CENTRAL KENYA NATIONAL SCHOOLS JOINT MOCK - 2015

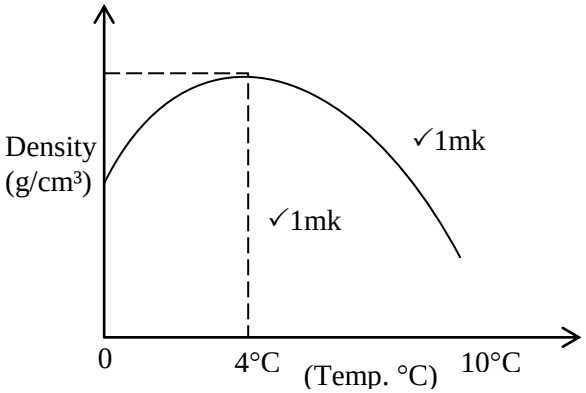
231/1 PHYSICS PAPER 1 MARKING SCHEME

1. Initial reading = 22.5cm³
   Final reading = 11.3cm³
   33.8cm³

2. Water has stronger adhesive forces and weaker cohesive forces but mercury has stronger cohesive forces than and weaker adhesive forces.

3. $P = h\rho g$
   $(0.76 - 6.65) \times 13600 \times 10 = 1.25 \times 10 \times h$ ✓1
   $14960 = 12.5h$
   $h = 196.8m$ ✓1

4. (i) Brownian motion is random constant motion of particles.
   (ii) Due to constant bombardment of chalk and air particles.

5. 

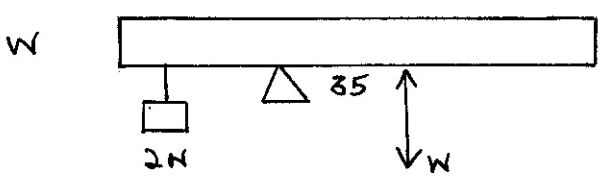
   NB: 1 mark to show max density at 4°C
   1 mark for curve

6. When the air is blown into the burner, it leaves the nozzle at a high speed/velocity ✓ thus the pressure at that region decreases ✓ below the atmospheric pressure ✓ thus the air outers the Bunsen burner. ✓

7. Max extension = 0.20m, spring constant = 125N/m.
   $F = Ke$ ✓1
   $F = 125 \times 0.2$ ✓1

8. Any 1
   Radiation ✓
   Evaporation ✓
   Conduction and convection ✓

9. $10 \times 200 = 35W$ ✓



$0.35 \times W = 0.1 \times 2$ ✓ = 25N ✓

$$W = \frac{0.2}{0.35} = 0.5714$$ ✓

$M = \frac{W}{10} \times 1000$ = 0.5714 x 100 ✓ = 57.14g

Or 0.05714kg

10. Law of inertia states that a body tends to remain in its state of rest or uniform motion unless acted upon by external forces.

11. Increase in temp ✓ leads to increase in K. energy of particles increasing their collision making the pressure to increase.

12. Raising of the road at an angle to minimize motor vehicles from skidding.

13. Energy cannot be lost or created but can be lost or created but can be converted from one form to another.

SECTION B:

14. (a) (i) Measure values of pressure ✓and temperature. ✓

(ii) Temperature varies with pressure.

- Values of temperature and their corresponding values of pressure are recorded. ✓
- A graph of pressure against temp. is plotted. ✓
- When the graph is extrapolated it passes through absolute zero. ✓

(b) $P_1V_1 = P_2V_2$ ✓1

26 x (a + 5) = 30(a – 5) ✓1

26a + 130 = 30a – 150

4a = 280

a = 70cmHg ✓1

Gas pressure = Atm pre + hρg

$P_1V_1 = P_2V_2$ ✓

$(\chi + 5)\ 0.26 = (\chi - 5)\ 0.30$ ✓

$\chi = \frac{2.8}{0.04} = 70cmHg$ ✓

(c) $\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$ ✓

$\frac{30000 \times 0.5}{300} = \frac{P_2 \times 9.5}{250}$

$P_2 = \frac{30000 \times 0.5 \times 250}{300 \times 9.5}$ ✓

= 1315.79 Pascals ✓

(d) Kelvin scale starts at absolute zero while Celsius scale starts at 273K.

