PHYSICS

FORM ONE

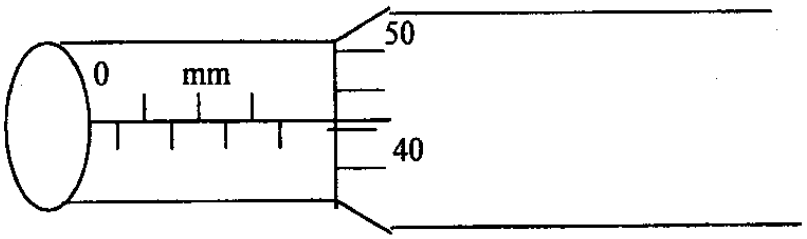
1. MEASUREMENT

1) 0.01cm
2) Reading 1.225 Amperes. 1m
3) 7.20
   0.03
   7.23 cm✓1
4) 22.5✔ + 11.3 = 33.8cm^3✔

5) Main scale Reading = 0.5 cm
   Vernier Reading =0.05cm
   Total Reading = 0.55 cm✓ 1mk (working to be shown)

6) 28.0 – 16.0
   = 12.0 cm^3 ;

7) scale reading = 7.5 mm.
   Thimble scale reading = 0.45m
   ∴No of division = 45



T 1

x 1 mk for correct diagram.

8) Density is mass per unit volume- relative density the number of times a substance is denser than water. ✔2

(b) - Mass of water that fills the bottle
= 72.4 – 17.0
= 55.4g31

- Volume of bottle = mass / Density
= 55.4 / 1✔ ½
= 55.4cm^3

- Mass of water that fills volume not occupied by shots in the bottle
= 145.1 - 97.2
= 47.0g✔ 1
- Volume not occupied by shots =
= mass / Density
= 47.9 / 1
= 47.9cm^3 ✔ ½

- Volume of shots = 55.4 – 47.9
  = 7.5cm^3 ✔ 1
- Mass of shots = 97.2 – 17.0
  = 80.3g ✔ 1
- Density of shots = Mass / Volume
  = 80.2 / 7.5 ✔ ½

  = 10.67 ✔ ½

  = 10.67g/cm^3

RD = 10.67 / 1 = 10.67 ✔ ½

OR

- Instead of working out the density of shots, work out the mass of 7.5cm^3 of water.

M = fv
= 1 x 7.5
= 7.5g $^1/_2$

RD = Mass of shots / Mass of equal vol. of water

RD = 8.2 / 7.5
= 10.67 ✔ ½

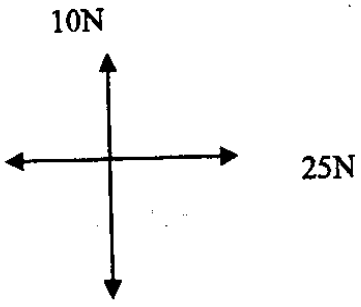
(c) - as the velocity increased the opposing forces (i.e upward thrust and viscocity) increases. ✔ 1
- When the opposing forces equal to the weight of the ball bearing (i.e. resultant force = 0), acceleration = 0 and the body moves with constant velocity ✔ 1

2. FORCES AND MOMENTS

9) 60 x F = 300 x 50✓

$F = \frac{300 X 50}{60}$ ✓ F = 2.5N✓ 3mks

10) (a)



(b) 20/2 = 10N ✓1

11) Combined spring constant
K = 8N/M ✔ 1
F = Ke

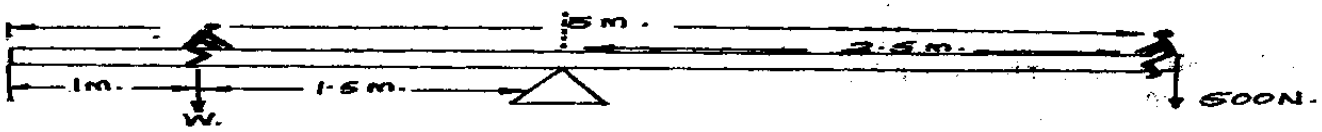
$e = \frac{F}{K} = \frac{10 \times 10\ N/kg}{8}$ ✓1

$= 12.5m$ ✓1

12) Quantity with both magnitude ✓ and direction. ✓
e.g. displacement, velocity e.t.c.

