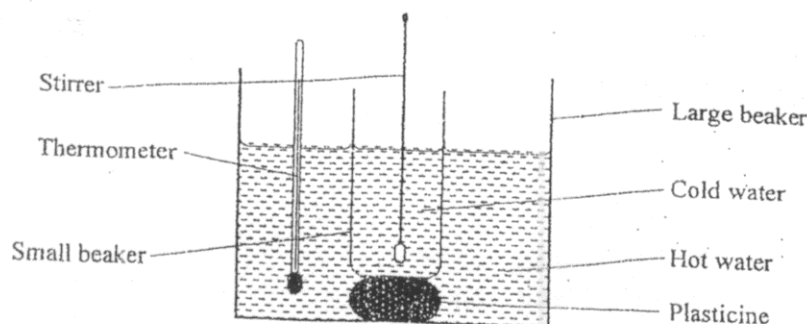


Figure 2

- d) Place a thermometer in the hot water and stir gently until the temperature drops to 75°C . Now start the stopwatch and measure the temperature T_1 of the hot water at intervals of 20 seconds. Record the values in table 2.

(Stir the water in the two beakers before taking the readings)

Pour out the contents of the two beakers.



e) Measure another 75 ml of cold water and put it into the small beaker. Place the small beaker inside the large beaker on the plasticine disc as before.

Again pour the boiling water into the large beaker until the levels of the water in the two beakers are the same. Place one thermometer in the cold water and the other in the hot water. Stir gently until the temperature of the hot water drops to 75°C. Start the stop watch and immediately read and record the Table 2 the temperature T_2 of the cold water. (You may now remove the thermometer in the hot water)

Read other values of T_2 at intervals of 20s and record in table 2

Time t (seconds)	0	20	40	60	80	100	120	140	160	180
Temperature T_1 °C	73	74	72	69	67	66	65	64	63	62
Temperature T_2 °C	37	41	45	49	52	54	55	56	57	58

Decreasing trend $\pm 5^\circ\text{C}$ $\frac{1}{2}$ mk each max 3mks

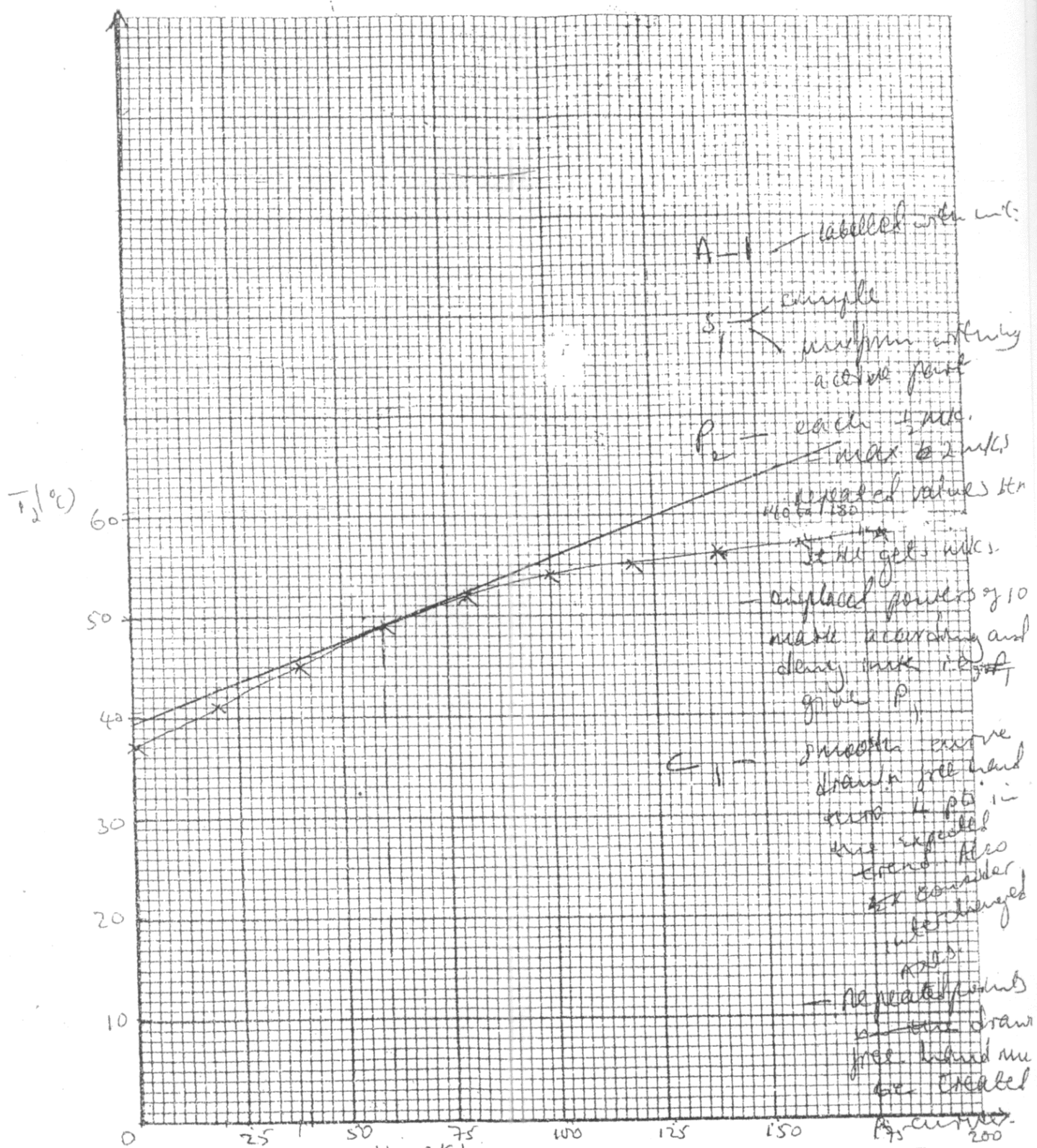
$\pm 5^\circ\text{C}$ - $\frac{1}{2}$ mk each max 3mks - increasing trend for T_2

Replacements will be accepted from when time is 140 second to 180 both T_1 & T_2

Temp above 80°C are not acceptable.



T_2 °C against time (s)



T_1 & T_2 can be plotted in kel



g) i) Determine the slope S of the graph at time $t = 60$ seconds (3 marks)

-Accept any curve of the form

Tangent drawn at $t = 60$ sec - 1 mk from student work

- Reading of correct interval - 1 mk

corr eval = 1mk

(3 s.f for each)

ii) Determine the constant k , given that $k = \frac{315 SX}{A (T_1 - T_2)}$

Where T_1 and T_2 are the temperatures of the hot and the cold water at $t = 60$ s, and X and A are in m and m^2 respectively. (2 mks)

- Corr subst of S , X , A , T_1 and T_2 - 1mk

Subst of T_1 & T_2 can be from table or graph

Don't mind mixed units at this level

- Eval to 3 s.f in S1 units - 1 mk