15. (i) Specific heat capacity is the quantity of heat required to raise the temp. of a unit mass of a substance by one Kelvin.

(ii) Heat gained by calorimeter = $M_C C_C \Delta\theta$
= Heat capacity x $\Delta\theta$
= 40 x (34 – 25)
= 40 x 9 = 360J
Heat gained by water = M_W x C_W x $\Delta\theta$
= 0.10 x 4200 x 9
= 3780J

(iii) Heat lost by metal block = 3780 + 360 = 4140J ✓

(iv) Heat lost by metal block = Heat gained by calorimeter + water
M_b x C_b x $\Delta\theta$ = 4140
0.15 x C_b x (100 – 34) = 4140
(66 x 0.15)C_b = 4140 ✓
$C_b = \frac{4140}{66 \times 0.15} = 418.18 Jkg^{-1}k^{-1}$ ✓

16. (a) There is change of direction with time. ✓
(b) Centripetal force is greater than weight. ✓
i.e $\frac{MV^2}{r} > Mg$
(c) (i) W = 6 x 2Π rads/s ✓
= 12 Π rad/s ✓
(ii) Angular acceleration
$a = \frac{V^2}{r}$ ✓
$= \frac{r^2w^2}{V}$
= $(12\Pi)^2$ x 0.6 ✓
= 86.4 rad^2/s^2 ✓
(iii) $T = \frac{MV^2}{r}$, but V = vw ✓ = 0.6 x 12Π
$= \frac{0.45 \times 7.2\Pi}{0.6}$ ✓
= 16.96N ✓
(iv) Linear velocity V = vw
= 0.6 x 12Π ✓
= 7.2Π
= 22.62m/s ✓

17. (i) Momentum is conserved and bodies moves together after collision (coelesce).
(ii) I Momentum before collision = Momentum after collision
(1600 x 20) + (800 x 0) = (1600 + 800)V
$V = \frac{32000}{2400} = 13.33 m/s$
II V = U + at
$\Rightarrow$ 13.33 + 15a $\Rightarrow$ pa = -0.89m/s^2

$V^2 = U^2 + 2as \Rightarrow S = \frac{V^2 - U^2}{2a} = \frac{0 - (13.33)^2}{-2(0.89)}$

$= 99.83m$

III Impulse tone $= \frac{\Delta P}{T} = \frac{1600(20 - 13.33)}{2}$ for minibus

$= 5336N$

Or

Or $\frac{800(13.33 - 0)}{2}$ for a car

$= 5336N$

(b) $V.R = \frac{1}{Sin\,30}\frac{1}{\frac{1}{2}} = 2$ ✓

M.A = E x V.R

$= \frac{80}{100} \times 2 = 1.6$ ✓

$E = \frac{L}{M.A} = \frac{50 \times 10}{1.6} = 312.5N$ ✓

Work done against friction = Work input – Work output

Mgh

Work output = 50 x 10 x 4

= 2000J ✓

Work input = Effort x distance moved by effort

$= 312.5 \times \frac{4}{Sin\,30}$

= 2500J ✓

Work done against friction = 2500 – 2000

= 500J ✓

18. (a) (i) Archimedes Principle states that when a body is partially or completely immersed in a fluid it experiences an upthrust which is equal to weight of the fluid displaced.