13) Sum of clockwise moments = sum of anti -clock ✓wise moments 1mk
$100 \times 0.4 = F \times 0.1$ ✓ 1mk
$F = 400\ N$ ✓ 1mk

14) -From O to A as current increases more and more domains become aligned
From A to B the saturation point is reached – all domains are in the direction of the field.



$w + 1.5 = 500 + 2.5$

$w = \left(\frac{500 + 2.5}{1.5}\right)$ T

$= 833.3N.$

$M = \frac{833.3}{10}$ T $= 83.33$ kg

3. EQUILIBRIUM & CENTRE OF GRAVITY

15) The centre of gravity (c.o.g) is raised and then lowered. 1mk

17) Cog raised hence less stable. ✓1

18) When a turning force is applied on a body , centre of gravity is raised up but goes back when the force is withdrawn. ✓ 1mk BTM

19) By adding weights to the base ; ✓
-Each correct ray ; ✓

20) Unstable equilibrium

4. PRESSURE

22) (a) Pressure is force acting perpendicularly per unit surface area. 1mk.

(b)(i) The height 'h' of the water column above the hole provides the pressure (p=dgh) which makes the water to come out. 1mk

(ii) Closing the top, open part will cut off the atmospheric pressure hence making the atmospheric pressure acting at the hole to be greater than the pressure inside due to the water column. 1mk

23) $hApA = hBpB$

$pA = \frac{p_B \checkmark\ p_B\ 1}{h_A} = \frac{7.5 \times 2}{20}$

$= \frac{15}{20}$ ✓1

$= 0.75 g/cm^3$ ✓1

24) Heat is an electromagnetic wave and is changed to heat it strikes mass of air is concentrated on the surface and spacely upwards. Hence most absorption of heat on the surface.

25) Due o pressure difference, blood pressure is greater than atmospheric. ✔

26) Higher level in A than B ;

27) Pressure would be the same at the same place.

$\therefore p_1 g h_1 = p_2 g h_2$ T

$1000 \times 10 \times h_1 = 13600 \times 10 \times \frac{67}{100}$

$h_1 = \frac{13600}{1000} \times \frac{67}{100}$ T

$= 9.112$ m. T

28) Volume of the tumbler when floating

$= 20 \times 20$

$= 400cm^3$;

Volume of air while the tumbler is under water. 1mk

$= 380cm^3$

According to Boyle's law P1V1=P2V2 ; 1mk

$100000 \times 400 = (100000 + h \times 1000 \times 10)\ 380$; 1mk

$3800000h = 2000000$

$h = \frac{2000000}{3800000}$

$= 0.54m$ 1mk

10mks

29) i) Exerts equal forces on all the wheels. ✔ 1

(ii) Less force is required.

(b) (i) - It is compressed (or its volumes reduces) ✔ 1

- As the piston moves down, the liquid flows so as to compress the air since liquids are incompressible. ✔ 1

(ii) Oil ✔ 1

- It doesn't cause corrosion or has high viscosity. ✔ 1

(iii) As shock absorbers ✔ 1

5. PARTICULATE NATURE OF MATTER

30) Matter is made up of molecules which lie in particular planes. 1mk

31) Temperature increases the kinetic energy of the particles (molecules) of air hence the rate of collision or random motion also increases. 1mk

32) (i) The perfume diffuses✓ 1 to the rest of the rooms.

(ii) Crystals cleavage: - the cutting or splitting of a crystal along some plane. ✓1

✓1

33) Condition: Divergence should be equal but lower than initial divergence of charged electroscope

34) Unlike changes are introduced by friction onto the surfaces ✔ and attraction keeps the two together.

35) h= volume of oil drop.
Area of oil film

$$= \frac{0.15\ mm^3}{3.142 \times (140)^2 mm^2}$$

$= 2.44 \times 10^{-6} mm.$

36) Vol of oil drop = Vol oil patch ; ✔
oil patch is mono layer ;

37) –No change in leaf – divergence ; ✔
-No charge resides inside a hollar container ;

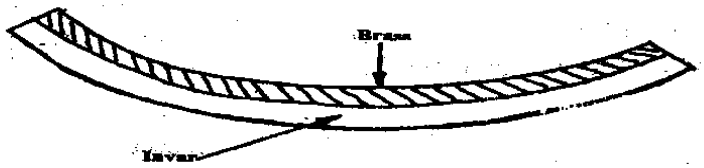
38) (i) The collision of smoke particles with invisible air molecules.
(ii) The random motion will be much slower.

