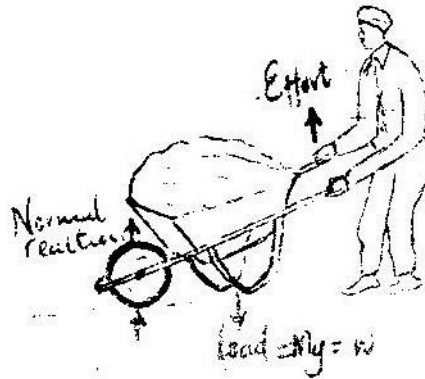# K.C.S.E 1995 PAPER 1 MARKING SCHEME

1. Micrometer   screw gauge

2.

Fig. 1

3. Effort would reduce
4. Flow from a to B
5. Pressure difference between liquids in A and B is P = egh where e is liquid, g = acceleration due to gravity and h is height

   But force = P x cross section area of siphon, P = F/A

   Thus F = egh A   Since e.g. A are constants

              Fα h

6. No change in flow OR the flow will still continue
7. Oil spread until it is one molecule thick or film taken as a perfect circle or oil drop has been taken as perfect sphere/ cylinder/ uniform thickness
8. The liquid expand uniformly, expansion is measurable (large enough), thermal conductivity
9. Rectilinear propagation/ light travels in a straight line
10. Water/ or glass are poor conductor of heat
11. Each material is brought in turn to touch the cap. The conductor will discharge the electroscope while the insulator will not (accept bring near conductor gauge)
12. Can be short – circuited without being destroyed

    Longer life/ electrolyte never need attention

    Can stay discharged without being destroyed

    Can be charged with large currents faster charging

    More rugged/ not damaged by rough condition of use/ robus Delivers
   large current, light
13. Surface tension / adhesive forces supports water column or more capillarity in tube 2 than tube 1

    Surface tension is the same in both tubes and equal to the weight of water column
    supported

    Narrow tube has longer column to equate weight to wider tube

    Volume of water in the tubes is same hence narrower tube higher column

14. – Length of conductor in the field
   - Angle between conductor and fields
15. All ferromagnetic materials are attracted by magnets or any magnetic materials is attracted
16. – increasing the tension
   - Reducing the length
17. At equilibrium sum of clockwise moment = sum of anti – clockwise moments
   Clockwise moments = P x   X = QY
                      Px = Qy
18. h glass = V air / V glass $1.5 = 3 \times 10^8$ √ g Vg = 3×10^8 / 1.5
        = 2×10^8 ms^{-1}
19. V = f λ sine V is constant reducing f to 1/3 ⇒   λ increases 3 fold
20. While light is composed of seven colour different/ many colour. For each colour glass had different value of refractive index/ different velocities of different λ. So each colour is deviated differently causing dispersion

21. A body at rest or in state of uniform motion tends to stay in that state unless an unbalanced force acts on it.

22. Heat capacity is quantity of heat required to raise the temperature of the body by 1 k or 1 ^{0}C while, specific heat capacity is quantity of heat required to raise temperature of unit mass of body by 1 k/ 1^0 C.

23. (If x ≠z but both above y give 1 mk. Accept difference of 1.0 mark)
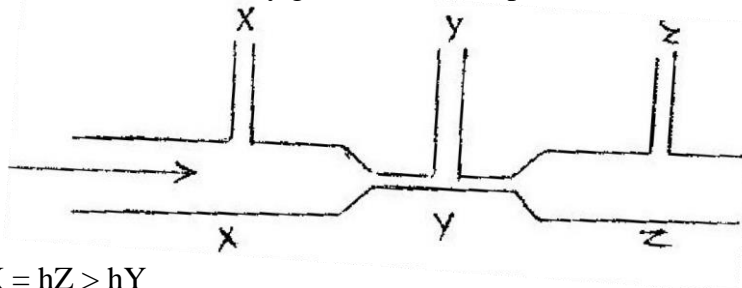
   hX = hZ > hY

24. – Reducing   - Increasing

25. Polarization

26.

Type of radiation	Detector	Uses
Ultra violet	Photographic paper fluorescence material	Cause ionization kills bacteria OR operating photosular cells photography

Infrared	Phototransistor blackened thermometer	Warmth sensation
Radio waves	Radio receiver or TV receiver	Communication

27. $E_2 = E_1 + h f$ i   or $E_2 - E_1 = h = c/\lambda$ h= plank constant c- Velocity of light
    λ- Wave length of light

28. – Lead   - Very dense/ has high atomatic mass
29. Extrapolation on graph (line to touch frequency) Reading on graph to $(4.0 + - 0.2) \times 10^{14}$Hz
30. Lines parallel to the one shown but cutting of axis further in
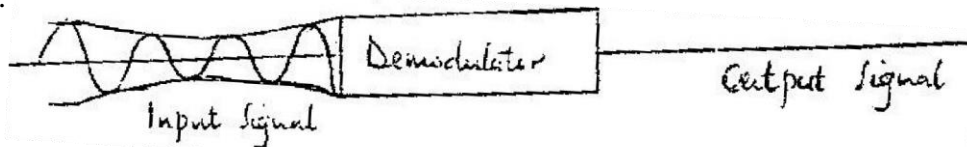31. Quality / Timbre
32. $X = 14$
33. The point where the weight of the body acts
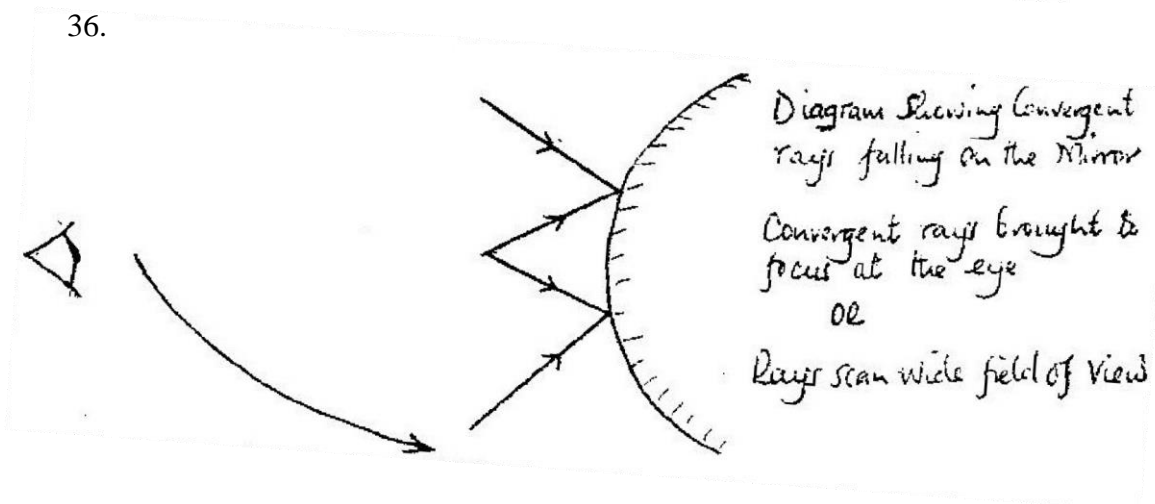34. Temperature of source be the same
    - Length of rods be the same / wax
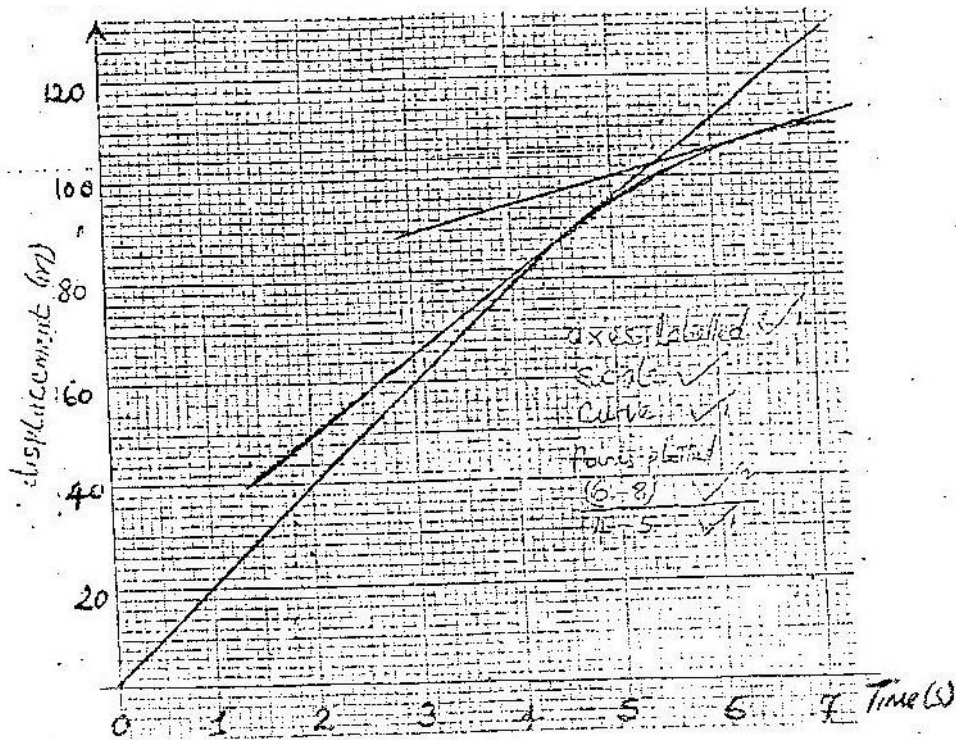   - Amount of wax (detector) be the same
35.

36.

K.C.S.E 1995 PHYSICS PAPER 232/2 MARKING SCHEMES

1. (a)

(b)   Constant Vel^0 Uniform vet   - zero accl^n

(c) $\sqrt{}$ 4.5 = $\dfrac{118 - 50}{6.5\text{-}2}$ = 15m/s 15.5 + -1.5 (14-17)

   $\sqrt{}$ 6.5 = $\dfrac{112 - 70}{7}$ = 6 m/s   (4=6)

   Average accln = $\dfrac{\Delta v}{t}$ = $\dfrac{v - 11}{t}$ = $\dfrac{(6\text{-}15)}{2}$

                                                = - 4.5 m/s^2

2. $\dfrac{1}{R_C}$ = $\dfrac{7}{R_1}$ + $\dfrac{1}{R_2}$ + $\dfrac{1}{R_3}$

    = $\dfrac{1}{6}$ + $\dfrac{1}{3}$ + $\dfrac{1}{6}$

    = $\dfrac{1}{6}$ R_C = $\underline{6}$ =

1.5 Ω

        4

(b) Total resistance = 1.5 + 2.5 = 4 Ω

$$E = 1(YFR) \text{ Or } 1 = \frac{V}{R}$$
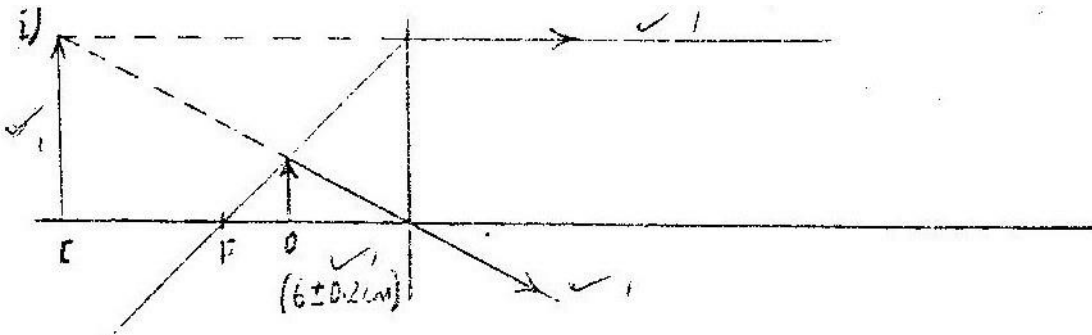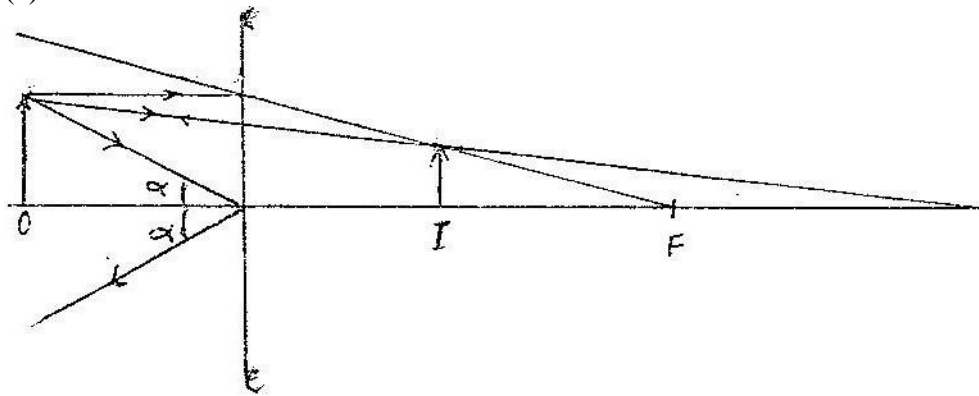
$2 = Ll$

Current through xy l = 0.5 A

P.d across yz = 0.5 x 1.5 V

s= current through 3 Ω = $\frac{0.5 \times 1.5}{3}$ = 0.25 A

(c) R = /L   A

$$I = \frac{RA}{L} = \frac{6 \times 5.0 \times 10^{-6}}{1.0} \quad \frac{\Omega m^2}{m}$$

= 3.0 x 10⁻⁵Ω m

3.   (a)

i)

(ii) Magnification = $\frac{V \text{ Isign}}{u \text{ Osign}}$ = $\frac{1.1}{1.6 \ 2.5}$ = 0.7 ± 0.05   OR   1.75

(b) $\frac{1}{f} = \frac{1}{u} + \frac{1}{v}$ $\frac{1}{10} = \frac{1}{60}$

$\frac{1}{l} = \frac{1}{l} + \frac{1}{l}$ u = 6cm
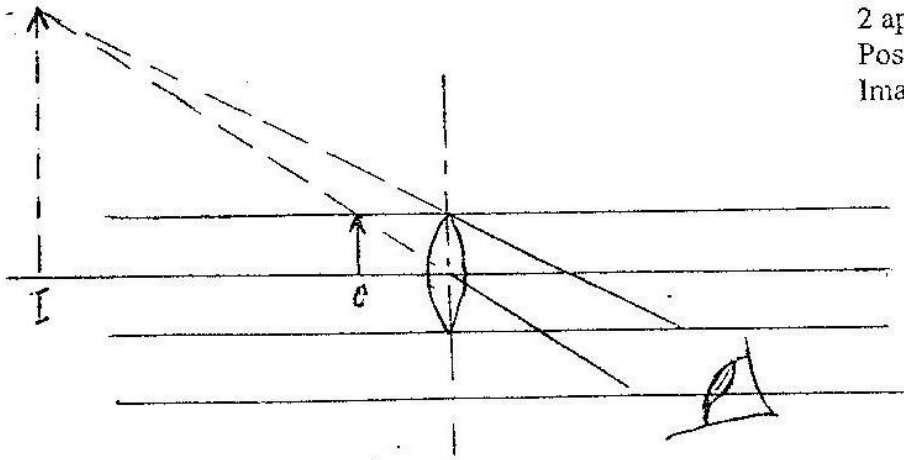
10   u   v

$\dfrac{1}{U} = \dfrac{1}{10} + \dfrac{1}{15}$ Objects is 6 cm from the lens

4 (a) Lens symbol object between f & F 2 appropriate rays position of image
Image correctly drawn

Lens symbol
Object between f & F
2 appropriate rays
Position of image
Image correctly drawn
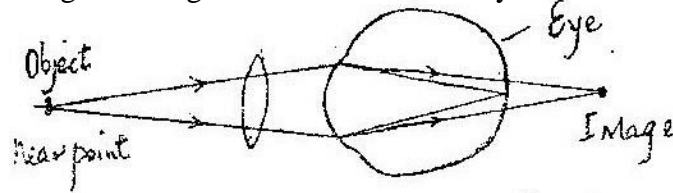
The diagram in figure 3 shows a certain eye defect

Fig. 3

(b) (i) Name of defect is long sightedness
(Refer to the diagram in the figure 3 above)

(c) (i) For water not to pour weight of the water must be less centrifugal force OR
for water to pour out $\dfrac{MV^2}{r} > mg$

(ii) Frictional force F = Centripetal force

$$\dfrac{MV^2}{R} = \dfrac{1200 \times (25)^2}{150}$$

$$= 5.0 \times 10^3 N$$

5. (a) (i) The magnitude of the induced e.m.f is directly proportional to the rate at which the conductor cuts the magnetic field lines

The induced current flows in such a direction as to oppose the changes producing it.

(ii) Plugging a magnetic into a coil in speed its g twins
as straight of magnetic field Results in an
increased in the induced e.m.f

(b) (i) Energy is neither created nor destroyed

Make power constant

VU = Joules (½)   current = charge (½)

        Count   time

        $P = IV$

For large V, 1 must lower for power input to be equal to power output

(ii) $\dfrac{Vs - Vp}{Ns \quad Vp}$ OR $\dfrac{Vs}{Vp} - \dfrac{Na}{NP}$

$Ns = \dfrac{Vs \times Np}{Vp}$ = $\dfrac{9 \times 480}{240}$ $Ns = 18$

SECTION II

6. (a) Progressive wave- Wave profile moves along with the speed of the wave

    Stationary wave – wave profile appears static

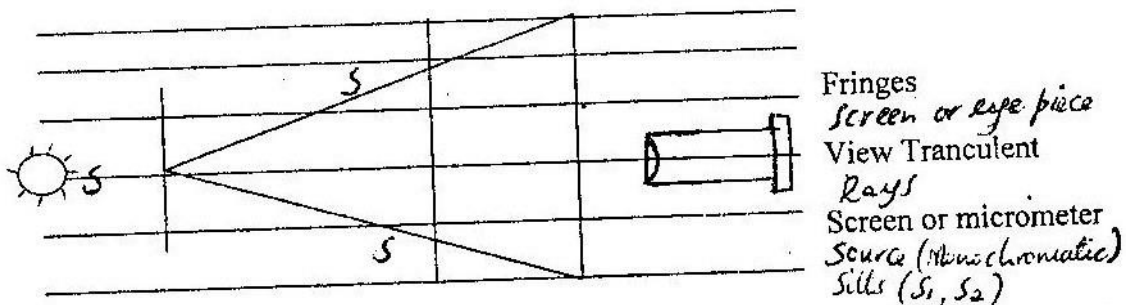Progressive wave – Phase of points adjacent to each other is different

Stationary wave – All points between successive node vibrate in phase

Progressive wave – Energy translation in the direction of the wave travels

Stationary wave- No translation of energy but energy associated in the wave

(b) (i) A glass slide i.e. blackened with soot or paint lines are drawn close together using a razor blade or pin.