(ii) Volume of solid in liquid A = 1cm x $2cm^2 = 2cm^3$

$= 2 \times 10^{-6}m^3$

Mass = volume x density

$= 2 \times 10^{-6} \times 8000$

$= 2 \times 10^{-3} \times 8$

$= 16 \times 10^{-3}kg$

$= 1.6 \times 10^{-2}kg$

$W = Mg = 1.6 \times 10^{-1} = 0.16N$

Volume of the block in liquid B = 1.5cm x $2cm^2 = 3.0cm^3$

$= 3 \times 10^{-6}m^3$

$M = \rho \times V$

$= 12000 \times 3 \times 10^{-6}$

$= 12 \times 3 \times 10^{-3}$

$= 36 \times 10^{-3}$
$= 0.036kg$
$W = Mg = 0.036 \times 10 = 0.36N$

(iii) Mass of the block =
Upthrust = 0.36 + 0.16
= 0.52N = Weight of the block
W = Mg
0.52 = M x 10
M = 0.052kg = 52g

(iv) Density of the block $= \frac{Mass}{Volume} = \frac{52}{2 \times 4}$

$= \frac{52}{8} = 6.5 g/cm^3$

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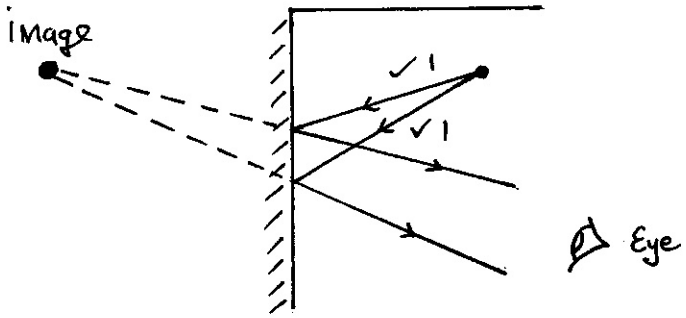
231/2 PHYSICS PAPER 2 MARKING SCHEME

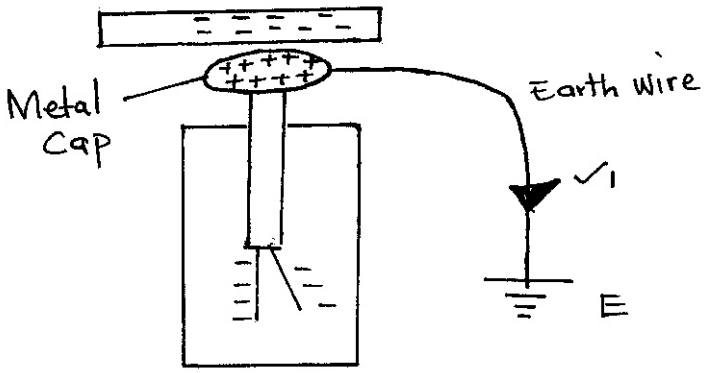
1. (a)



(b) It forms multiple images that overlap.

2. (i) For even distribution of charge.

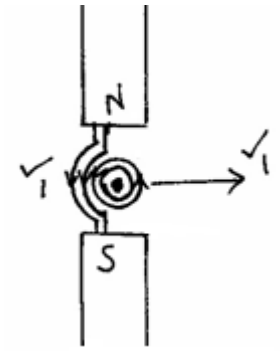
(ii)



3.

Type of radiation ✓1	Detection method	Use
Infrared	Blackened thermometer	Warmth sensation
Micro waves	- Crystal detectors - Solid state diodes ✓1	Communication

4.



(i) From N - S ; around conductor ;
(ii) Direction of force; (NB; lines should not cross)

5. - Nail is hammered in North - South direction.
- Earth's magnetic field aligns dipoles of the nail in one direction.

6. (i) Focal plane is a plane passing through the focal point and perpendicular to the principal axis.
(ii) Produces an - Upright image.
- Magnified image

7. $f = {}^{20}/_{36}HZ$
$l = {}^{0.80}/_{4}$ m
$V = fl$
$= {}^{20}/_{36} \times {}^{0.80}/_{36} = 0.111\ ms^{-1}$

8. - Air is warmer at upper layers.
- Velocity of sound waves will be higher in the upper layers than lower layers hence they will be refracted downwards.