39) Bright specks ✔ (1) were moving in a zig-zag manner ✔ (1) This is due to the bombardment of smoke particles by the unseen particles of air. ✔ (1)

6. THERMAL EXPANSION

40) When water enters a crack in a rock, and then freezes, there is an increase in volume hence causing weathering of the rock. 2mksbmt

41) (a) Adjust the screw upwards, so as to prolong the heating, by prolonging contact line. ✓ 1
(b) Alcohol has a low freezing point. ✓1



42) Water and glass are poor conductors of heat. ✓ 1mk.
43) Ice is less dense than water. ✓ 1mk
44) It expands greater than mercury
45) $e = 4 . L R 6$ ✔

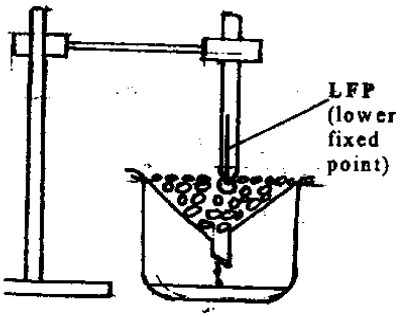
$$e = \left(3.0 + 10^{\%5} \times \frac{50}{1000} \times 100 - \frac{}{1000} \right)$$

$$= (3.0 \times 10^{\%5} \times 5)\ m$$ ✔

$$= (15 \times 10^{\%5})$$

$$= (1.5 \times 10^{\%4})\ m$$ ✔

46) Lower fixed point: - Clamp the thermometers that the bulb is inside the funnel as shown below.



✓1

- Put ice into the funnel and to cover the bulb and wait until water from melting the drops from the funnel.
- Mark the steady position of the mercury thread. This is the lower fixed point.
- Condition

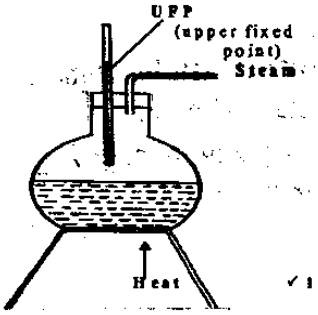
No mark for the unfunctional diagram.

Upper fixed point: - Half fill the conical flask with water and place it on the tripod stand. Insert thermometer and the tubing into the cork and cork the flak as shown

✓1 Heat the water to boiling.

Note the steady maximum ✓1 temperature of the thermometer. This is the upper fixed point.

Conditions - No working diagram - 0 mark



✓1

7. TRANSFER OF HEAT

47) Opaque and expand regularly. 2mks

48) Evaporation takes place at all temperatures while boiling takes place at a fixed temperature.
Evaporation takes place on the surface of the liquid while boiling takes throughout the liquid.
In evaporation, no bubbles are formed while in boiling bubbles of steam from all over.
Decreasing the atmosphere pressure increases the rate of evaporation but lowers the boiling point.
Any two mks

49) Region 'A' remains unburnt while region B get charred (burnt) because wood is a poor conductor hea while metal is a good conductor of heat. 1mk

50) A - Silvery surface. ✓1
B - Vaccum ✓ 1

(b) B - Convection and Conduction. ✓ 1
C - Conduction ✓1

(c) Power emitter/absorber. ✓ 1

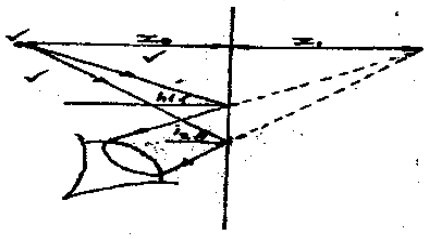
51) The occupants breath out moist air. ✔ When it gets into contact with the glass surface, ✔ it looses its latent heat of vaporization and condenses.

52) Dull black ; ✔
Its a good absorber of radiant heat ; ✔

53) Radiation ⟶ minimised by the silvery / shiny surfaces.