(ii)   Path differences equals to an odd number of half wavelengths or completely out of phase (180^0)

Fringes
Screen or eye piece
View Tranculent
Rays
Screen or micrometer
Source (Monochromatic)
Slits (S_1, S_2)

(iii)   Photometer / photocell or thermometer with a bulb

7.   (a) Common or sillen (semiconductor) is doped with impurity atoms which trivalent (e.g boron or indium) intensity in currency on pole group 4 doped with trivalent

(b) p-n-p emitter and carries made of p type material are of n- type material for charge carries holes

    n − p − n − emitter and collector made of n- type material are made of p- type (or charge carries electrons)

(c) At the middle of the reaction of a curve a tangent is drawn change on output (ΔV_0) is determined and a corresponding change input (ΔV_1) also attained change amplification.

(d) (i)
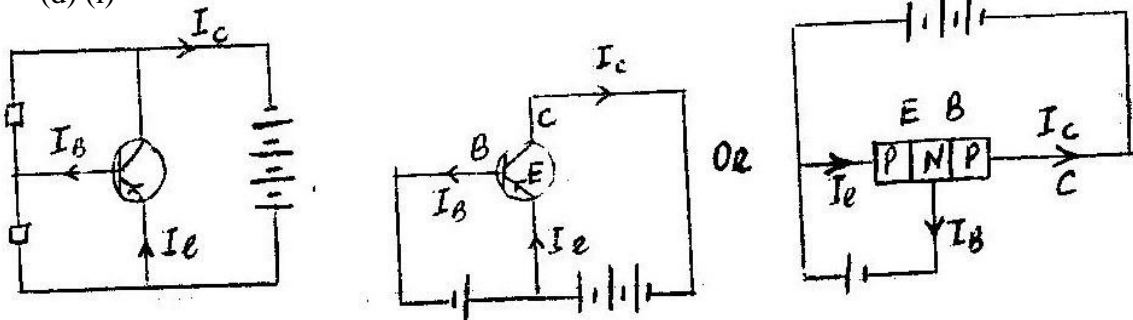
(ii) $i_2 = l_C \, r \, l_B$

(e) Base − emitter − forward biased   Base collector − reversed biased **PHYSICS PAPER 231/1A 1996 MARKING SCHEMES**

- Correct full marks to be given
- Wrong units no marks given
- Wrong substitution no mark
- No units full mark

1. 15.00 + 0.30 = 15. 30 mm; or 1.53 / 1.53 x 10^2m

2. Frequency: OR wavelength or energy

3. Length of container/ height

    Width of the base/ base area/ diameter/ radius of the base/ thickness

4. $h_p \, p_1 \, g = h_2 \, p_2 g$ Same as $h_1 \, p_1 = h_2 \, p_2$ $h_1 = \dfrac{h_2 \, p_2 g}{pg} = 8 \times \dfrac{18}{08}$

    = 18cm;

5. (i) Rubber is elastic and when a nail pushed through it stretches and grips the nail firmly without allowing air leakage

    (ii) Valve effect pressure from inside causes tyre rubber to press firmly on the nail

6. Concrete mixture and steel have approximately the same linear expansively. The expand/ contract at the same rate;

7. Radiation is at the electromagnetic waves Φ infrared while conduction involves particles, which move at lower speed

8. There are three different sources of light of the different intensities; brighten/ dimmed / different direction/ amount quality. Similar sources/ at different distances from the object

9. like charges repel unlike charges attract
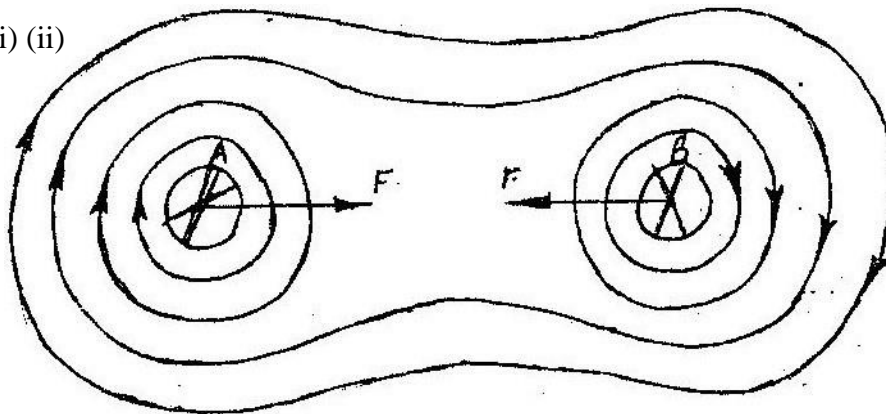
10. Mass per unit length

   Or (linear density/ thickness/ cross – sectional area/ diameter, radius

11. Adhesion

   Cohesion/ surface tension

12. As the thermistor is heated its resistance reduces/ conductivity increases hence drawing more current through it; hence less current flowing through B;
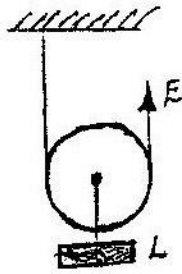
13. (i) (ii)

14. T< F or F> T

   Moments of T and F about are equal; but the perpendicular distance from O to T perpendicular distance from O to F/ Resultant moment are zero 15. Turn anticlockwise about O, OR Oscillate about O

16.

Correct diagram
Correct label E,L and arrow

17. The wavelength/ velocity of the water waves reduces; away from the centre

because the pond becomes shallower/ pond deeper at centre

18. Interferences (accept beat)

19. Parallel resistor allow diversion of current; hence may not overheat; / current shared by parallel resistor

20. Heat gained $5(80 - 40) = m(40-15)$ Heat gained MCD θ (80- 40)

    $5(40) = 25m$ Heat post MCD θ =m $(40 - 15)$ MC $40 - 15$

    $5(80-40) = 25\ m$

    $25m = 200 = m = 8\ kg$

21. Equal qualities of heated supplied;

    $MC_W\theta_W = MC_P\theta_P$ $MC_W (Q_W - Q) = MC_P (Q_P - Q)$ Since θP
    $> \theta W$ or $MC_w > \theta_0 = MC_P > Q_P$
    $C_W > \theta_P C_p$

22. Magnified, enlarged upright, virtual , image behind the mirror, negative distance

23. Apparent depth = Real Depth $12m = 0.9\ m$
                 Refractive indese of water   1.3

24. Pressure is inversely proportional to the speed OR speed increases as pressure distance

25. Maintaining a stable voltage during make and break/ storing charge during make and break and stops arcing sparking

26. High temperature causes high – pressure build up in the cylinder, which causes the explosion; OR increases of KE of gas molecules which result to pressure, build up causing an explosion   (2 mks)

27. A Polaroid absorbs/ cuts off light waves in all planes except in a particular plane of propagation   (1mk)

28. A hears a constant frequency produced by the siren/ same roundness/ pitch B hears a frequency that increases as the vehicle approaches/ sound of increasing loudness/ higher sound   (2 mk)

29. Solid copper is denser than water hence the solid sphere sinks; weight is greater than upthrust. Hollow sphere experiences an upthrust equal to its weight so it will float/ density of hollow sphere is less than that of water   (2 mks)

30. The weight of the door and the force are perpendicular to one another (1 mk)

31. Eddy current   (1 mk)

32. Low negative voltage is applied on control grid, which control the number of electrons reaching the screen   (1 mk)

33. Low speed / high charge / more massive/ size is large/ bigger` (1 mk)

34. n.p.n

35. Limit the current through the base controls the current/ protect transistor from high current or voltage/ regulate reduce voltage.

36. Diode is forward biased; Base currents flows; hence collector current flows and lights the bulb/ current amplification   (3 mks)

    air molecule are in constant random motion; smoke particles collide with these air molecules hence their random motion

PHYSICS PAPER 232/1B MARKING SCHEMES 1996

1.   (a) (i) Acceleration a is rate of change of velocity a
        $= \dfrac{v - u}{t}$

        $V = U + at$

        (ii) Distance is average velocity * time
    $S = \dfrac{(v + u)t}{2}$;

Substitution for V with $u + at$;
$S = ut + \frac{1}{2} at^2$

 (iii) Using $t = \dfrac{v - u}{a}$; in $s = ut - \frac{1}{2} at^2$

$s = u \dfrac{(v-u)}{a} + \frac{1}{2} a \dfrac{(v-u)^2}{a} = V^2 = u^2 \div 2$ as

(b) u = 50 – v = 0 a =2

Using $v^2 = u^2 - 2as$;

Substitute $0 = 50^2 + 2 (-2) s$;

S = 625m;

2. (a) (i) Each bar is suspended at a time using the string;
   The suspended bar is allowed to rest;
   Its orientation is observed and recorded;
   This is repeated several times for confirmation

   (ii) The bar magnet settles in the N – S specific direction, due to its
   Interaction (l) with magnetic field of the earth (l)
   The iron bar settles in any direction; (l) because it does not have a magnetic field
   to the interact with that of the earth; (l)

(b) P and Q are magnetized to the same level, by applying two different (l) current lp
and lq such that lq > lp (l)
Thus Q requires greater magnetizing power, (l) since its domains are more difficult to
align; (l) P is easier to magnetize, since its (l) domain are more easily aligned: (1 mk)

(Total 14 mks) 3 (i)

Series resistors 4 + 1 + 5Ω   (1 mk)

 Parallel resistors 2 + 3 + 5 Ω   (1mk)

$$R_p = {}^5/_2 = 2.5$$

 Total effective resistance 5.5 + 2.5 = 8.0 Ω   (1 mk)

(ii)   Current $l = \underline{V}$; $= \underline{4.0}$; = 0.5A;
                              R   8.0

(iii)   Current through each wing   = 0.5 = 0.25 A;   (1 mk)
                                              2
                Potential at Y = 0.5 x 4;   11;   (2 mks)
                Potential at Q = $\underline{0.5}$ x 2; = 0.51;   (2 mks)
                                     2

                Potential difference between Y and Q
                    = 1-0.5 V; = 0.5   (2 mks)
        = 0 -0.5 V; + 0.5V   Total 13 mks)

4. (a) (i) The aluminium block is heated using the electric immersion heater for some time t; The temperature changes (2) $\Delta \Phi$ of the block is recorded;

      (ii) Mass of the block m

      Time taken t

      Initial temperature Φ_1 final temperature Φ_2

      Current I voltage V;

      Heat given = heat gained by electrical heater the block

            1 $Vt = mc (\Phi_2 - \Phi_1)$

            C = 11.1

            M $(\Phi - \Phi)$

    (iii)   Oiling the holes for better thermal; contact lagging

    (b) Heat gained by calorimeter

      = 60 x 10^{-3} x 378 (45 – 25) J;

      = 453.6 J

Heat gained by water

= 100 x 10^{-3} x 4.200 (45 – 25J;

= 8.400J

Heat lost by condensing steam = m/

(163.5 – 160) x 10^{-3}/J

= 3.5 x 10^{-3} x / J

Heat lost 3.5 g of (condensed steam) water cooling to 45^0C

    3.5 x 10^{-3} (100 – 45) x 4,200;

        = 808.5J

Heat given   = heat gained

Hence:

3.5 / x 10^{-3} + 808.5 J = 453 6J + 8,400J;

             = 2.3 x 10^{-6}J/Kg;

5. (a) (i) Particles of the transmitting medium vibrate in the direction of the wave for a longitudinal wave, but at right angles for a transverse wave:

Sound requires medium but no medium required for electromagnetic wave; speed of sound lower than that of electromagnetic wave;

    (b) (i) Speeds of sound;

      2.5 x s = 400 x 2

      S = 320 m/s;

   (ii) 2 $\underline{(x - 400)} = 2.5 + 2$);

         320   = 1120m;

(c) (i) Double slit provides coherent sources;

(ii) Dark and bright fringes;

The central fringe is the brightest while the intensity of the other fringes reduces away from the central fringe;

(iii) I. The separation of fringes increases

II. Central fringe is white; fringes on either side are colored;

6. (a) Keep angular velocity Wl constant;   Centripetal force provided by mg;

Fix the mass m and measure of m;

Repeat for different values of m;

(b) (i) graph (see on the next page

Axes labeled

Scale

Pts plot

Straight line

(ii) Gradient of the graph

$= \dfrac{0.625 - 0.1}{0.525 - 0.075} = 1.167$ N

Force F on the body $= m_b W^2 r$

Where mb = mass of the body

$M_b w^2 r$ = Gradient of the graph = 1.167

$W^2 = \dfrac{1.167}{0.1} = 11.67$

$W = \sqrt{11.67}$

$= 3.42$ rad s^1

7. (a)
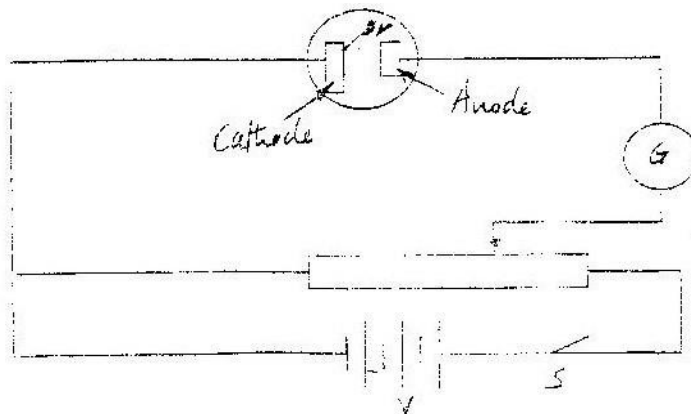
Close switch S

Vary pd until G deflects

(b) l)

K (J) x 10^{-19}	5	10	10	30	4
F = C/D (H_E) x 10^{-15}	1.89	2.64	4.11	5.55	6.5

Finding f
See graph
Axes labeled
Scale
Pointed plotted
Straight line

(ii) Work function Φ is given by Φ hf_0
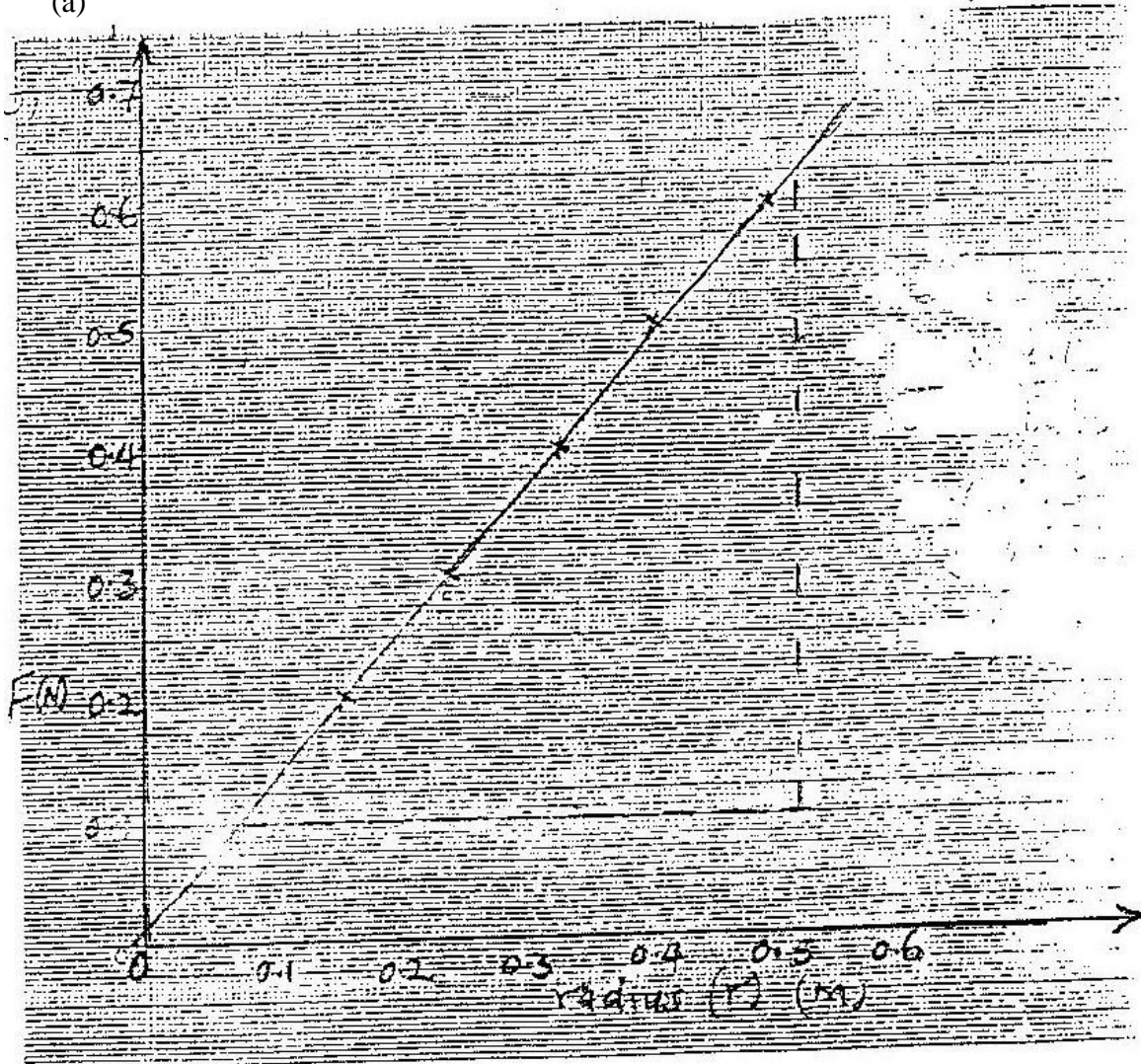
   F_0 is the x – intercept of graph

   F_0 (from graph) = 1.2 x 10^{15} H_E

Φ = 6.63 x 10^{-34}0.5 x 1.2 x 10^{15}

   = 7.96 x 10^{-19} J

No. 6
(a)

KCSE 1997 PHYSICS PAPER 232/1 MARKING SCHEME

1. Volume = 7.4 – 4.6 cm

   2.8cm

   Density = $\underline{mass}$

   　　　　 Volume

   = $\underline{11g}$

   　 2.8 cm^3

   = 3.9gcm^{-3}

2. F_1 and F_6

3. Either altitude or latitude/ radius of earth changes/ acceleration due to gravity from place to place away from the earth

4. Balance: meat + 0.5 kg on one side and 2 kg on the other:

5. $H_1 P_1 g = h_2 p_2 g$ $H_2 = \underline{1.36 \times 10^4 \times -64}$
   $8 \times 10^2 = 1088cm;/$
 $10.88m.$