9. ${}^{1}/_{f} = {}^{1}/_{u} + {}^{1}/_{v}$
Objective lens
${}^{1}/_{v} = {}^{1}/_{3} + {}^{1}/_{5}$
$v = 7.5$ cm

eye piece
${}^{1}/_{v} = {}^{1}/_{3.2} + {}^{1}/_{2.5}$
$v = -11.43$ cm

10. (a) The incident ray, the normal and the refracted ray, at the point of incidence all lie on the same plane.

(b) $n_1 \sin \theta_1 = n_2 \sin \theta_2$
$1.5 \sin 55 = {}^{4}/_{3} \sin r$
$\sin r = 1.5 \times {}^{3}/_{4} \sin 55$
$= 0.9215$
$r = 67.150$

SECTION B

11. (a) - Surface area of plates of B is higher than that of A.
- B has more plates than A per cell.

(b) (i) 3.0 V

(ii) $\dfrac{3.0 - 2.4}{0.6 \times 2}$
$= 0.552$

(iii) $I = {}^{V}/_{R}$
$I = {}^{0.6}/_{2} = 0.3A$
$V = IR$
$= 0.3 \times 3$
$= 0.9$ V

(c) (i) OV

(ii) $\dfrac{6.0 \times -4}{0.6 \times 0.4} = 0.24\mu F$
$Q = CV$
$= 0.24 \times 10^{-6} \times 12$
$= 2.88 \times 10^{-6}$ C

(iii) $V = \dfrac{Q}{C} = \dfrac{2.88 \times 10^{-6}}{0.4 \times 10^{-6}}$
$= 7.2$ V

12. (a) The magnitude of the induced EmF is directly proportional to the rate of change

of magnetic flux linkage.

(b) (i) C - Secondary coil.

(ii) To reduce resistance

(iii) - To minimise sparking at the contacts.
- To cause the primary current and hence the magnetic flux to decay to zero.
(any 1mk)

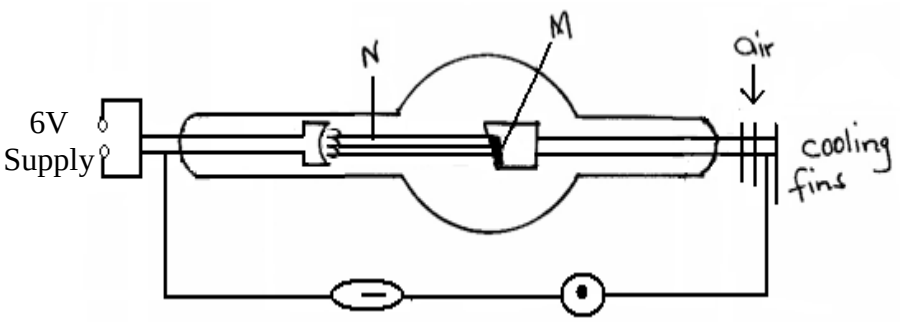
(c) (i) Power output = 12 x 120 = 1440
Power input = $^{100}/_{80}$ x 1440
= 1800
Current primary = $^{1800}/_{240}$
= 7.5 A

(ii) Replace the commutators with slip rings

(d) (i) Y - Blue /black
Z - Yellow

(ii) 2 x $^{35}/_{60}$ x 30 = 35 kW
35 kW x 12.50
= ksh. 437.50

13. (a)



(i) To direct the X - rays out of the tube through a window on the lead shield.

(ii) M - High melting point.
N - Negatively charged.
- Travel in a straight line.
- Posses K.E (*any 1 mk*)

(b) (i) $n = \frac{I}{e}$

$= \frac{10 \times 10^{-3}}{1.6 \times 10^{-19}}$ ✓1

= 6.25 x 10^{-16} electrons ✓1

(ii) ev = $^{1}/_{2}$ mv^2 ✓1
1.6 x 10^{-19} x 2000 = $^{1}/_{2}$ x 9.11 x 10^{-31} x v^2
v = 26,505182.42 ms^{-1}

(c) $\frac{400v}{2cm}$ ✓1
= 200 v/ cm

14. (a) a = 140
b = 36

(b) (i) A - Beta particles
(ii) C is more massive than A
(iii) It posses no charge.