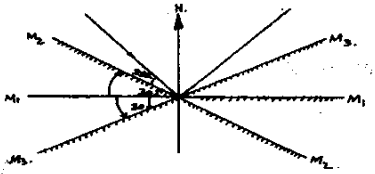
8. LIGHT I

54)



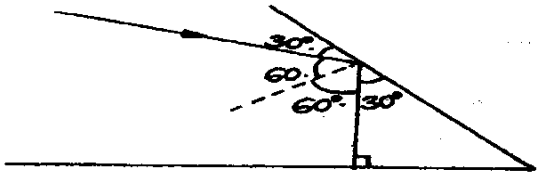
1mark object distance 1mark for rays from object *conditions*: $x_o = x_i$: rays must have arrows

55)



56) 25^0 or 85^0

57)



✓ 1mk

58) Reflected ray rotates through 2 x 20 ;=40 Angle between the two rays , 100 + 40; = 140 ; ✓

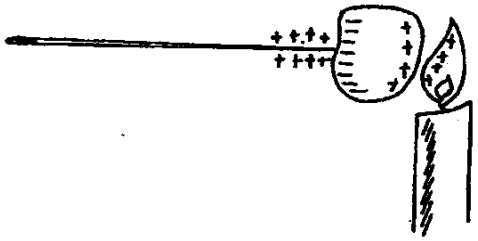
59) The thick glass behaves as two parallel mirrors hence forming infinite number of images.
Clear image is formed by reflection from the front surface of the glass and the faint image is formed by multiple internal reflection inside the glass.

9. ELECTOSTATICS I

60) The unchanged rod has both charges hence the unlike charges attract. The leaf falls. 2mksbmt

61) Each material is brought in turn to touch the cap.
Conductor will discharge the electroscope while insulator will not. ✓ 1mk

62) air between flame and needle is ionized.



——→high concentration of charges at the sharp end of the pin. ✓

——→ Air is ionized , negative charges are attracted to the pin, and +ve charges are repelled , making the flame +ve charged hence repulsion. ✓

OR **-high concentration of +ve charges at the pin.**

-Electrons are knock out from the flame , hence repulsion. ✓

63) (i) The metal is first brought closer to the sphere then if it <u>attracts</u>✓ each other the sphere must be positively charged or if it repels then it must be <u>negatively</u> ✓ charged OR using the galvanometer deflection, i.e. if negatively charged it deflects to the right and vice versa.

(ii) The galvanometer is deflected <u>anticlockwise</u> to show the present of positive.✓ 1

(iii) Galvanometer will be deflected in the <u>anticlockwise</u> ✓1 direction. ✓1

10. CURRENT ELECTRICITY I

64) Relative density of acid. 1mk

65) (a) Brightness of 1 and 3 will be dimmer than ✓ 1 when all three light - higher effective resistance.

(b) Charging current } ✓1

Charging time any one.

66) Longer life.
Needs no attention
Can stay discharged without being destroyed
Can be charged with larger currents.
It is lighter.
Can deliver larger currents. ANYONE ✓ 1mk

FORM TWO
11. MECHANICAL PROPERTIES OF MATTER

67) F = k x e
F = k x 4
F = 20 x 4✓
F = 80N — 2mks

68) (a) Hooks Law states: - the extension produced on a spring is directly proportional to the stretching force provided the elastic limit is not exceeded.

(b)(i)

$F = ke$

$e = \frac{F}{K}$

$= \frac{5}{20}$

$= 0.25m$✓1

For the two springs in parallel

$\ell = \frac{0.25}{2}$

$= 0.125m$✓1

(ii) $k = \frac{F}{e}$

$= \frac{5}{0.125}$ ✓1

$= \frac{5000}{125}$

$= 40N/M$✓ 1

69)

	M1	M2	M3	M4	M5	M6
Vol, V (cm^3)	2.50	3.80	5.20	6.10	8.00	10.0 ✓ (2)
l_1(cm	3.70	7.80	11.40	16.10	10.90	22.60 ✓ (2)
L_2(cm)	3.30	6.70	9.90	14.0	16.40	19.60 ✓(2)
(l_1.l2) cm	0.40	1.10	1.50	2.10	2.50	3.00 ✓ (2)

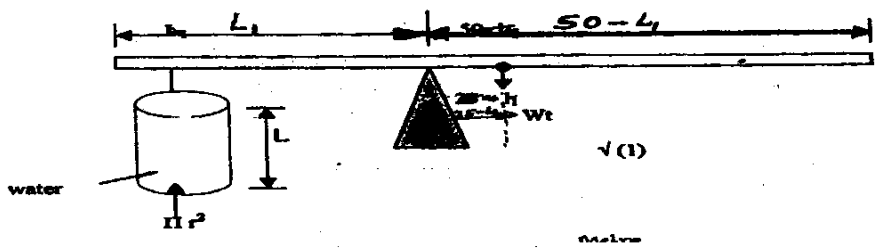
$$\frac{\Delta V}{\Delta(l_1 - l_2} = \frac{10.0 - 6.0}{3.0 - 1.75} = \frac{4.00}{1.25} = 3.2 \quad \checkmark(1)$$