6. Volume of 1 molecule $= \dfrac{18cm^3}{6 \times 10^{23}}$

Diameter of the molecule $= \dfrac{18cm^3}{6 \times 10^{23}}$

$$\sqrt[3]{\dfrac{18cm^3}{6 \times 10^{23}}}$$

$= 3.1 \times 10^8$ cm
$= 3.11 \times 10^8$

7. Glass is a bad conductor of heart, the difference in temperature between the inside and the outside cause unequal expansion

8. Adhesion of water to glass is greater than cohesion

9. The rate of cooling depends on the rate of evaporation
   Rate of evaporation depends on the surface area
   Surface area A, < surface area B for evaporation

10. A ray from A   A ray from B
    Relative positions of A and B correctly drawn

11. Solar cell (photovoltaic) photocell/ photo electric cell

12.
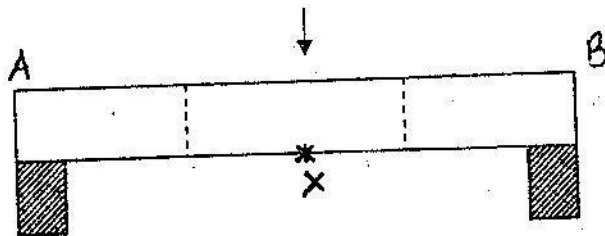
13.   Soft magnetic materials loose their magnetism easily while hard magnetic materials retain magnetism longer

14. $Q = It$ $Q = 0.5 \times 4x \times 60;$ $= 120C$

15.
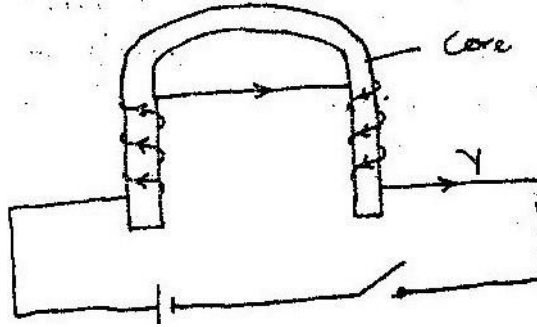
16. $d =$ speed $\times$ t; $340 \times 2;$ 680m
17.   At low speeds the speed is streamline
             At high speed the flow is turbulent

18. $\dfrac{V_r}{V} = \dfrac{l}{l_r}$

             $\dfrac{240}{6} = 30$ $l_r = 0.75A;$

19. $mgh = \tfrac{1}{2}\,mv^2$ OR $V^2 = U^2 + 2as;$
             $h = \tfrac{1}{2}$ $S = \dfrac{V^2}{2as} = \dfrac{36}{2(10)} = 18m;$
             $S = ut + \tfrac{1}{2}\,at^2$ $= 1.8m;$

20. $V = f\lambda;$
             $V = \dfrac{3.0 \times 10^8 \, ms^{-1}}{95.6 \times 10^6 S^{-1}} = 3.14m;$

21.   6V

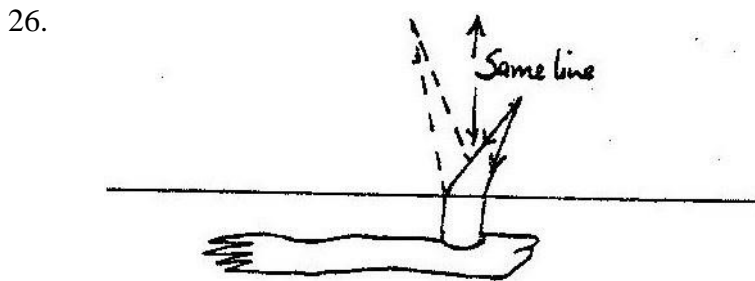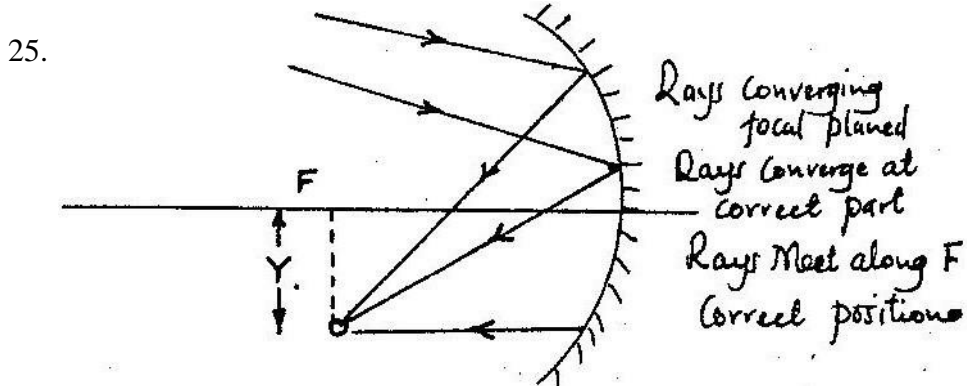22.   parallel $\dfrac{1}{R_P} = \dfrac{1}{400} + \dfrac{1}{400} + \dfrac{2}{400}$

             YZI $= \dfrac{V}{R} = \dfrac{12}{60} = 0.02A$

             I $= \dfrac{V}{R} = \dfrac{12}{60} = 0.02$ A

             $\dfrac{400}{} \times 12 = 8V$

23.   (No of irons) x 1000) = IV

          Number = $\underline{13 \times 240}$ = 3.12;
                         1000

24. Extra heat is required to change ice to water / latent heat of fusion

25.

Rays Converging
    focal planed
Rays Converge at
    correct part
Rays Meet along F
Correct positions

26.

Same line

27. A trolley slows down/ motion decreases since mass increases and the momentum is conserved, the velocity goes down

28. $C_T = C_1 - C_2 = 1 = 1 + 1$

          C_T C_P C_3

          $= C_T = \dfrac{C_P \ C_3}{C_P + C_3}$

29. $^0C + 273 = -20 + 273 = 252K$
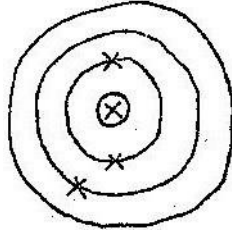30. (a) Dark and bright fringes   (b) Coloured fringes

31. Small differences in frequencies

32.

33. By using laminated core

34.

3 electrons
Correct position

35. After 3 secs number decayed = ½ x 5.12 x 10^{20} = 2.56 x 10^{20}
Next 3 secs. Number decayed = ½ x 2.56 x 10^{20} = 1.28 x 10^{20}
Total number decayed   = (1.28 + 2.56) x 10^{20}
                          = 3.84 x 20^{20}

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MARKING SCHEME.

1. i)   -To make and beak contact / circuit
          - It bends and straightens or the metals expand differently.
   ii)   Current flows, heating takes place, temperature rises, strip is heated and
          bends way from contact ; disconnects heater; temperature; drops
          reconnected heater or completes circuit.

   b) Let final temperature be θ_2

      Heat lost by water = 4200 x 0.2 (20- θ_2)

      Heat lost by glass = 0.2 x 670 x (20 - θ_2)

      Heat gained by ice = 0.04 x 334 x 10^3

      Heat gained water = 0.04 x 4200 ($\theta_2 - 0$)

   Heat lost = Heat gained.

   4200 x 0.2 (20 - θ_2) + 0.2 x 670 x (20 - θ_2) = 0.04 x 334 x 103 + 0.04

          X 4200 ($\theta_2 - 0$)

          $\theta_2 = 5.36^oC$

2(a)   i)
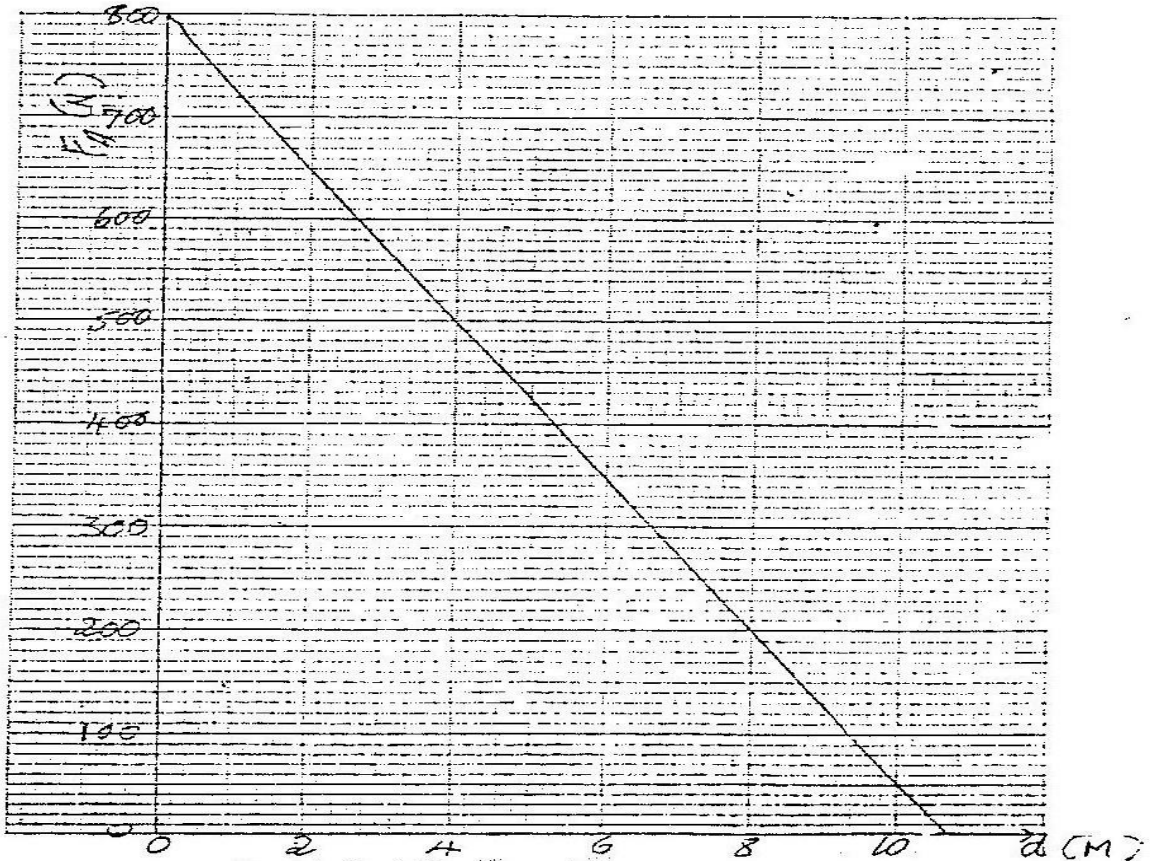
   ii)   Extrapolation F4 – 0   10.6m force is zero
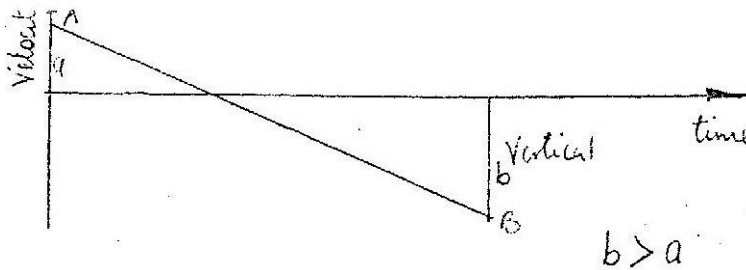   Leading x axis = 10.6 + 0.2   10.6 -8

Intercept 10.6

$10.6 - 8 = 2.6$ = 2.6m away from B

b) $10w + (10 \times 60) = 2.0 \times 40 \Rightarrow 10w + 6x = 80$ $w = {}^x/_{10} = 2N$

3a)

b) i) $V = u + at$ Deceleration $= \dfrac{u - v}{t}$

$0 = 20 + 2a$ OR

$a = -10ms^{-2}$ $= \dfrac{20 - 0}{2}$

                                                        $= 10ms^{-2}$

ii) Stopping time = 2.2s   Total time stop = 2.2 sec   Before

stopping $= 0.2 \times 20 = 4m$ $S = ut + {}^1/_2 at^2$

$\dfrac{10 - 202}{2(-10)} = \dfrac{400}{20} = 20$ $= (20 \times 2.2) + {}^1/_2{}^+ 10 \times 2.2^2$

$20 + 4 = 24m$ $= 19.8m$

4a) AB: $(2000 \times 20) + (600 \times 200) + ½ \times 10 \times 4000) + (½ \times 30 \times 4000)$

                $40000 + 120000 + 60000$

     Total $200000J = 200KJ$

b) $6000 \times 0.6 = 3600w$

c)   Power Input $= \dfrac{3.0 \times 10^5 \times 10 \times 360}{60 \times 60} = 3.0 \times 10^5 wx$

Total $= (3 + 2\_ \times 10^3 = 5.0 \times 10^3 kw$ Eff. $^3/_5 \times 100 = 60$

5a) Amount of current   No of coils / shape of core / X – core

b) i)   End of coil facing up becomes a south pole and the metre rule is pulled down / attraction
        occurs. Or Rule tips; core magnetized; top of core becomes south pole; attracts magnet.

   ii) The metre rule to have appointer attached to read zero when switch S is open. Use rheostat
       to vary current to maximum and calibrate accordingly.

c)HF $= hf_o + ½ mv^2$

   $= (3.2 + 82) \times 10^{-19} = 11.2 \times 10^{-19}$ $f = \dfrac{11.2 \times 10^{.19}}{6.63 \times 10^{-19}}$
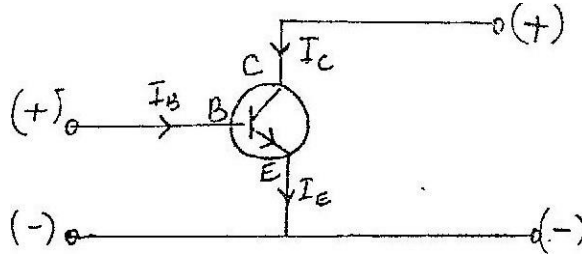
            $\lambda = c = \dfrac{3.0 \times 10^8 \times 6.63 \times 10^{-34}}{F \quad 11.2 \times 10^{-9}} = 1.76 \times 10m$

SECTION 2

6ai) Semiconductors – conducting is by holes   Conductors – conducting is by electrons
ii) Semiconductors – silicon, germanium   Conductors – copper , tin iron.

b)i)

ii) $I_B = _{0.5/100}$ x 2 =0.01 mA I_C = 2- 0.01 = 1/99MA
      $I_E = I_C + I_{rs}$

iii) $I_B = \dfrac{0.5 \times 4}{100} = 0.02$mA I_c = 3.98mA
                                $I_b = 0.02 – 0.01 = 0.01$ I_C
= 4 – 0.02 = 3.98mA $I_c = 3.98 – 1.99 = 1.99$ $h_{FE} =$
3.98
                0.02   = 1.99
     $I_c = 3.98 – 1.79 = 1.99$
     $I_b = 0.02 – 0.01 = 0.01$
       HFE =   Ic   = 1.99 = 1.99
                 Ib = 0.01
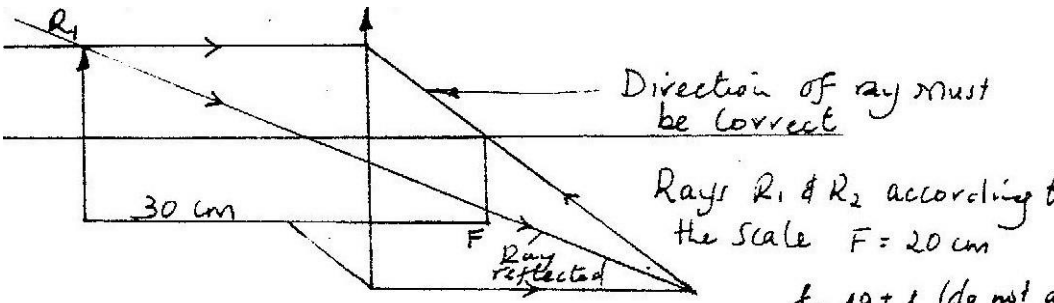 $I_c = \dfrac{1.99}{0.01} = 199$
          I_b 0.01

7a(i) Transverse – particles in the wave perpendicular to the direction of the wave.
     Longitudinal – particles move in the same direction as the wave. b)i)
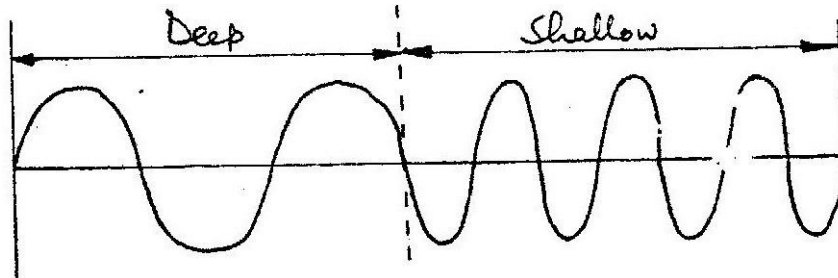
ii)   Velocity decreases since the frequency remains the same. No loss of energy therefore
       amplitude does not change.

c) a)   Frequency = $^{30}/_{60}$ = 0.5 Hz

    b)   Speed = $^6/_2$ = 3m/s λ = V/f $^3/_{0.5}$ =6m

d) A long AA' – loud and soft sound (constant)
    a long OO' – loud and solid.

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1. Accuracy of measuring tape is 10m or o.1 cm $\pm$ 5cm or o.o5m.

2. Length of post is 1.5 (1.50 x 1.55) Rangep = N3=

3. Quantity of heat equation 20x (42-26)x C=10^3 x 15 x60

   C=2.8x 103JKg^{-1}K = (2812.5 OR2813)

4. Detecting imperfection in metal structures/block/flaws

5. addition of soap solution to pure water reduces the strength of the skin total was holding pin from sinking and so it sinks. Surface tension supports the pin.
   Addition of soap reduces tension/weakens/broken.

6.

Direction of ray must be correct

Rays R_1 & R_2 according to the Scale F = 20 cm

f= 19±1 (do not accept calculation)

   Low contact pressure between tyre and earth/no sinking.

7.

8. I_P =N_3 = Np= 20000x3= 2000
   I_s=N_P 30

9. surface area of water . Nature of surface of the container/colour/texture /material/ (ambient temperatures).

10 Evaporation and cell reaction cause loss of water. Distilled water does not introduce impurities to the cell.

11. E=IR +h
    I= E =   2.0
    R+r   2.0x0.5   =0.8A

12. $\underline{50}$ = $(I)^n$ n =3(half-lives)
    400      $(2)^n$
    Half –life $\underline{72}$ = 24 min.