(c) $N_o = 82 - 10 = 72$
$N = 19 - 10 = 9$
72 36 18 9
3 - half line = 210
1 half life = $^{210}/_{3}$ = 70 seconds.

15. (a) - The UV emits photoelectrons from the zinc plate.
- These elections are repelled away and electroscope becomes discharged hence leaf falls.

(b) $hf = w_o + K.e$

$\frac{hC}{T} = 2.04 \times 10^{-19}$ J - K.E

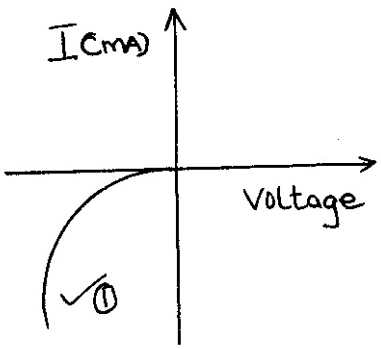
K.E = $\frac{(6.63 \times 10^{-34}) \times (3 \times 10^{8})}{4.5 \times 10^{-7} m} = 2.04 \times 10^{-19}$ ✓1

KE = 2.38×10^{-19}J

$= \frac{2.38 \times 10^{-19}}{1.6 \times 10^{-19}}$

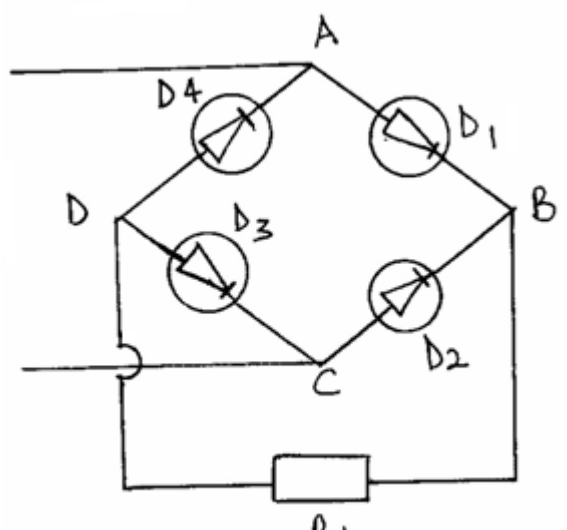
= 1.4875 ev

(c) (i)



(ii) - Holes

(iii)



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231/3 PHYSICS PAPER 3 MARKING SCHEME

Angle io	L(cm)	L_2(cm)	(cm^{-2})	Sin^2i
20	6.9	47.61	0.0210	0.1170
30	7.1	50.41	0.0198	0.2500
40	7.3	53.29	0.0188	0.4132
50	7.9	62.41	0.0160	0.5868
60	8.2	67.25	0.0149	0.7500
70	8.6	73.96	0.0135	0.8830

(6mks)

h) Slope = $\frac{rise}{run}$

(0.70, 0.0152) (1.02, 0.012)