(ii) $\frac{21}{5k} = 3.2 \; ie \; slope \sqrt{} \quad \checkmark(1)$

$\frac{21}{3.0} = 5k = 6.5625 \sqrt{} \quad \checkmark(1)$

$K = \frac{6.5625}{5} \sqrt{} \quad \checkmark(1)$

$K = 1.3125 \sqrt{} \quad \checkmark(1)$



- Place a small beaker full of water to a balance a half metre rule.
- Assuming the weight of the beaker being negligible.
- Get the volume = $\pi r^2 l$

Using density of water x 1g/cm^3 calculate the mass = Vxd = πr^2 lxd.
Weight = πr^2lxdxg.
C.M. = A.C.M.√ (1)
Weight of water x l_1 = weight of rule x (25cm – l_1)

$$\text{Weight of rule} = \frac{weight\ of\ rule\ x\ l_1}{25cm - l_1} \quad \text{mass of rule} = \frac{weight\ of\ rule}{10} \quad \checkmark(1)$$

70)

x(cm)	h(cm)	$X^2(cm)^2$	$x^2/h\ (cm)$
20	3.0	400	133
25	5.6	625	111
60	8.5	900	106
35	12.8	1225	95.7
40	18.0	1600	88.9
45	25.5	2025	80.9
	± 0.5		± 0.5