13. High resistance voltmeter takes less current/low current recording low current.

14. Domains/Dipoles initially organized are disorganized by mechanical forces.

15. As the rod approaches the cap, negative charges/electrons on the cap are repelled towards the rod. The leaf collapses since the positive charges on it are neutralized attraction. As the rod gets even closer to the cap moved more negative charges/electrons charges are repelled to the leaf, causing it to diverge.

16. Length of the rod; diameter/cross sectional area of the rod/thickness nature/type of rod material/conductivity.

17. $R=P^{1/4}$ I = $\underline{2.0 \times 10^6 \times 0.5}$ = 2m OR = 2.041 or 2.0408
    $\hspace{3cm}$ 4.9 x20^7

18 Some energy is lost due to friction/air friction acts on the pendulum/air dumping on the apparatus air resistance.

19. In TV (CRT) deflection is by magnetic field, while in CRO deflection is by electric field. X-Y plates.

   ATV (CRT)has two time bases while a CRO has only one.

   In CRT it produced 625 lines per second while CRO is 25 lines per second.

20. Heating/ cooking/communication/eye/photographic film or plate/LDR/photocell.
   21. Diode is forward-biased, no current flows

   Current flows when the switch is closed but when terminals are reversed, no current flows

22. Angle of inclination/nature of surface/length of inclination $\hspace{1cm}$ Height of inclination/frictioal force between the surface.

23. layers of the crystal material are arranged according to faces/ plans/ flat surfaces.

   Cleavage is only possible parallel to those faces/places/flat surfaces.
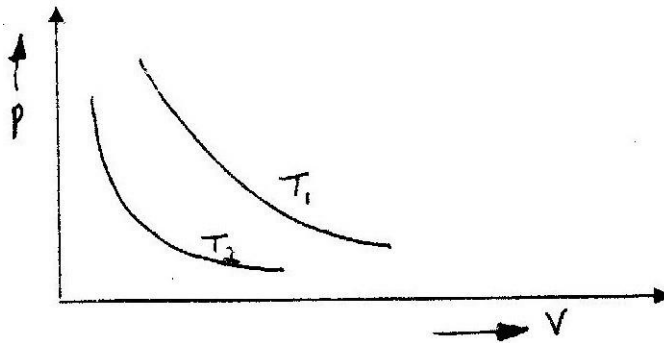
24. Principles of moment.

   200 x1.5 R x 0.5, 0.5f=1x20x10or 0.5,R=600. R=F +200 = 400N take moments about O

   F=600 -200 =400N

   F=400N

25.

26 Addition of impurities with higher boiling points/presence of impurities. Water heated under a higher pressure than atmospheric/below sea level.

27. Moon covers the sun/obstruction of sun by the moon

   Both heat and light have same velocity/both are electromagnet waves.

28. Overtones/harmonics

29. Since F=MV2/V the sharper the corner (as B) the small the value of R hence the greater the F. (M& V constant).

30. Gas through the nozzle gains velocity. Hence its pressure reduces above the nozzle. The higher atmospheric pressure pushes air into the gas stream.

31. When mercury is heated (during a fire); it expands and makes contact, completing the circuit to ring the bell.

32. There will be no variation of intensity of light/ uniform intensity/no bands/one 33.
    Is the one which cannot form on a screen   Is formed by rays which are not real
    Is formed by extending rays.   Formed by apparent rays. 34. Component of
    weight down the slope =50 sin $30^0 = 25N$ Total force parallel to slope=
    (29+25) N 54N.

PHYSICS PAPER 232/2 K.C.S.E 1998 MARKING SCHEME

1. iii) Scale, axes label, unit-plotting 8-10-2 5-7-1 Curve (smooth)
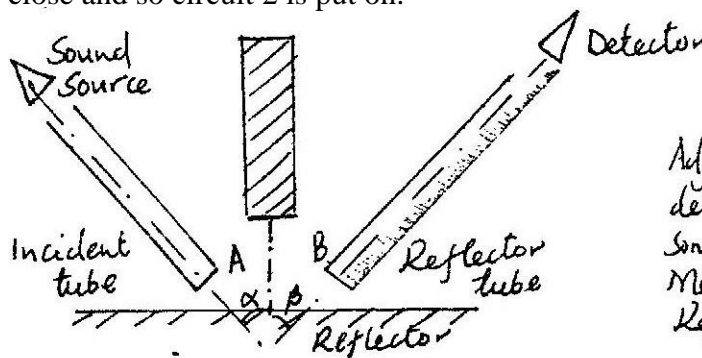
   iv)   As the number of turns is increased, alignment of domain with field increases.
           After 35-36

       turns, all domains are aligned, so that magnet is saturated.

   Sketch – curve above 1 to some saturation, and from origin.
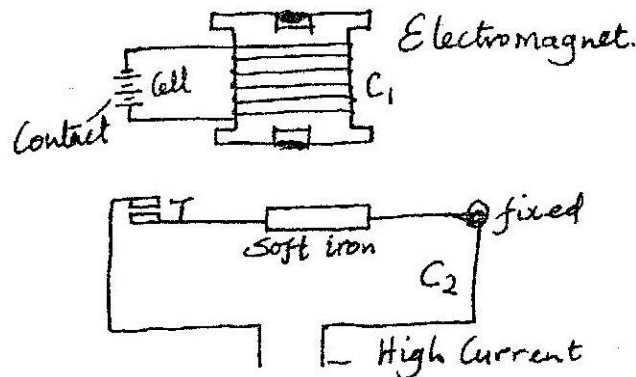
   b)   When switch is closed electromagnet attracts soft iron. This causes T to
        close and so circuit 2 is put on.

2.

   bi)   Volume of block = 4x4x16 = 256 cm3
           Mass of block = 154 gm
           D= m=$\underline{154}$=0.6g/cm^3 deny ½ mk if not to d.p
              V 256

   ii)   Volume of liquid ¾ of 256 = 192 cm3
           Density of liquid = $\underline{154}$ = 0.8g/cm3
                               192

3.   a   i) The bullet will land on the track   It has some horizontal (inertia) velocity as the track.

         (ii)   (Use g = 10ms-2}

$$S = ut + \tfrac{1}{2}\ at2$$

For freefall $u = 0$ $t = \sqrt{2h/g}$ T = 6sec

Horizontal distance = vxt   = 6x50 = 300m

V2 = U2 + 2as   OR v= 2U + at OR ½ Mu2 = mgh

From above u = 30m/s

S = ut + ½ at2

T = ut + ½ at2
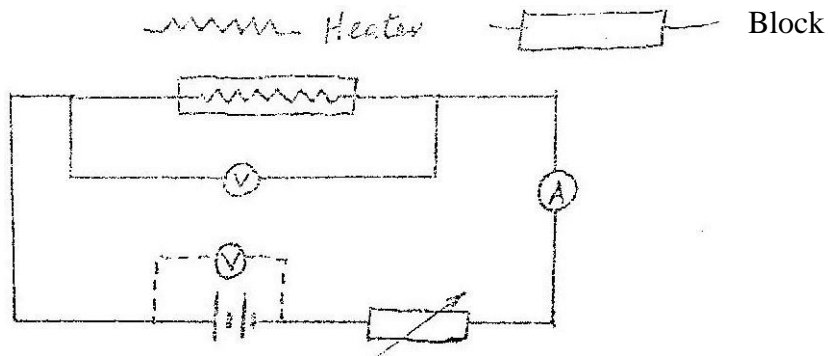
T = 6   D = vxt   = 50x6   =300cm

       (bi)   Measure pressure with Bourdon gauge
                     Measure the length of air (reg volume at tone).

       (ii)   Tabulation values of p and length of air column (volume)

                     Plot graph of I/V vs P OR L vs I/P

                     Graph is a straight line.   Hence pa I/v

                     Tabulate P and V (I)   Calculate PV or PL

                     PV (1) = PL   Hence Pa $^1/_v$
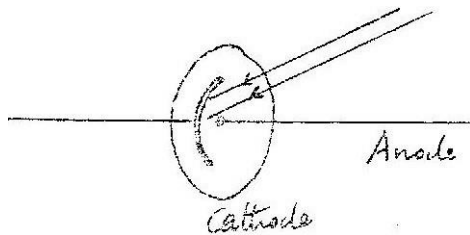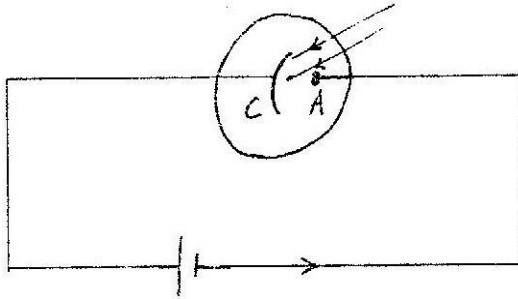
4.   a)   i)

       (ii)   Voltage, current, time

       (iii)   Q v/t   Rate= Q/t = v/tT (T=time taken for sun to heat)
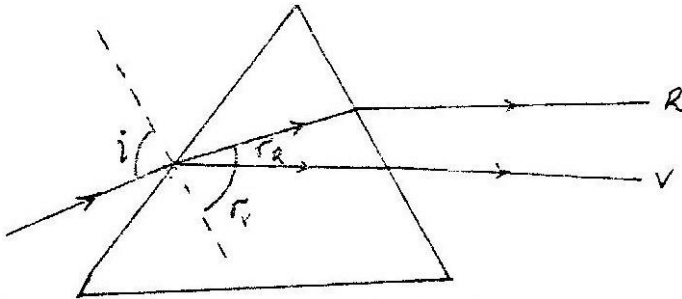
       b)   Fig. 4 shows a photocell.

ii) When light rays strike cathode C surface electrons gain photon (energy) hence the cathode.

iii) Draw a simple circuit including the photocell to show the direction of flow of current.

5 a)   i)

ii) Since sin i is common and r < re then sin rv < sin re

b) n Sin C=1 OR Sin C $^1/_n$

$\sin C = 1/_{1.4}$ C= 45.600 (45.58)

or 45.35 min/45.36

SECTION II

6 a)   When T and Y are connected C is charged by E, until C achieves same p.d. across it as for E C max p.d is achieved when T and Y are connected after first process. C acts, as source of e.m.f and discharges through r unit no more current flow or current is zero.

b)   Current = dQ draw target at 30. Substitution I =3.6μA ± 0.2A.

7a)   2 complete rays, 2 with arrow at one end image (inverted real) (continuous tie) locating F size 2.4 ±0cm

b)

U (cm)	20	25	30	40	50	70
V(cm)	20	16.7	15	13.3	12.5	11.6
1 V(cm⁻¹)	0.50	0.040	0.033	0.025	0.020	0.014

$\frac{1}{V}$ (cm^{-1})	0.50	0.060	0.067	0.075	0.080	0.086

ii) $^1/_f = {}^1/_u + {}^1/_v$ Intercept $^1/_f$

   $0.1 = 1/f$ $\therefore f = 10$cm

PHYSICS PAPER 232/1 K.C.S.E 1999 MARKING SCHEME.

1.   Reading on the vernier calipers

   $0.5 + 0.01(5)$ $0.5 + 0.05$cm $= 0.0055$m/5.50mm.

2.   Third force F3 acting on the ruler is either upwards or downwards.
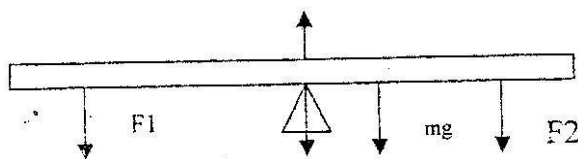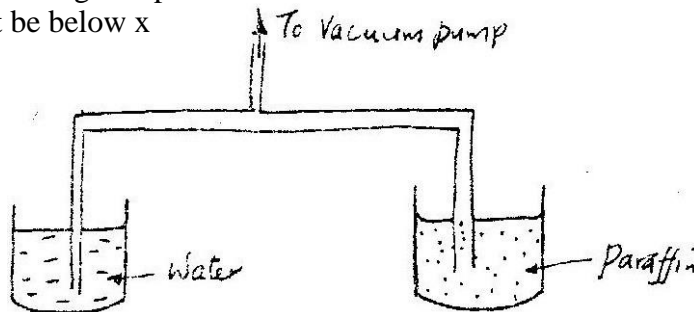
No: My must be at the centre.

3.   Center of gravity rises when the body is tilted slightly and lowers when released / returns to original position.
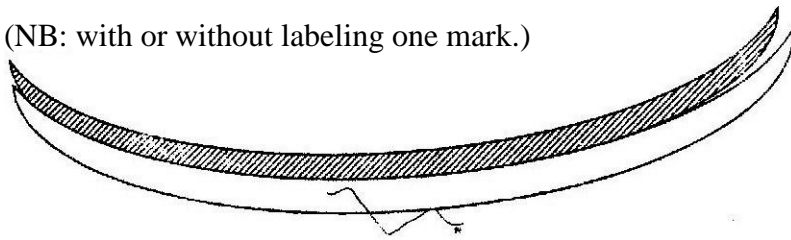
4.   Y must be below x

   Reason: P water is greater than paraffin = height of water required is therefore less than that of paraffin.

5.   Cohesion between Hg molecules is greater than adhesion between Hg and glass molecules/cohesion force or adhesion. Force.

6.

   Deflection $\Rightarrow$ existence of a +vely charged nucleus.

(NB: with or without labeling one mark.)

Few deflected ⇒ nucleus is small/mass is concentrated at the centre

7.   αParticles are + vely charged, if majority deflected most ⇒atom is empty.   8.   Angle of rotation of reflected ray=2(angle of rotation of mirror)

$$=2 \times 30 = 60^0$$

9.   Charge concentrate at sharp point causing heavy discharge/ ionization neutralization, leaf falls off.

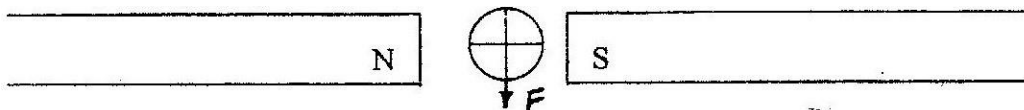10. $V = IR$ ⇒$I = {}^V/_R$ $I = 3/! = 3A$

$/_R= 1/R1 + 1/R2= 2/2$

$/_R = 1=R=1$

11.   4mm=20N

1.5 =?   F = Ke

1.5x 20 $K = F = \underline{20}\ = 5 \times 10^3\ N$

4   e $4x\ 10^{-3}$

= 7.5 N $F=5x\ 10^3 \times 1.5 \times 10^{-3}$

=7.5N

12.   -Dipping a magnet into a container with iron fillings, most of them will cling at the poles ⇒
- Use of plotting compass to trace.

13.

14.   Moment of couple = Force x distance between forces.
=10 x 2 = 20NM.

15.   F = Ma   = 70 x 0.5   F 35N
35N = 20a $a = \underline{35}$ $= 1.75M/s^2$
                           20

16.   P = force x velocity   Power = $Fd/t = \underline{20 \times 10x\ 20}$
Mg x h/t = 20x 10 x $^{20}/_{40}$ 40
           = 100w   = 100j/I

17. $F = I/T = {}^1/_{0.5} = {}^{10}/_5 = 2HZ$
         OR
F = No. of waves made in 1 second = 2 Hz
         OR
$F = \underline{No\ of\ waves}$
         Time   = 2/1 = 2.5 / 1.25 = 2Hz

18.   Beat frequency f = f2 – f1   F = f2 – f1

$$= 258 - 256 \qquad\qquad 256 - 258$$
$$= 2Hz \qquad\qquad =/-2/ = 2$$

19. $P = V1 = 15000 = V \times 2$ $W = QV$ but $Q = It$ $e = I^2Rt$

$10 \times 60 = V = W\ 15000\ 1500 = 2 \times 2 \times R \times 60 \times 10$

$^W/t = VI = V = 1500$ $\qquad Q\ 60 \times 10 \times 2$ $\qquad 60 \times 10 \times 2150 = 24R$

$\qquad\qquad 10 \times 60 \times 2 \qquad\qquad V = 12.5v \qquad 25 = 4R$

$\qquad 150 \qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad V = \underline{25} \times 2$

$\qquad 12 \qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad 4$

$\qquad 12.5V \qquad\qquad\qquad\qquad\qquad\qquad V = 12.5V$

20. Heat lost by substance = heat gained by water

$$M_sC_s\ \theta_1 = M_wC_w\ \theta2$$
$$2 \times 400 \times 60 = M_w \times 4200 \times 1$$
$$M_w = \underline{2 \times 400 \times 60} = \underline{30} = 11.4kg$$
$$\qquad\qquad 4200 \qquad\quad 7$$

21. $V = I(R + r)$

$5 = \underline{10}\ (R + 50)500 \Rightarrow R + 50 \Rightarrow R = 500 - 50 = 450\Omega$

$\quad 1000$

22. Apparent depth $= 30 - 10 = 20cm$ $\underline{real\ depth} = \underline{30} = 1.5$

$\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\quad$ Apparent depth 20

23. Kinetic energy ray / heat energy.

24. - Horizontal acceleration is zero because g component horizontally is 0

$\quad$ -Horizontal velocity remains constant

$\quad$ - Resultant horizontal force is zero $\qquad\qquad\qquad$ - resultant force is Zero.

25. V_2 is smaller than V_1 $\qquad\qquad\qquad\qquad V_1$ is larger than V_2

$\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad$ 26.
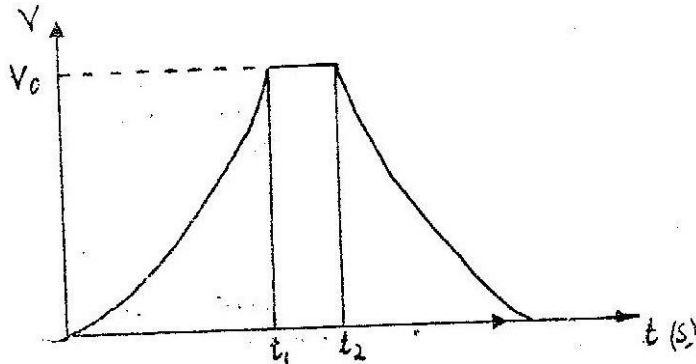
27. $P_1 = 1.03 \times 10^5$ $\qquad T1 = 20:C = 393K$ $\qquad V1 = V$

$\quad P_2 =?$ $\qquad\qquad V2 = {}^1/_8V$ or $_v/_8$

$\quad P_1V_1 = P_2V_2$ $\qquad\qquad 1.03 \times 10^5 - P^2/_8$ $\qquad = p^2 = 3.24 \times 10^5N/M^2$

28. Radio waves, infrared, x-rays, Gamma rays.

29. Up thrust $= PV \times 10 = 10\ PV$

30. Ultra violet releases electrons from zinc plate by thermal emission.   On removal of electrons, zinc becomes +vely charged.