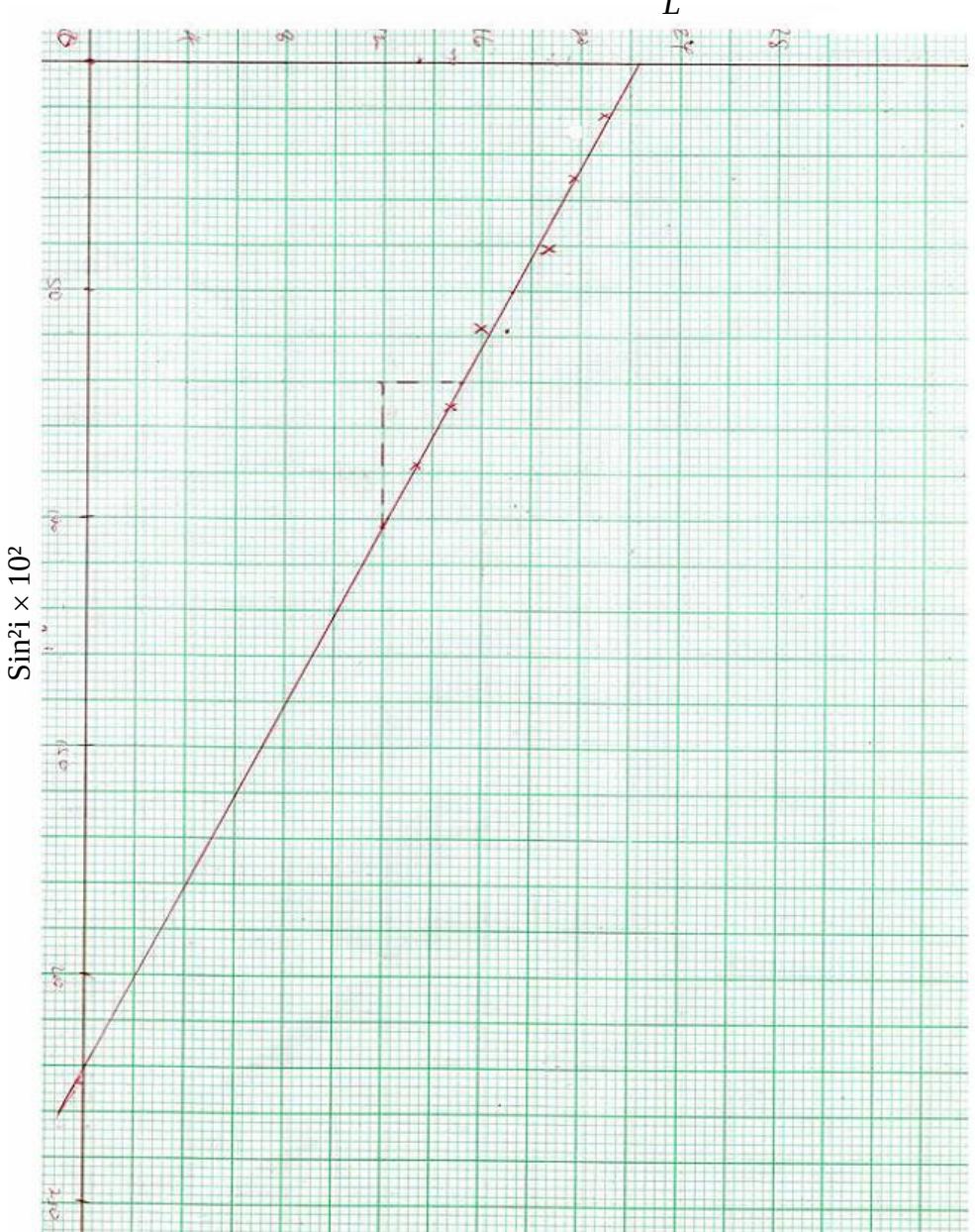
Slope = $\frac{(0.152 - 0.012)}{(0.70 - 1.02)} = \frac{0.0032}{-0.32} = -0.01$