- ½ mk for each entry. Total - 6mks

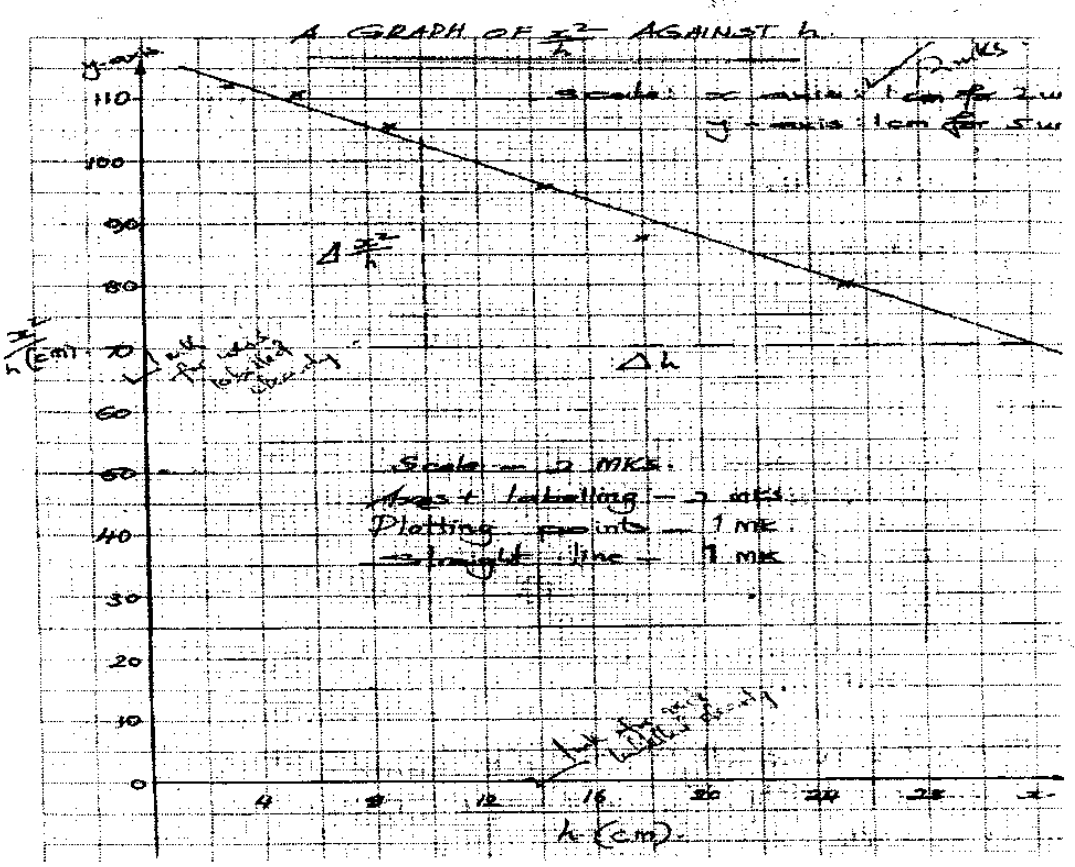
(ii) Graph 6mks

(iii) Slope = -1.8 ± 0.1 -ve = 1
value - 1

(iv) $\frac{x^2}{h} = 121.5 \pm 0.5$ = 2mks

(b)(i) Time for 20 oscillations
= 29.0±/s 1mk
T = 1.45 seconds

(ii) P = 0.51±0.01 2mks



71) (a) Position P can vary from 53.0— 47.0cm marks.✓

X_2 = 61.3cm $64 \leq X_2 = 60.00$

X_1 = 28.6cm $30 \leq X_1 = 25$

$W = \frac{50 \quad X_1}{X_2 - X_0} = \frac{50 \times 28.6}{61.3 - 50.0} =$ 126.5g✓

(b) X_0 = 50.0

d_1 = 38.7cm✓

d_2 = 51.3cm✓

$Q = \frac{Wx\,(d2 - d0)}{d1} = \frac{126.5 \times 1.3}{38.7}$ ✓ =4.2gm✓1

All readings of meter rule should be to 1 decimal - accuracy of meter rule otherwise do not accept.

Mass of rubber bands = 4.2g

72) .(i)

x(cm)	h(cm)	$X^2(cm)^2$	$x^2/h\,(cm)$
20	3.0	400	133
25	5.6	625	111
60	8.5	900	106
35	12.8	1225	95.7
40	18.0	1600	88.9
45	25.5	2025	80.9
	± 0.5		± 0.5

- ½ mk for each entry. Total - 6mks

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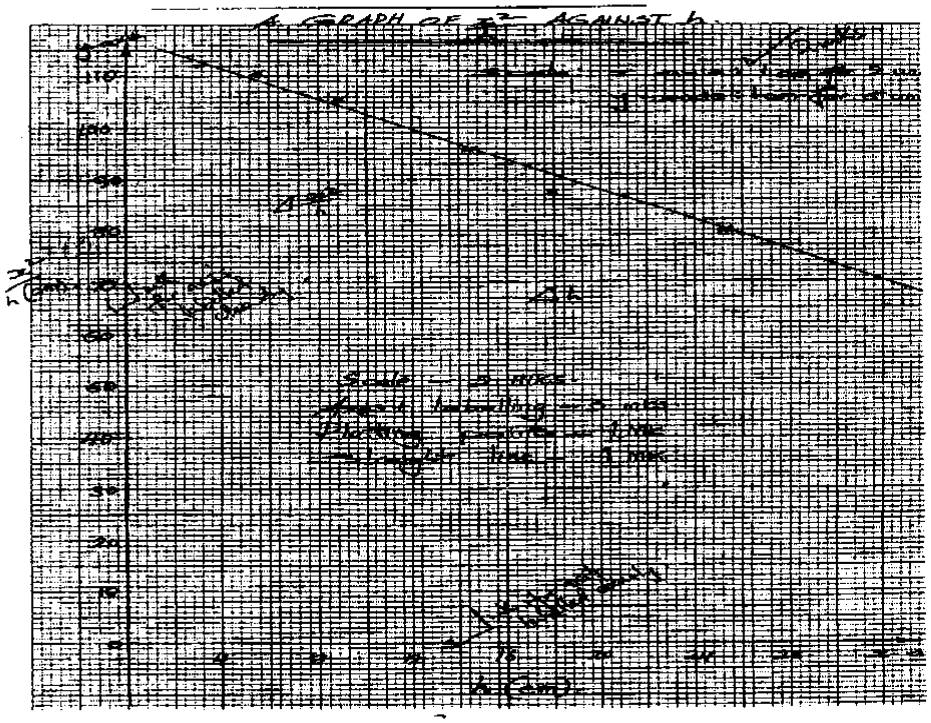
(b)(i) Time for 20 oscillations
= 29.0±/s 1mk
T = 1.45 seconds

(ii) P = 0.51±0.01 2mks

II

Length (l) cm	**L^2 (m^2)**	**Time for (10) oscillations**	**Period (T) for one oscillations**
8 cm	0.0064	16.50 ∀ 1	1.65
10	0.01	19.00	1.90
12	0.0144	21.60	2.16
14	0.0196	23.80	2.38
16	0.0256	25.90	2.59
18	0.0324	27.50	2.75
20	0.04	28.90	2.89
	(1mk)	**(2mks)**	**(1mk)**