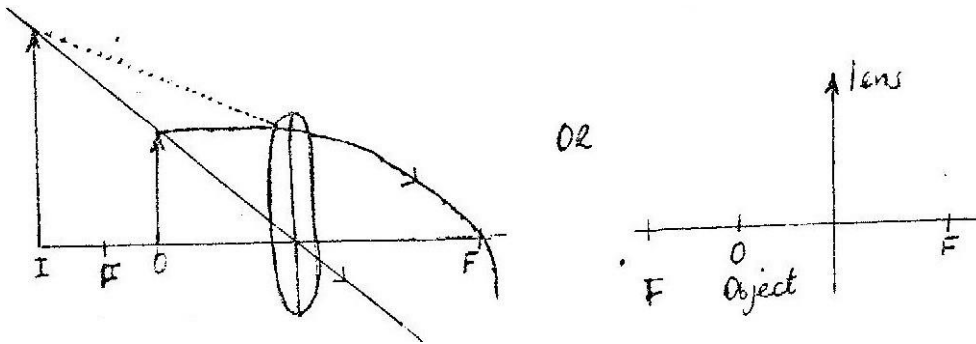Positive charge on zinc discharges/ neutralizes the charged on the electroscope.

31. Tension = centripetal force.

$T = Mv^2/r$ but v = wr $2 = 0.1$ x w^2 x 0.33

$T = Mw^2r$ t = 0.2 x 10 = 2N 2N = Mw^2r $2 = 0.1$ x w2 x 0.03

-$w^2 = 2/0.003$ w $\sqrt{2000/3}$ w = $\sqrt{666.7}$ = 25.82 rads/s 32.

Object should be between F and lens.

33. Downwards into the paper.

34. A-earth wire   B – live wire   C neutral wire

35. Z $\xrightarrow{\quad Y \quad}$ Z $\xrightarrow{\quad}$ β $Z_{+1} + ^o - 1e$

Or Atomic number charges by / New is a head of the old or Z + 1

PHYSICS PAPER 232/2 K.C.S.E 1999. MARKING SCHEME

1a) Longitudinal waves - direction of the disturbance while ½ .Transverse waves – direction of propagation is perpendicular to that of the disturbances.

b i)   YP – XP = 2λ

ii) Dark fringes; crests and troughs arrive at the same time OK destructive interferences Bright fringes; crests arrive together at the same time OR constructive interference.

iii) No interference pattern because no diffraction takes place. C
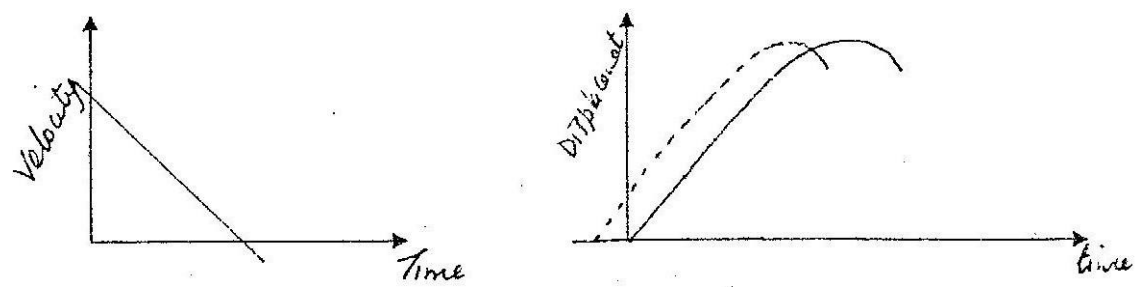
  i)   T = (2.5 – 5) x 10 – 3

$= 20 \times 10 - 3s\ 10^3$

$F = 1/T = 50\ Hz.$ $1/20 \times 10^{-3}$

ii)
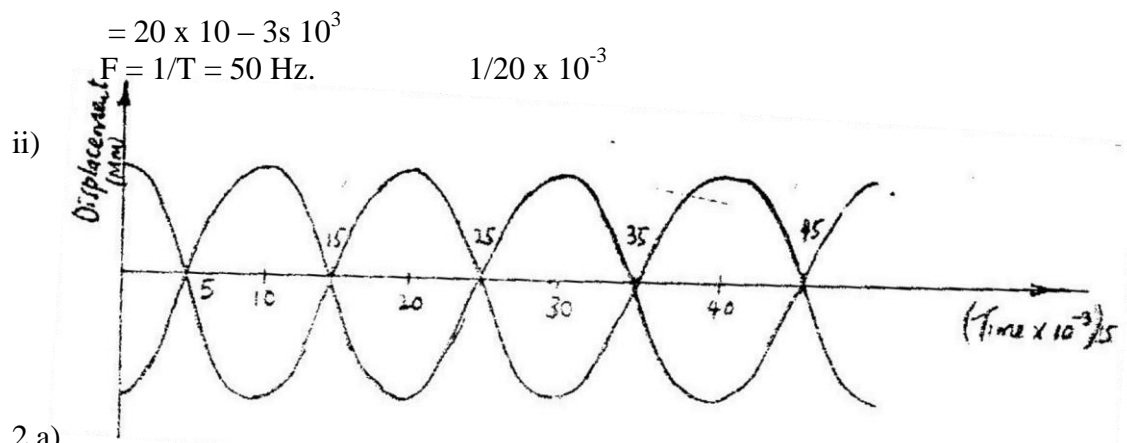
2.a)

3i)   Average velocity at intervals AB and CD.

     $T = 1/50 \times 56$ $V_{AB} = 1.5cm/0.1s$ $V_{CD} = 3.2cm/0.1s$

     $= 0.1s$ $15cm/s$ $32cm/s$

ii)   Average acceleration of the trolley.

  (b) $V2 = \underline{U2 + 2gh}$ mgh $= 1/2MV2$ ‾‾‾‾‾

       $V = \sqrt{2gh}$ $V = \sqrt{2gh}$

ci)

4a)   Figure 5 represents a simple voltage amplifier circuit.

b i)   Base current.

              Current gain $= \dfrac{\text{Collector current}}{\text{Base current}}$ $p2 = 1_a/I_b$

                   $\dfrac{62.5 = 2.5 \times 10\text{-}3}{I_b}$

            $\dfrac{Ib = 2.5 \times 10\text{-}3 = 40uA}{62.5}$ $(4\times10\text{-}5)A$

ii)   Load resistance, R_L $IcRL = Vcc = 5.5$

     P.d across R_L $RL = \underline{5.5}$ $= 2.2k\Omega$

                                       2.5×10^{-3}

                             $10 - 4.5 = 5.5$ ICRL $= 5.5$

                             $RL = \underline{5.5}$

                               2.5×10^{-3}

5a) Ammeter reading decreases.

The resistance of metals decreases with increase in temperature. i)

$P = V^2 = \dfrac{(240)^2}{R}$ P = 576w   R   100 ii)   P = VI

$I = \dfrac{P}{V} = \dfrac{576}{240} = 2.4A$

SECTION II 6a)

Benzene sinks in liquid benzene.

Water increases in volume on solidifying while benzene reduces in volume; ice is less dense that liquid water. Solid benzene is denser that liquid benzene.

b i)   Weigh the metal block in air and in water

Fill the overflow can in water and place on a bench / diagram

Collect the overflow in the beaker and weigh

Compare difference in weight of metal block and weight of overflow

Repeat

Up thrust = tension + weight

        = (0.5 + 2.0) = 2.5N   alternative

        Weight of H2O) = 2.5N   Up thrust = 2.5N

$\underline{M_w}$ = 1000   R.D = $\dfrac{\text{Wt. in air}}{\text{Upthrust}} = \dfrac{2.0}{2.5} = 0.8$

V_w

        Vw = 0.25 volume of wood   €wood

                1000   €wood

        Density of wood = $\underline{0.2}$ €wood

                        0.25/100

                        $\underline{0.2 \times 1000}$

                            25

                        800kg/m3

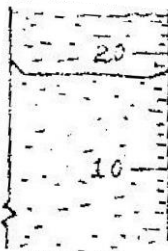c i)   Time taken for half of the radio acute material to disintegrate.

        ii)   Correct readings for 60 and 30 time 25 + 2 minutes

PHYSICS PAPER   232/1 K.C.S.E 2000 MARKING SCHEME

   1.

   2. Acceleration of gravity on Jupiter is higher than that of earth, so a bag of saw dust must be less massive if the greater acceleration on earth is to produce the same pull as sugar bag on earth.
   3. Beaker becomes more stable because the position of C.O.G is lowered on melting or water is denser than ice.

4. On earthing negative charges flow to the leaves from earth to neutralize positive charges when the rod is withdrawn the leaves are left with net negative charge.

5. Since the system is in equilibrium let A be the area of piston and P the pressure of steam

$$P \times A \times 15 = W (15 + 45)$$
$$2.0 \times 10^5 \times 4 \times 10^4 \times 15 = W \times 60$$
$$W = 20N$$

6. Particles of gases are relatively far apart while those of liquids and liquids are closely parked

7. Since the strip is bimetallic when temperature rises the outer metal expands more than the inner metal; causing the strip to try and fold more; this causes the pointer to move as shows

8. This is because metal is a good conductor, so that heat is conducted from outer parts to the point touched; while wood is a poor conductor

9.
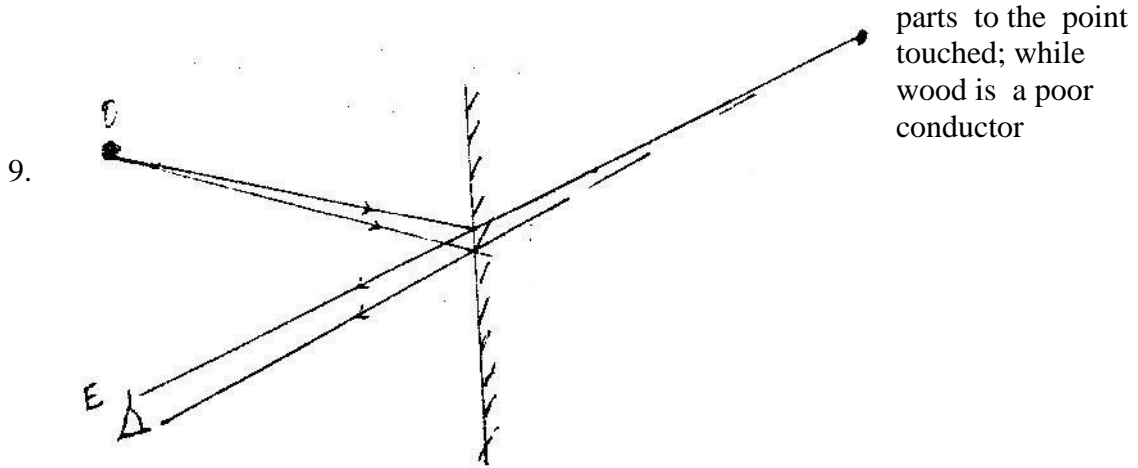
10. Can withstand rough treatment
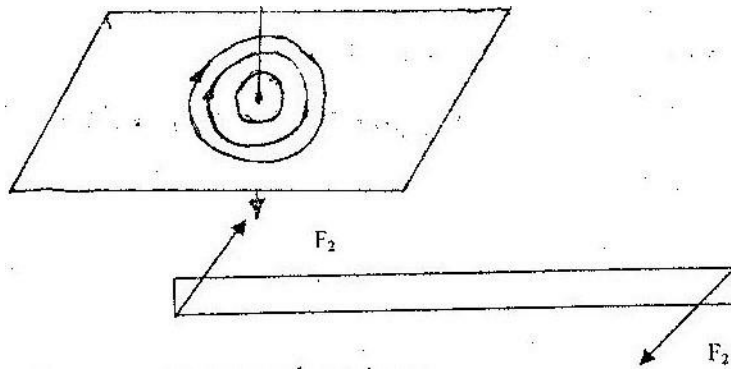Do not deteriorate when not in use

11. Struts are DE, DC, AD, BD   Ties are BC; AB

12. The keepers become magnetized thus neutralizing the pole, this reduces repulsion at the poles, thus helping in retention of magnetism

13.

14.

Force F_2 at the ends perpendicular and turning to opposite to F_1

15. VR = 4;
16. Efficiency of the system

Efficiency $= \dfrac{M.A}{V.R} \times 100 = \dfrac{100}{20} \times \dfrac{1}{4} \times 100 = 89.3\%$

$= 89\%$

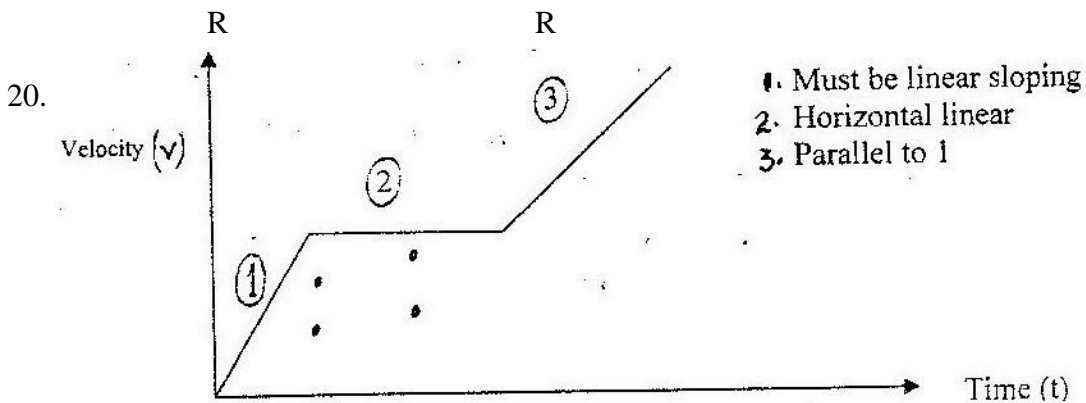17. Sound waves
18. Let A's represent current through the Anometers using Kirchoffs Law

$$A_1 + A_2 = A_3$$

But $\quad A_1 = A_2$

So $\quad A_1 = A_2 = \frac{1}{2} A_3$

Similarly $\quad A_4 + A_5 = A_3$

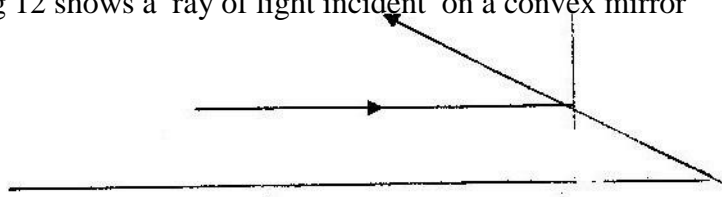So that $\quad A_4 = A_5 = \frac{1}{2} A_3$

So $\quad A_1 = A_2 = A_4 = A_5$

19. $P = \dfrac{V^2}{R};$ $\qquad 40 = \dfrac{240^2}{R}$ $\qquad R = 1440\Omega$

20.

1. Must be linear sloping
2. Horizontal linear
3. Parallel to 1

21. Wire expands becoming longer (reduces tension) this lowers frequency hence pitch.

22. Boiling point of spirit is lower than that of water. Specific heat capacity is lower than that of water.

23. Fig 12 shows a ray of light incident on a convex mirror

Reflected extended backwards to cut
axes at 1·5 cm
V = 1·5 x 2 = 30 cm

24. Fig 13 shows a semicircular glass block placed on a bench. A ray of light is incident at point O as shown. The angle of incidence, i is just greater than the critical angle of glass
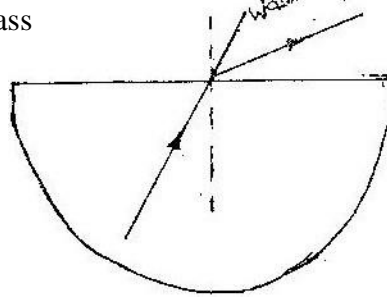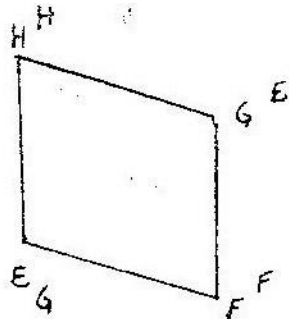

25. The air above paper travels faster than below causing lower pressure above. Excess pressure causes paper to be raised.
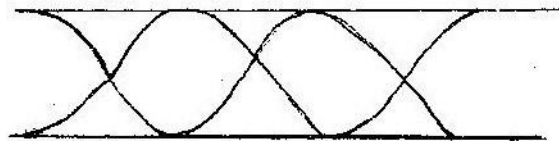
26. Combined capacitance $= 1.5 \, \mu F$

$= CV = 1.5 \times 3$ $= 4.5 \, \mu C.$

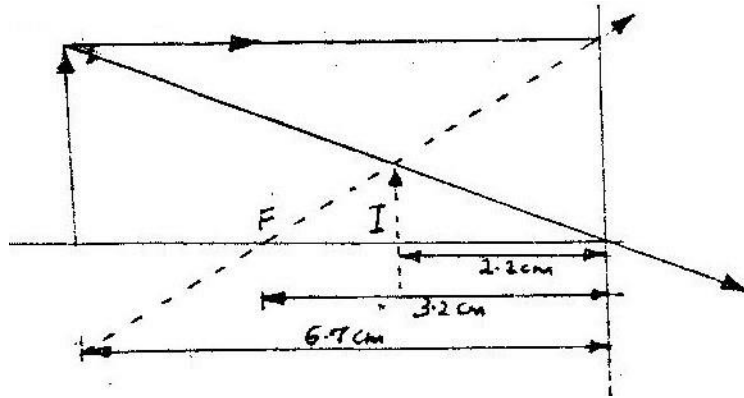27.

Correct Orientation either of
those Shown

28.

Correct resonance
Shape.

29. Microwave / cooker/ telephone/ radar etc

30. U.V removes electrons from zinc surface so leaf will not only collapse if electroscope was negatively charged.

31.