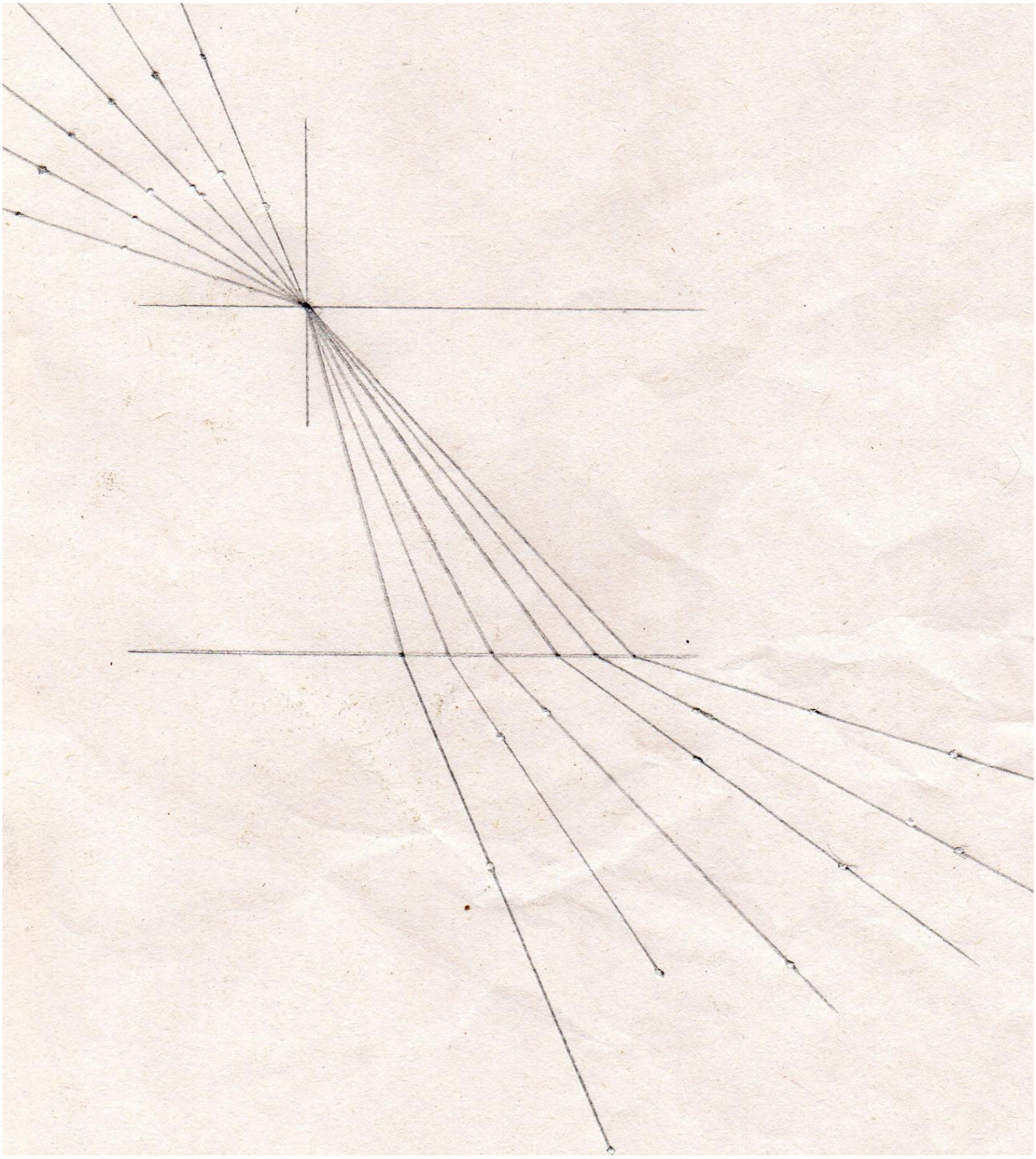
i) C = 0.0224

B = 2.20

j) Q = $Q = -\frac{0.0222}{-0.01} \div 2.20$

= 2.24 =1.020





2.

Length L(cm)	I(A)	Pd V(v)	I(mA)	pdV(v) (mV)	Log I	Log V
20	0.14	0.25	140	250	2.146	2.398
30	0.16	0.35	160	350	2.204	2.544
40	0.18	0.50	180	500	2.255	2.699
50	0.19	0.65	190	650	2.279	2.813
60	0.20	0.85	200	850	2.301	2.929

80	0.24	1.30	240	1300	2.380	3.114

(9mks)

e) Slope = $\frac{rise}{run}$ (3.0,2.32) (0.16,1.50)

$$= \frac{232 - 15}{3 - 0.16} = \frac{0.82}{2.84} = 0.2284$$ (3mks)

f) Log k =C =1.46 k=10 $^{1.43}$ = 28.84 (2mks)

n=slope=0.2284 (1mk)