Award: ½mk for 3 correct values
1 mks for 4 correct values
1 ½ mks for 5correct values
2 mks for 6 and above correct values



73) **PART II**

b) x = 1.8 cm
c) y = 12.6 cm
d) m = 19 .4g

e) r = 0.765cm

f) $D = \frac{m}{\pi r^2 (y - x)} = \frac{19.4}{\pi (0.765)^2 (12.6 - 1.8)}$

$= \frac{19.4}{19.86} = \underline{0.98}$

74) **Part I**

i) h= (38-42)cm -1 mark

ii) f=$\frac{h}{2}$ (19-21) -1mark

Object distanceU(cm)	Image distance	Magnification M=$\frac{v}{u}$
22	118	5.36
24	82	3.42
26	64	2.46
28	56	2.00
30	50	1.67

1mark for each correct value for a maximum of 4 values

1mark for all correct evaluation (2dp).One wrong value No mark.

(Table max. 5 marks)

iii) grad= $\frac{1}{f}$ -(½ mark)

$= \frac{3.8}{90-18}$ =0.05 -(½mark)

f=$\frac{1}{0.05}$ =20 -(1mark)

iv) Values of f are the same – 1mark

PART II

II) X = (1.5 - 2)cm -(½ mark)

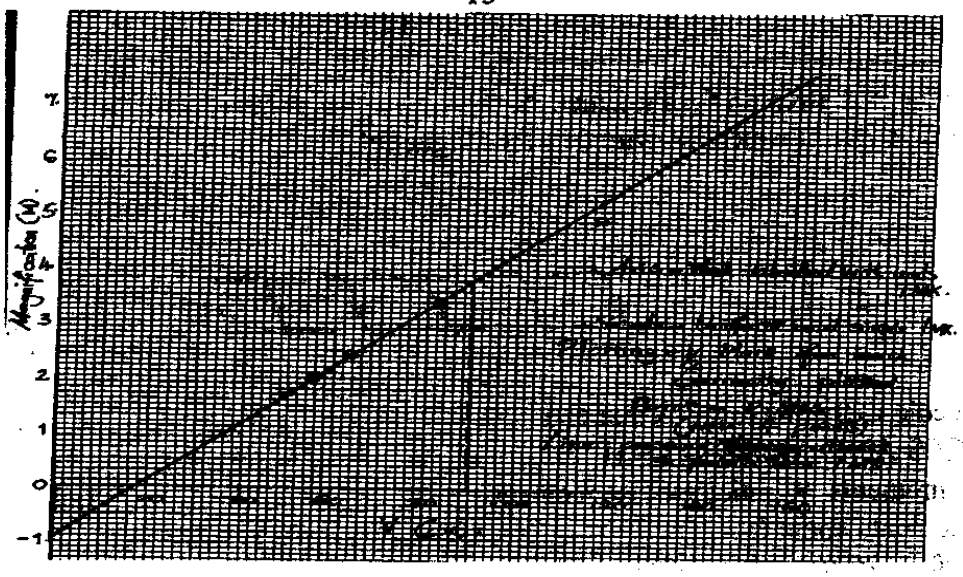
(III) y = 12.5cm -(½ mark)

(IV) m = (20-22) grams (1mk)

(V) d = 1.64 /= 0.82 (1mark)

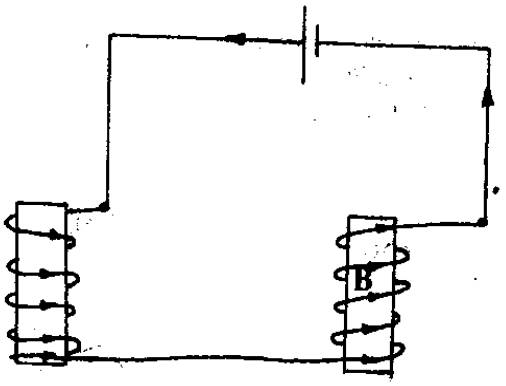
VI) $D = \frac{22}{3.14(0.82)(10.5)}$

$= \frac{22}{22.18} \cup 0.99$ (1mark)



12. MAGNETISM

75) Because of attraction between unlike poles. The earth's magnetic north pole is in the geographic south pole and its magnetic south pole is in the north pole. (2mk)



76) N - N ✓1

(b) When heated, or hammered, the vibrations will cause the domains to face different direction. ✓1

77) By suspending it freely to see whether it will rest in the N.S position. ✓

78) Keepers become strong induced magnets with opposite poles to the adjacent poles of bar magnets. Dipoles in domains of both magnets and keepers. ✓ 1mk