32. Number of turns/ strength of magnetic field

33. To reduce eddy currents in the armature

34. Difference in energy of the state/ nature of atoms

35. X – rays produces   - Hard X – rays are produced

36. From 300 – 150 = 74 S   200 – 100 = 76 S

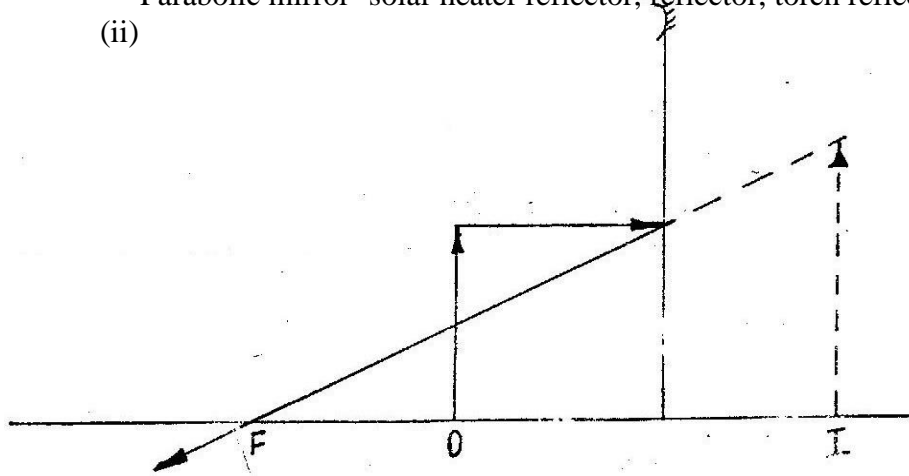Average = 75 ± 1 other values on the graph could be used

Donor impurity is the atom introduced into the semiconductor(doping) to provide an extra electron for conduction.

PHYSICS PAPER 231/2 K.C.S.E 2000 MARKING SCHEME

1. (a)   (i) Convex mirror – driving mirror/ supermarkets mirrors

Parabolic mirror- solar heater reflector, reflector, torch reflector etc.

(ii)

(b) (i) V= 45   M = 3.5 (from graph) m = v/u ⇒ 3.5 = 45/u
U = 12.9 cm ± 0.4

(ii) Choosing convenient value of 'm'

M = I, V = 20 =u M= v/f-1   M = v/f   -1/f= 1/45+ 1/12.9

1/f = 1/20 + 1/20   v= 45m = 3.5 m= 0 = f = v

f= 10cm   f = 9.8 – 10.3 f= 10 cm   f = -10cm

2. (a) Initially the balls accelerates through the liquid because terminal viscosity is greater than viscous and upward forces after sometimes the vicious forces equals mg and the balls move at constant velocity. The difference due to the fact that the viscosity L_1 is greater than that of L_2 (coefficient of viscosity)

(b)
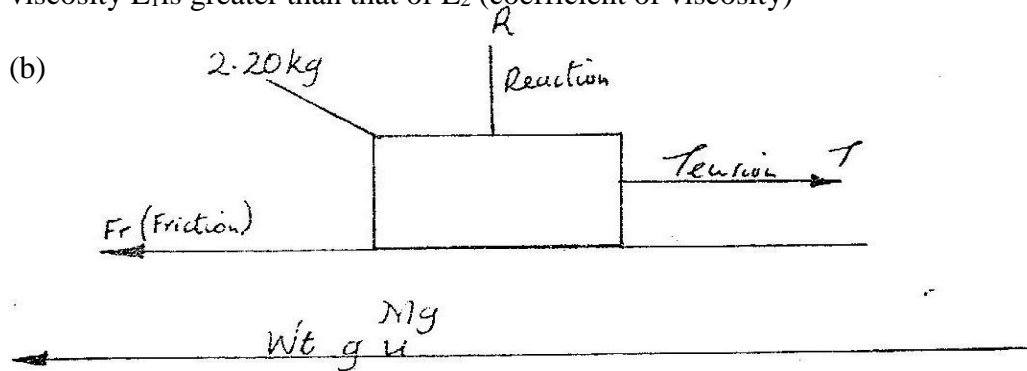
(ii) (I) A. plot the graph of acceleration against the mass m
See graph paper
Graph 5 marks
Plot 2 marks
Axes 1 mark
Scale 1 mark
Line 1 mark

(II) Intercept = μg

Intercept = 2.80 ± 0.2 (from graph)

$$M = \frac{2.80 \pm 0.2}{10}$$

$$M = 0.28 \pm 0.02$$

3. (a) When temperature rises, K.E/speed of molecules of the gas increases. Since volume is constant this increases the rate of collision, with the walls of the container, and increase in collision increases pressure.

(b)

(i) Length of column of dry air   Temperature

    Length/ height of the head   Volume of air

(ii) Temperature is varied and values of L and T. Measured and recorded; a graph of L versus T. (A) is plotted. This is a straight line cutting T axis at O (A) (or -273^0C) since tube is uniform L α T.

(iii) The water bathy allows the air to be heated uniformly.

(c) $\frac{P_1V_1}{T_1} = \frac{P_2 V_2}{T_2}$ $= \frac{1.5. \times 10^5 \times 1.6}{285} = \frac{1.0 \times 10^5 \times V_2}{273}$

                   $= V_2 = 23m^3$

4.   (a) (i) Easily magnetized and demagnetized

      (ii) $\frac{V_p}{V_s} = \frac{N_p}{N_s}$ $\frac{240}{V_s} = \frac{500}{50}$

            $V_s = 24;$ $V = V_{PR}$

               $V_{QP} = 1/3 ;$ $V_{PR} = 8 V$

      (b) Volume of A displaced $= 6.0 \times 12$ cmcm^3 or P = G * g

                  Mass $= 12 \times 10^6 \times 800$ F = PXA

                               $= 0.0096$ kg   ans = 0.09N

              Weight = mg = 0.096N

      (ii)   Volume of B displaced $= 6.0 \times 3$ $= 18$ cm^3

        Weight $= 18 \times 106 \times 1000 \times 10$ $= 0.18N$

      (iii)   Weight of block = weight of third displaced

        $0.096 + 0.18 = 0.276$

        Mass = 0.027 kg

        Volume $= \frac{0.0276 \text{ kg}}{42 \times 10^{-6}m^3}$

=657 kgm^{-3} can also be in g/cm^3

5. (a) When whirled in air centripetal force is provided by bottom of container because of the holes, there is no centripetal force on water on the water, so it escapes through holes leaving clothes dry.

    (b) (i) I   Centripetal force equals force of friction
    $$F= Mw^2r = 0.4$$
    $$W^2 = \;\; 0.4 \qquad\qquad\qquad or\; F = Mw^2r$$
    $$\qquad\quad 0.1\;x\;0.08 \qquad\qquad\qquad 0.4\;0.1\;w^2\;x\;0.08\;W=$$
    $$\qquad\quad 7.07rad/s \qquad\qquad W\; = 7.07\;rad/s$$

    II $F= Mw^2r = 0.1\;x\;7.07^2\;x\;0.12$
    $$= 0.60N$$
    Force required $= 0.60 - 0.40$
    $$0.20N$$

    (ii)   The block will slide this is because although the frictional force is greater centripetal force would be needed to hold it in place.

SECTION II

6. (a) Conditions of interference: Waves must equal frequency and wavelength; to be in phase or have constant phase relationship (comparable amplitude)

   (b) Walking along PQ creates path difference between waves from L$_1$ L$_2$ when the path difference is such that the waves are in phase of full of wavelength loud sound is heard, when the path difference is such that the waves are out of phase. (½ of odd ½ λ) low sound is heard.

   (ii) $L_1\; A - L_2\; A = \lambda$
   From the figure $L_1A = 18.5cm + 0.1$
   $L_2\; A = 18\; cm + 0.1$
   $L_2A = L_1\; A = 0.5\; cm + 0.2$
   Using scale given $\lambda = 0.5\; x\; 200$
   $= 100cm$
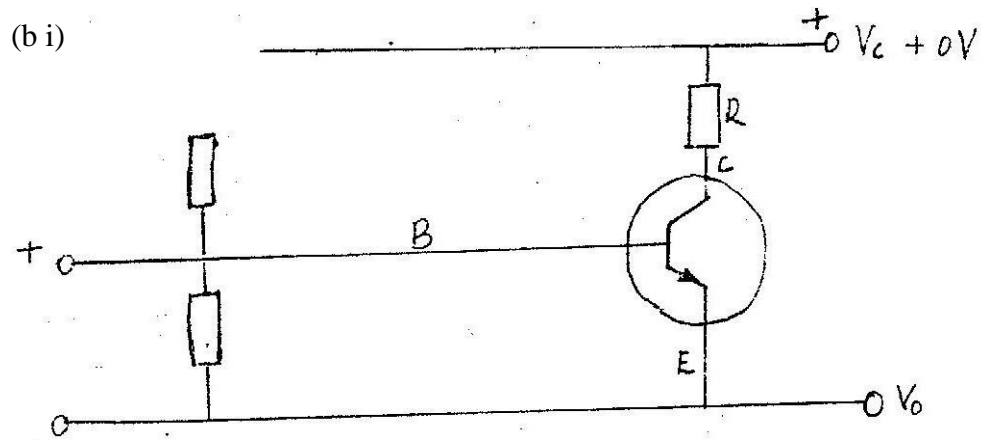 $V= f\;\lambda \qquad\quad = 350\; x\; 1$
   $350m^{-1}$

   (iii)   The points interferences are closer; higher frequency $\Rightarrow$ shorter wavelength; so if takes shorter distance along PQ to cause inference.

7. (a) Pure semi- conductors doped with impurity of group 3, combination creates a hole (positive), this accepts electrons.
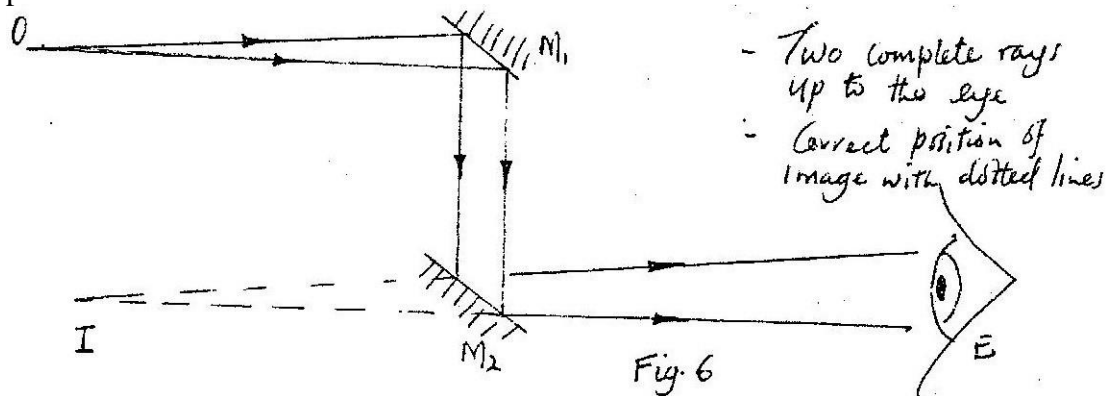
(b i)

(i)   At V_e E = 0

$V_{cc} = I_c$ R $_L$

L_c = 9/1.8 K Ω l_c = 10

$V_eE = V_{cc}$ = 9

(ii) Δl_c = (see graph) = 3.5 − 1.2 = 2.3 mA

B = Δl_c

Δl_c

2.40A

40 μ A

= 60.

PHYSICS PAPER 232 /1 K.C.S.E 2001 MARKING SCHEME

1. Volume removed = 11.5cm3

    Density = $\dfrac{mass}{Volume}$ = $\dfrac{22}{11.5}$ 1.9cm^{-3}

2. Weight on side A has bigger volume when water is added.

3. Centre of gravity of A is at (geometric) centre while that of B is lower when rolled. Centre of gravity of A stays in one position while that of B tends to be raised resisting motion as it resists; thus slowing down B. OR B there is friction force between the surfaces which resists motion.

4. No air on moon surface / no air pressure / no atmosphere.

5. When the permanganate dissolves / or breaks up into particles (molecules) these diffuse through the water molecules

6. When rises up the tube into the flask or water is sucked into the tube or bubbles are seen momentally.

7. Cold water causes air in the flask to contract // reduces pressure inside flask or when cold water is poured it causes a decrease in volume of air the flask or

    pressure increases in the flask // volume of the flask decreases.

8.

    - Two complete rays up to the eye
    - Correct position of Image with dotted lines

    Fig. 6

9. Point action takes place at sharp points (A , B, C, D), charge concentrates at

    sharp points causing high pd, this causes air the surrounding to be ionized. The positive ions are repelled causing points to move in opposite direction.

10. By forming hydrogen layer / cover or hydrogen atoms or molecules which insulate the copper plate OR forming it cells between hydrogen and zinc which opposes the zinc copper cell or by forming a hydrogen layer / cover which increases

Fig. 8
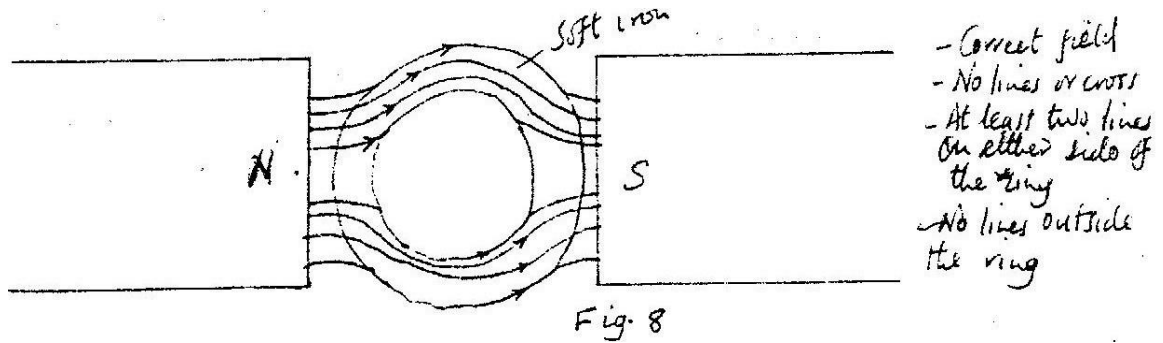
internal resistance.

11.

12. $F_2 F_3$ or F_1 and F_4

13. Moment of a couple = one force x distance between the two forces.
    Distance between F_1 and $F_4 = 0.8\sin 30^\circ$.   Moment $= 0.8\sin 30^\circ$ x 100 $=10NM$
    Alternative (F_2 and F_3) Moment $= f$ x $1M = 60N$ x $1 M = 60nM$(or J)

14. $V2 - U2 = 2aS$ OR $S = \underline{v+u}$ t $1502 - 3002 = 2a (0.5)$ 2
    a= -67, 500ms^{-2} 0.5 = V =   150m/s u = 300m/s s = 0.5
    or deceleration = 67,500ms^{-2} $\underline{300 +}$ $\underline{150/t}$ t = 1/450s
                                           2

                                $a = \underline{v - u} = \underline{150 - 300}$
                                           t $1/450 = -667,500$m/s^2

15. Efficiency $= \underline{\text{work done by machine x 100}}$ $E = \underline{\text{work out x 100}}$
                    Work done on machine   Work input

; Work done on machine (work input) = 550,000j.

16.
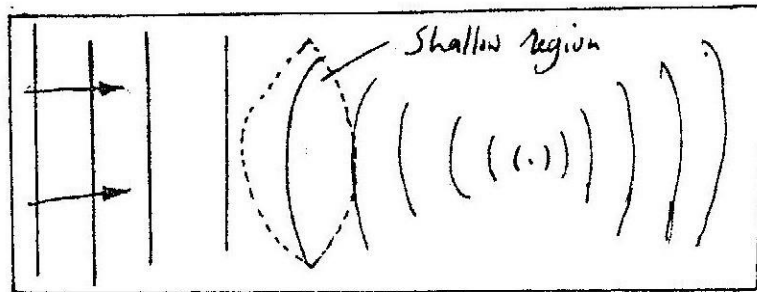
Fig. 10

17.   R = V/I = 1.5 / 0.1 = 15'Ω
            R = 15'Ω - 12'Ω = 3'Ω
         OR E = 1(R +r)
                1.5 = 0.1 (12 + r) = 1.5 =1.2 + 0.1r
                0.3 = 0.1e =   r = 0.3/0.1'Ω
                R = 3'Ω.

18.   Current in heater = _p_ = _3000_ = 12.5A
                              V   240

   Fuse not suitable since current exceed the fuse value.

19.   Heat loss will be higher in A

       Methylated spirit will boil faster / evaporates / more volatile causing loss of heat through latent heat of vaporization.

20.

Fig. 13

Two correct rays from C

Correct Image Position

(14·5 cm – 15·0 cm)

Fig. 14
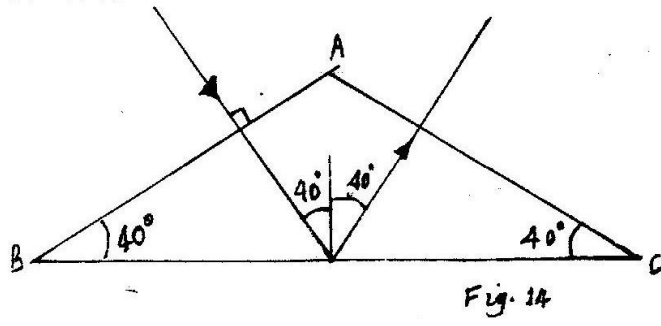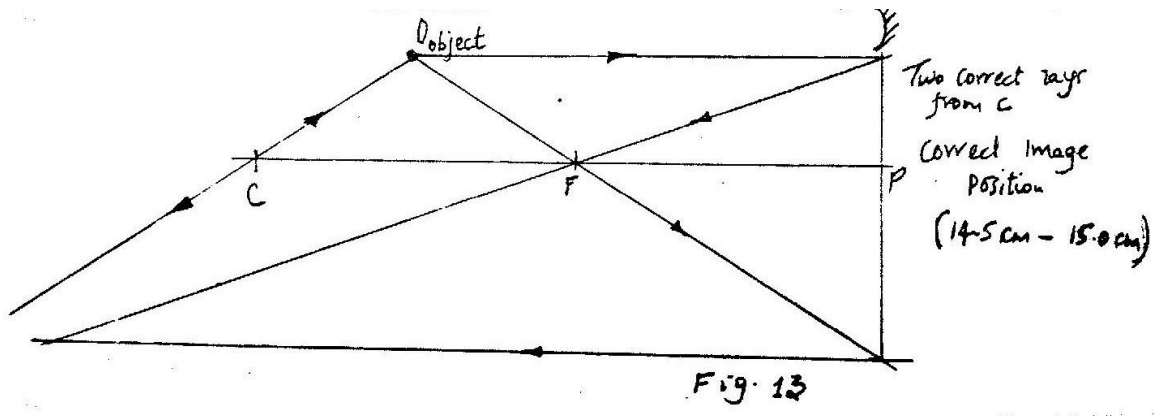
21.

22.

23.

24.
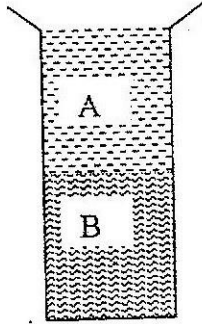
Fig. 15
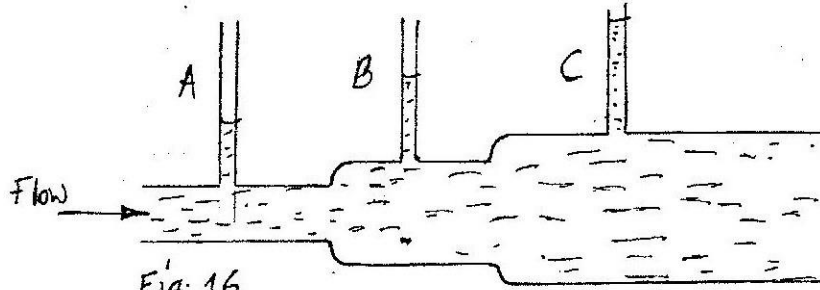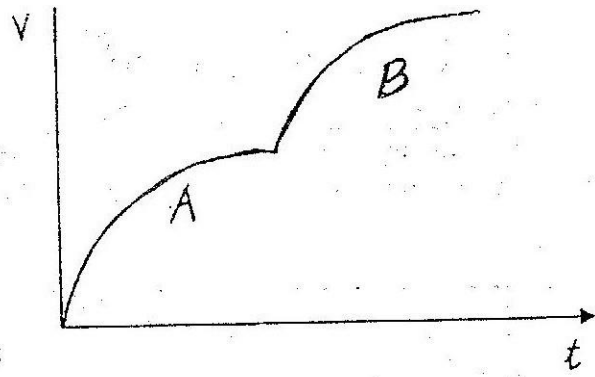
Fig. 16

Since masses are the same, there are more hydrogen molecules than oxygen molecules/more collision in B than in A and hence more pressure in B. Collision in B is higher than in A.

25.

(i) Fundamental Mode

(ii) 2nd harmonic

(iii) 3rd harmonic.

26.   Fh = f1 – f2   OR Fh = f1 – f2
    Fh = 6 – 4   = 6.25Hz – 4Hz
    Fh = 2   =2.25Hz.

27.   Longer radio waves are easily diffracted around hills/ radio waves undergo diffraction easily.

28.   Tension in A = 1.05N – 1.0N = 0.05N

Tension in B = tension due to A + Tension due to B
0.05 + 0.05 = 0.10N

29.

30.

Fig. 21

31.

32. E = pt = 60 x 30 x 60 x 60J   E = 60/1000 kW x 36hrs
In kWh = 60 x 36 +60 x 60 J   E = 0.06 x 36
          1000 x 60 x 60
        = 2.16 Wh   E = 2.16kWh

33. Pd across Anode – cathode   Or anode potential (voltage)
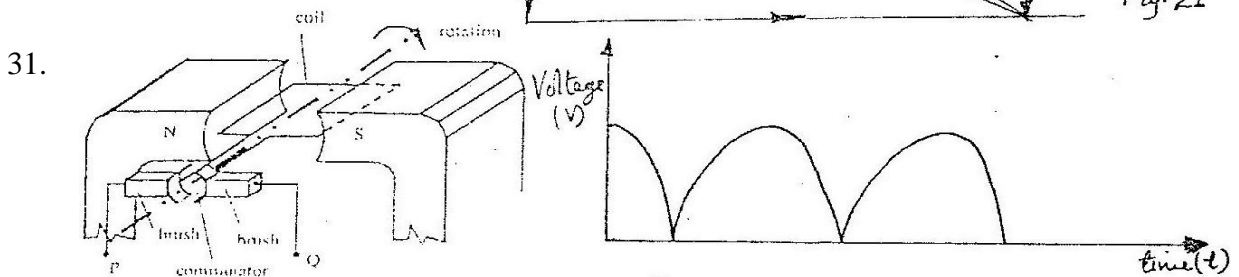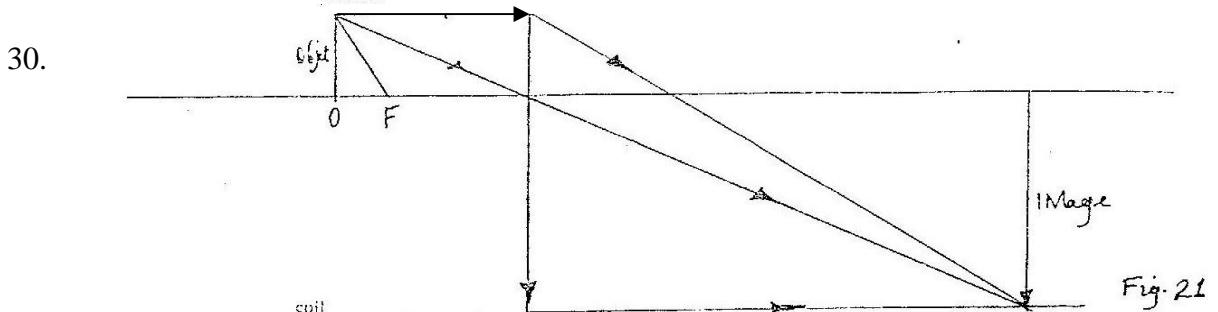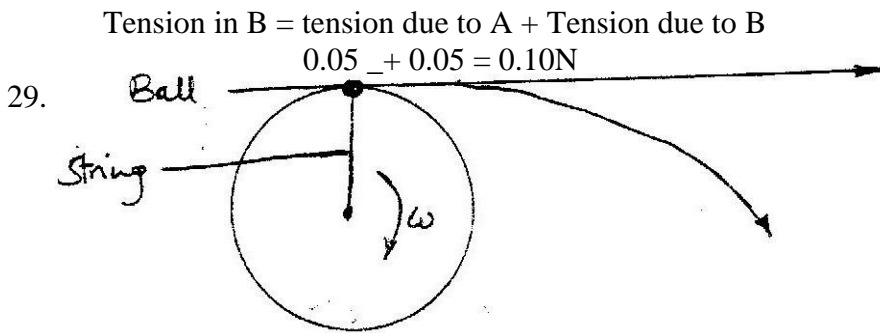
34. r - β (Beta)or ie   B = 82   C = 206

PHYSICS PAPER 232/2 K.C.S.E 2001. MARKING SCHEME

1. Let final temperature be T

   Heating gained by melted ice MCT = 0.040 x 340,000J

   Heat lost by water. = MCθ 0.040 x 4200 x (20-T) J

   Heat gained = Heat lost

   13600J + 168 TJ = 1680 (20-T)J   T= 10.8⁰C

2 a i)   So as to have opposite polarity on the poles.

   ii)   since the current is varying with time; it causes the current in the solenoid to
          vary, with time causing the diaphragm to vibrate this vibration is at the
          frequency of speech; hence reproducing speech.

   iii)   No vibration/receiver does not work, steel core pieces would become
          permanent magnet/so force of attraction would not be affected by variation
          in speech current.

b) $\dfrac{N_p}{N_s} = \dfrac{V_p}{V_s}$ $V_s = \dfrac{240}{400} \times 20 = 12v$

$V_s = V/R = 12/50$ $= 0.24$ A

I_s Peak $= 0.24A \times 2$

$= 0.34A$

3. a) Fill tray with water to the brim and level on bench; sprinkle lycopodium powder on the water surface either pick an oil drop with kinked wire; and measure the volume of a drop; put one drop at centre of the tray let oil spread and measure maximum diameter d of the patch; hence reproducing speech.

b) Hydrogen since its less dense it diffuses faster.

c) $p= pgh$;   Or mass $= D \times V$

$= 1000 \times 2 \times 10$ $= 1000 \times 2/1000$

1-p

$= 100 \times 10 \times 10 \times 2 \times 2 \times 10^{-4}$ $= 0.4kg$

$= 4N$ $= 0.4 \times 10$ $= 4N$

4. i) Filament heats up cathodes; causing electrons to boil off the cathode. ii) Grid controls brightness of spot since it is negatively charged it repels the electrons reducing number of electrons

iii) A vertical line would appear/spot oscillates vertically
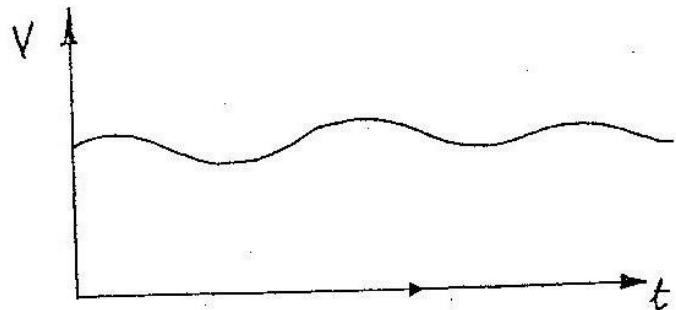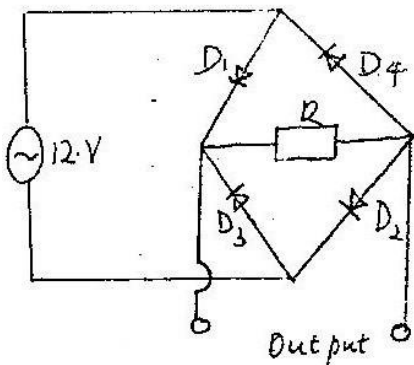
iv) Deflection in TV is by magnetic fields.

v) Magnetic field produces greater deflection on electrons beam allowing wider screen.

b) Energy released $E = E_f - E_i = 5.44 \times 10^{-19}j = 4.08^{-19}j$

$E = hf = \dfrac{h C}{\lambda}$

$\lambda = \dfrac{6.63 \times 10^{-34} \times 3.0 \times 10^8 m}{4.08 \times 10^{-19}}$

$= 4.88 \times 10\text{-}7$ m $(4.87 - 4.90)$

5a)

bi) IE = IC + IB

$100 + 0.5$

$= 100.5mA$

(ii) β = Ic / IB = $\dfrac{100}{0.5}$ = 200

SECTION II.

6 a i) A body at rest or in motion at constant velocity stays in that state unless acted on by an unbalanced force; the rate of change of momentum of a body is directly proportional to the force acting on the body(F = ma) for every action, there is and equal and opposite reaction: any one for;

(ii)

$V^2(M^2/s^2)$	0.04	0.16	0.36	0.64	1.00	1.44

Graph – see graph papers   Axis – labels

Scale   Plot – 5.56 point

Line   - 4 point   Slope = $\dfrac{1.24 - 0.100}{0.210 - 0.016}$ = 5.88 + 0.27

b)   V2 + u2 = 2as

When $\mu = 0$

V2 = 2 x 0.5 x 100

Momentum = mv = 200 x 1000 x (2x 0.5 x 100)

2.0 x 10^6 kgs^{-1}

OR   S = ½ at^2

T = 100 x 2

T = 20 sec   Momentum p = Ft

F = ma

- 200 x 1000 x 0.5 = 10^6

7 a i) The pressure of a fixed mass of an ideal gas is directly proportional to the absolute temperature provided the volume is held constant.

ii)

I/V(m^3)	40.0	5	58.8	71.4	83.3	90.9

Graph – see graph paper   Axis – labels

Scale   Plot – 5 – 6 points
Line – 4 points
Slope $\underline{4.24 - 2.00}$ x 105
        86 – 40
      = 4.87 x 10^3 paM^3

      = 4.94 ± 0.65

Slope = 4.94 ± 0.65

Slope = 2RT

    R = 4.87 x 10^3

       2 x 300

    = 8.12NM/K or

JK   = 8.23 ± 0.11 b)

P1 = P2

T1 = T2

T1 = 12 + 272 = 285

T2 = 88 + 273 = 361

P2 = $\underline{1.0 \text{ x } 105 \text{ x } 361}$

      285

I/P x 10^5 (pa -1)	0.5	0.40	0.33	0.29	0.25	0.22

Y = intercept = 3.8 Log 600R

    600r = 6309.57

      R = 10.5 + 5.0

PHYSICS PAPER 232/1 K.C.S.E. 2002 MARKING SCHEME

1. 11.72/11.72 CM/0.01172M
2.
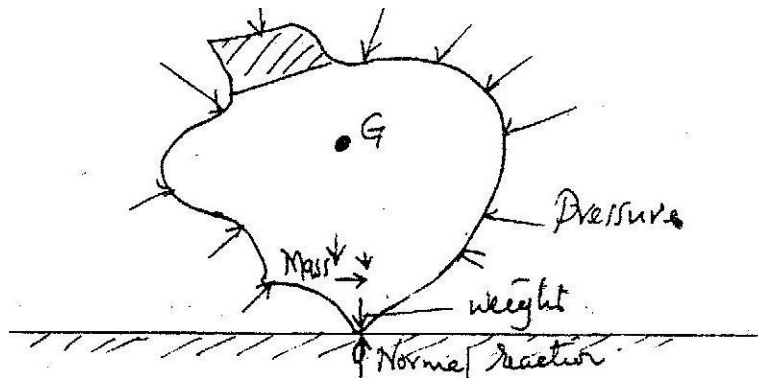
3.   g moves / shifts to the right / C.O.M. moves/ shifts/ more weight or mass of he right/ weight will have a clockwise movement about O/causing greater moment of force towards right than left.

4. $R = V = \dfrac{0.35}{0.70} = 0.5\Omega$

$P = RA = \dfrac{0.5 \times 8 \ 10^{-3}}{0.5} = 8 \times 10^{-3}\Omega$ m.

5. $p = F$ $P = \dfrac{F}{A}$

$= \underline{2500}$

425,000pg   Total press $= \dfrac{2500}{0.025}$ $= 2,000 \text{N/m}^2$

$=250,000\text{PG}$

6. -Low temperature reduces K.E / velocity of molecules

- Hence lower rate of collision / less collision   -Reduction in pressure

7. Can B

Good absorber of radiation.

8.
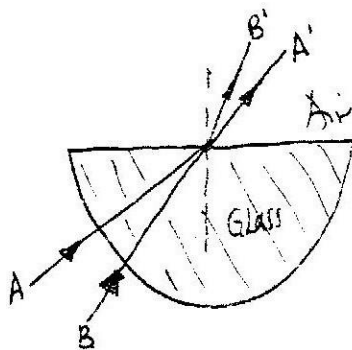
A' & B' are the refracted rays

19. (Assume no heat losses)

Heat gained = heat lost $E = pt = mc \ \theta$

$2 \times c \times (30 - 20) = 90 \times 15 \times 60$ $90 \times 15 \times 60 = 2 \times c \ 10$

$C = \dfrac{90 \times 15 \times 60}{20}$ $4050\text{j} / \text{kgk} = c$

$C = 4050\text{j/kgk}$

20. Mattress increases stopping time/time of collision increased this reduces the rate of change of momentum.

21. $C = C_1 + C_2$ $Q = CV$

CT = 3x2   5µF   V = $\underline{Q}$ V=1 x 10^{-4} = 20V
                                    C

22.

ρ

Boyles law

23.

A

B

24.   V   =fλ
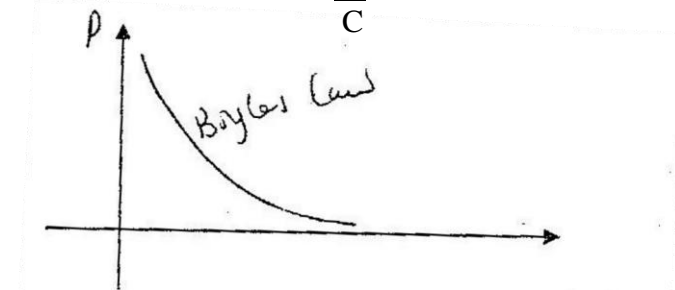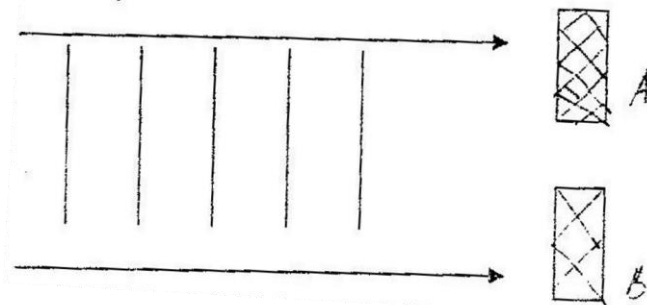
λ   = $\underline{v}$ = $^{330/}_{30}$ = 11m
       F

25. Law of floatation − a floating body displaces its own weight
    Weight of block = weight of mercury displaced
    0.250 x g = 13.6g
    $\underline{0.25}$ =   v
    13.6 x 10^3

    V = $\underline{1.838 \times 10\text{-}5 \, m^3}$ = 18.4cm^3
         1.839 x 10-5m^3

28.

V

29.

T
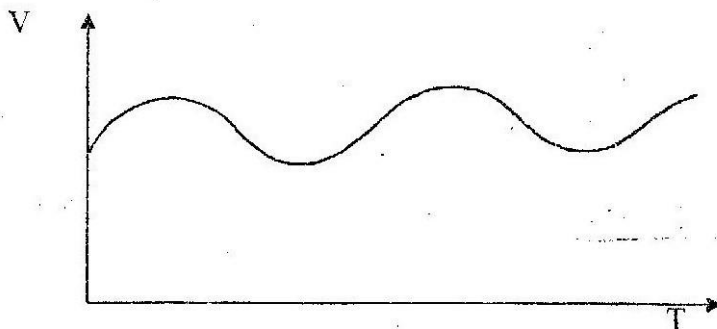
30. p = VI

           Kettle   Iron box   TV
    I = p/n = $^{2500}/_{250}$ = 8A 750/250 = 3A $^{300}/_{250}$ = 1.2A
    Total = 8 + 3 + 1.2 = 12.2A   = Appropriate fuse = 15A 31.
    107 − 42 = 65

32. Penetrating power

33. Downwards

34. Work function of metal / min energy required to eject e-1 for excess energy work function.

PHYSICS PAPER 232/2 K.C.S.E 2002 MARKING SCHEME

1a) (speed of light in vacuum e = 3.0×10^8 ms^{-1})

Refractive index = speed of light in vacuum

$$= 3.0 \times 102 \text{ m/s}$$

$$1.88 \times 102 \text{ m/s}$$

$$= 1.596 = 1.60$$

b) $\sin C$

$$=$$

$$\underline{1}$$

$$n$$

$$\frac{1}{1,596}$$

C $= 38.8^0 - 38.48$

$$38.7 - 38.42$$

c) $\sin \theta$

$$=$$

$$1.596$$

$$\sin$$

$$21.1$$

Si

$$n\,\underline{\theta} = n$$

Sin 21.1

$$\theta = 35.25_0 - 35.15^1$$

$$35.35_0 - 35.21^1$$

2. β - βeta radiation

Force is of the circle implying negatively charged (Fleming's left hand rule)

(bi) K= alpha   (ii)   X= 88   Y= 288

(ci) Increase in thickness

(ii) Increase in thickness reduces the radiation reaching the Geiger tube

(iii) Increase in pressure

(iv) Increase roller pressure squeezes metal sheet (possess more) reducing the thickness of foil coming out of them.