79) ($F_2 . y) = F_1 . x)$; ; ✓

$$F_1 = \left\{\frac{y}{X}\right\} . F_2 ;$$

81) (i)P
(ii)Q

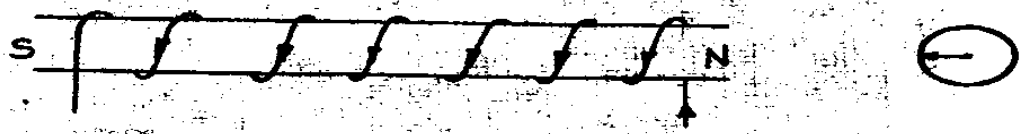
13. MAGNETIC EFFECT OF AN ELECTRIC CURRENT

82) (a) AB - Out of the page
CD - into the page 1mk

(b) Increase the amount of currents.
Increase the number of coils.
Use a stronger magnet.
The aluminium rod rolls towards the left. ✓1

83) Speed of moving it, ✔ strength ✔ of magnet. ✔
No. of turns and angle at which the wire cuts the magnetic Flux

84)



The needle will point towards that end.

14. FORCES AND MOMENTS II

85) Clockwise moments = anticlockwise moments; 1mk
take moments about Q

$R_p \times 20 = 2000 \times 15 + 60000 \times 10$ = 45000N 1mk

$R_p = \frac{300000 + 600000}{20}$

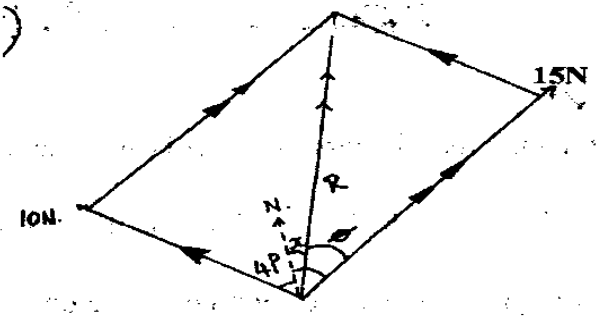
$R_p + R_p$ = total weight
$R_Q = 80000 - 45000$
= 35000N

86) Clockwise moments = anti-clockwise moments. ✔1

Mg x 25 + 5 x 50 = 30 x 20
10m x 25 = 600 - 250

$m = \frac{350}{250} = 1.4kg$ ✔

87)



$R^2 = 10^2 + 15^2 = 325N^2$
$R = 18.3N$ ✔
But $\tan\theta = \frac{10}{15} = 0.6667$

$\therefore \theta = 3.7^0$ ✔

Hence magnitude = 18.37N
Direction at a beam of 191.3^0
($\sin x = (45 - 33.7^0) = 11.3^0$) ✔

88). (a)
10 x 4 = 1 x (y+F) F = 30N ✔
40 = 1 x (10 + F)
(b) y is a magnetic material. ✔

89) Since the V.R of the machine is 1;
Extra work done against friction requires more force; 1mk

(b) P.E = mgh
= 20 x 0.5; 1mk
=10J; 1mk

(c) Energy supplied = Force x distance; 1mk
= 25 x 0.5; 1mk
= 12.5J; 1mk

(d) The energy supplied is converted into heat energy: 1mk
because of the friction between the movable parts; 1mk

(e) Q = MCΔθ 1mk
0.1x460x5; 1mk
=230j; 1mk

(f) Energy converted into heat when raised once = 12.5-10= 2.5J; 1mk
number of times to be raised

$$=\frac{230}{2.5}$$ 1mk
$$= 92;$$

15. LINEAR MOTION

90) $s = ut + \frac{1}{2}gt^2 \quad u = 0$ 1mk

$= 0 + \frac{1}{2} \times 10 \times (30)^2$ 1mk
=5 x 900
=4500m 1mk

91)

$V_1 = \frac{0.004}{0.02}$ $\quad V_2 = \frac{0.006}{0.02}$

$v_2 = 3\,m/s$

$V_1 = \frac{4}{20}$ $\quad a = \frac{3 - 0.2}{0.14}$

$V_1 = \frac{1}{5}$ $\quad = \frac{2.8}{0.14}$

$V_1 = 0.2\,m/s$ $\quad a = 20\,m/s^2$

92) The graph represents the motion of a body projected vertically upwards. ✓1