(v) Alpha particles have little penetration very few or none pass though foil.

(vi)

3.
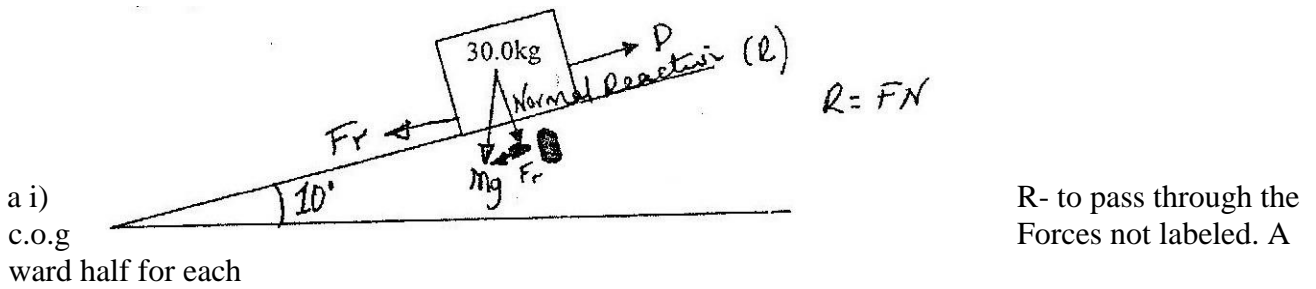
a i) c.o.g ward half for each

R- to pass through the Forces not labeled. A

(ii) $= mg \sin\theta$ $= 30.0 \times 10 \sin 10^0$ $= 52.1$ N (accept 52.08, 52.08, 52.09)

(ii) $A = F$ Net force down $= Mg \sin\theta$ - friction $= 52.1 - 20$
$$= 32.1$$

$$M = \frac{32.1}{3.0} = 1.07 M/S^2$$

(iii)   Acceleration increases with the increase in angle

4 a i) A   ice absorbs latent heat without in temperature (or ice melting no change of temperature heat goes to latent heat fusion)   B   Water molecules gain K.E (increase in K.E.)   C   heat is used to change water into vapour.

ii) Water has anomalous expansion, where we have maximum density at 4^0C. Anomalous behaviour/explain. iii)   Frozen seawater has a lower temperature than frozen fresh water boiling point of sea water is higher than fresh water.

(b)   (heat gained $=$ $ML + MC\theta$
$$= 3 \times 336 \times 10^3 + 3 \times 4200 \times 5$$
$$= 1.07 \times 106J$$

5 a i) Transverse waves (accept elliptical)

ii)   As waves move in the medium, the particles of medium do not move: they vibrate in positions so cork does not move.

iii)   Period of wave T= 0.205
$$f = \frac{1}{T} = 5Hz$$
$$V = fx$$
$$X = \frac{0.30}{5} = 0.60M$$

iv)   Velocity decreases when depth decreases hence the x decreases (since frequency is constant wavelength decreases)

b)   1st resonance λ I$_1$fe λ $= \frac{Il_2 - I_2}{2}$ OR V= 2F (I$_2$-I$_1$)
      4   2   f=

$2(I_2-I_1)$ 129-77

$\underline{\lambda}$= 129-77

2

2nd resonance $3\lambda = I_2+C$ λ= 104 cm   =340

V=fλ

340=fx 1.04 = 326.9 Hz.

F= 327 Hz (326.9)

a)   Charles law: for a fixed mass of a gas at a constant pressure the volume is directly proportional to the absolute temperature Kelvin thermodynamics.

bi)   Volume of gas trapped by drop of cone sulphuric acid, water in heated (in both) and volume (height) of gas: in tube increase as temperature rises; values of height H and T are tabulated; a graph of volume V versus temperature T^oC is plotted;

graph is straight line cutting T at – 273^oC (absolute Zero); so volume is directly proportional to absolute temperature.

ii) -Short temperature range   - Keeping pressure constant is difficult ci)

When θ - θT – 273k   Extrapolation on graph show: Pressure read off β

= 9.7 x 10^4 pa ii)   p1 = 1.15 x 10^5 pa θ_1 = 52.0^oC

p2 = 1.25 x 10^5 pa θ_2 = 80.0^oC

$\qquad$ p1 $\qquad\qquad$ p2

$\qquad$ To + θ1 $\qquad$ To + θ2

$\qquad$ 1.115 x 105 $\qquad$ 1.25 x 105

$\qquad$ To + 52 $\qquad\quad$ To + 80.0

$\qquad$ To $\quad$ 270

- Rise in volume height $\qquad\qquad$ - Rise in temperature

-Recording of tabulation $\qquad\qquad$ - Graph

-Analysis of graph $\qquad\qquad\qquad$ -Conclusion

$\quad$ Alternatives

P $\quad$ = $\quad$ mx + c

P $\quad$ = $\quad$ kθ + kto when K gradient.

K $\quad$ = $\quad$ Dv = (1.14 – 1) x 105

$\quad$ Dx $\quad$ 50 – 10

$\quad$ = $\quad$ $\dfrac{0.14 \times 10^5}{40}$

$\qquad$ 14000

$\quad$ = $\quad$ $^/_{40}$ $\quad$ 350pac ()

KT $\quad$ = $\quad$ Constant

C $\quad$ = $\quad$ 9.6 X 10^4

$350\ T_o = \quad 9.67 \times 10^4$

to $\quad = \quad 274.3\ (266\text{-}284)$

5.   ai) µV light removes electrons on zinc plate. This lowers the excess charge constant (negative) on leaf leading to collapse/ becomes less negative

(more positive) ii)   Since µv light removes electrons positive charge re attracts the electrons thus keeps the charge constant and so leaf does not collapse.

bi)   Frequency of incident light / energy of proton / energy of light work function of surface

ii) From Kemax = hf - θ   h is slope of graph   Slope = (10 – 20) x 10^{-19}

$(2.6 – 1.4)$ x 10^{15}

H = 6.7 x 10^{-34} fs

At Kemax = θ hf = 0

Extrapolation shown or

Read off f_o = 1.07 x 10^{15} Hz

Θ = 1.07x 10^{15}x 6.67 x 10^{-34}

= 7.4 x 10^{-19}

c)   Kemax   =   hf θ

     = $\dfrac{6.67 \times 10^{34} \times 5.5 \times 10^{14}}{1.6 \times 10^{-19}}$

     =   2.29 eV

Since hf< θ no photo elective effect

E =   hf = 6.67 x 10^{-34} x 5.5 x 10^{14}

Or θ =   2.5 x 1.6 x 10^{-19}

PHYSICS PAPER 232/1 K.C.S.E 2003 MARKING SCHEME.

1.

$$\frac{39 Cm^3}{Dr}$$
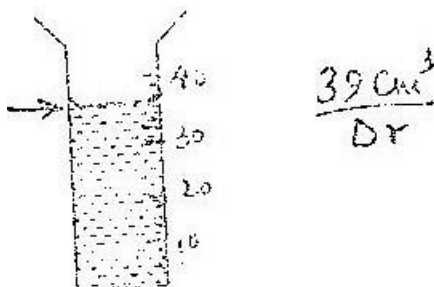
2.   30.0 + 0.5 = 30.5   (No mark if working not shown)

3.   Low density / weight / mass lowers Cog Lower Cog increases stability. Or higher mass / weight / density raises Cog. Higher Cog. reduces stability.

$P = \int hg$ / $p = dhg$

   = 1.36 x 10^4 x 0.7

   = 9.52 x 10^4 or 95200 Nm^{-2} Allow g = 9.8m/s^2 (follow through working)

4.   Air molecules are in continuous random motion. They bombard / knock / collide with smoke particles

5.   Glass flask initially expands / Heating increases the volume of the flask; hence the lignin level drops. Eventually water expands more than glass, leading to the level rising.

7.   Initially the wire gauze conducts heat away so that the gas above does not reach the ignition temp/point. Finally the wire gauze becomes not raising the temp of

    the gas above ignition point.

8.

      R = I = 90 = 40o

       Or

R = $\underline{180}$ – 100 – $\underline{80}$ = 40°
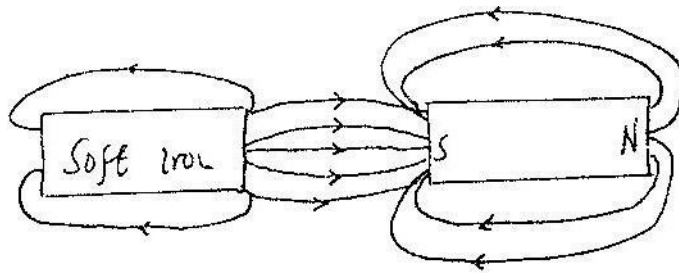
    2   2
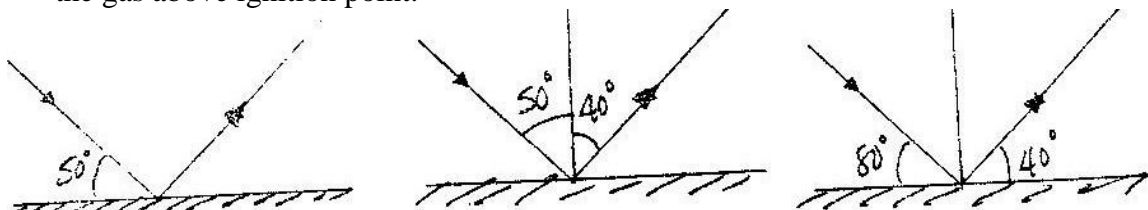
9.   The negative charges on the rod initially neutralize the positive charges on the leaf and the plate / A the road is moved towards the cap electrons are repelled to the leaf, making it to fall.

       As the road is brought nearer, the excess negative charges on the leaf and the plate.

    Current for a longer (Do not accept cheaper)

11. Temperature

12.

Soft iron   S   N

13. It does not retain magnetism / Iron is easily magnetized / demagnetized / Iron enhances / strengthens magnetism.

14. Clock wise moments about pivot = Anticlockwise moments about pivot.   F x 2.5 Sin 30 = 2.5 x 20   F = 40N   Acc. F cos 60o = 20.
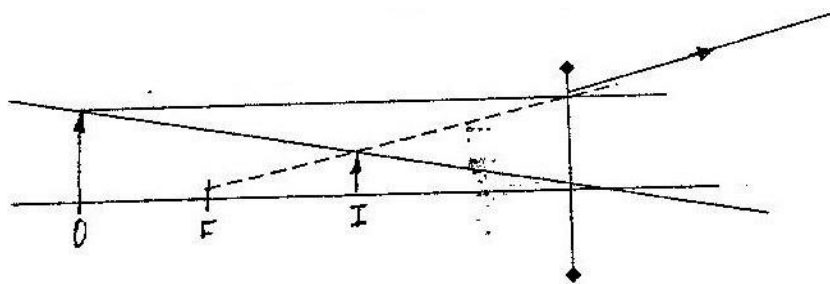
   F = 20

       Cos 60 = 40N   (Do not accept symbols for principle.)

15. Light travels from optically an optically denser to a less dense / rarer medium / the incident ray is inside the optically denser of the two media.

16.

       Rays marked independently: Correctly if in the right direction with arrows. Object
       distance is 9.1cm + 0.2 (8.9 – 9.3). No arrow on the virtual. Any through optical centre.
   Other rays to principal axis and dotted through F.

17. $P = V^2 / R$ $P = VI = I^2R$

   $75 = \dfrac{240 \times 240}{R}$ or   Do not accept $p = VI$ alone without I^2R

                                     $R = {}^{P}/_{1}{}^{2}$

   $= 768 \ \Omega$ $R = 75 \times {}^{240}/_{75} \times {}^{240}/_{75} = 168 \ \Omega$

18.   Beta particle β (Do not a ward for beta ray) Beta radiation Beta emission

19.   Dope with group III element (e.g. Boron, Al, Ga). Three silicon electrons pair up with
       impurity atom electrons. One electron of silicon has no electron to pair up; hence a hole is
       created(For correct structure without explanation but showing a group three element.

20.   Piece of metal does not displace own weight but the two together displace their own weight/
       weight of water displaced is less than the weight of metal while weight of water displaced
       equals the weight of the tow/up thrust equal to combined weight.

21. Speed = distance / time   speed = <u>600m/s</u>
     = 1200   1.75
        3.5   =343 m/s
     = 343m/s   (Range 342.8 - 343 m/s)
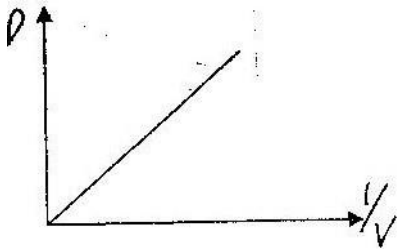

OR
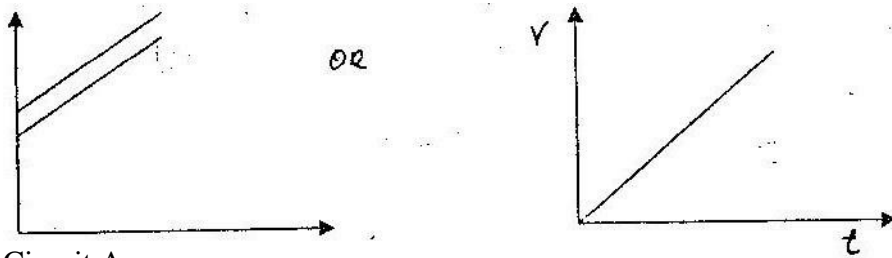
22.

Circuit A
Current draw from each cell is less than in B / In A there is les internal resistance.   23.

24.

25. To with stand high temperature / high melting point.
26.
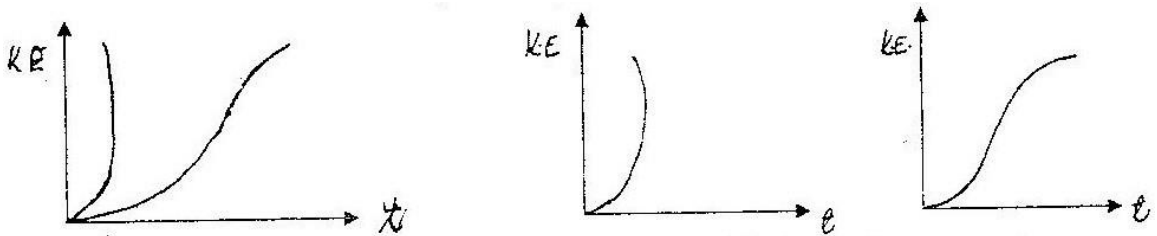
27   Fringes will be closer together / more fringes of violet light has a shorter
     wavelength Red light has longer wavelength.

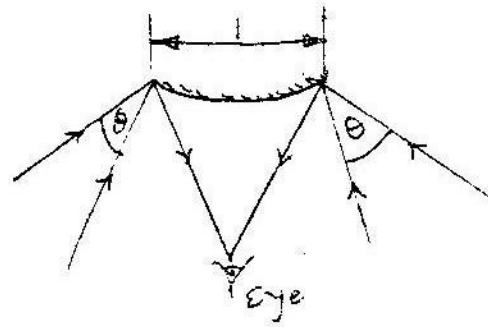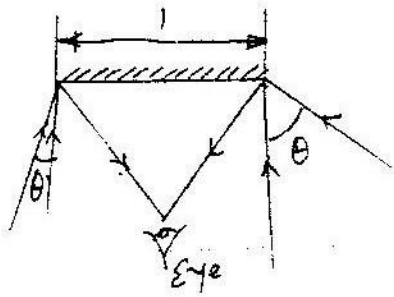28. Do not accept: Heat loss = heat gain

    $Pt = mc\theta$ or $VIt = mc\,\theta$

    2500t = 3.0 x 4200 x 50

   T = 252s / 4.2min / 4 min 12s.

29.

2

2m

30. $F = ma$

$a_2 = \underline{a_1}$

Accept $F = ma$
for formula mark

$F = 2 ma_2$

$a_2 = \underline{a_1 m}$

$2ma_2 = maf$

31. Radio waves, Infrared, visible light, U.V light, X-rays (accept correct order)

32. Galvanometer deflects; Changing flux produced in p is linked to Q causing an e.m.f to be induced / by mutual inductance an emf / current is induced in Q.

33. Maximum deflection of G will be double; flux linkage doubles when the turns are doubled.

34.

35. $Q = hf0 = W_o$ or $\& = hfco$
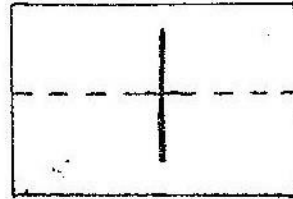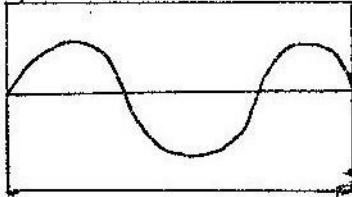
   $= 6.63 \times 10^{-34} \times 9.06 \times 10^{14} j$

   $= 6.01 \times 10^{-19}$ J or 6.0061×10^{-10} or 6.0×10^{-19} if working is shown.

36. Fast air causes low / - reduced pressure at the top. So there is <u>net force upwards</u> on pith ball / <u>pressure difference pushes</u> pith ball upwards.

37. Parallel $C = (1.3 + 0.7\ 0)\mu F = 2.0\ \mu F$ or $2 \times 10^{-6}F$

   Series $1 = 1 + 1 = 1$

   $C_T\ 2.0 / 2.0$

   $C_T = 1.0\ \mu F\ //\ 1.0 \times 10\text{-}6\ F.$

PHYSICS PAPER 232/2 K.C.S.E 2003 MARKING SCHEME.
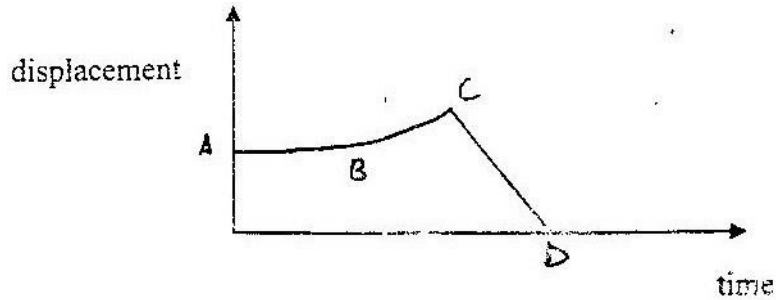
(i)   Velocity equal zero; (ii) body is uniformly accelerated;
    (iii)   Body is uniformly decelerated to origin

(b i)   S = ½ at 2 a = 10 ms -2
         45 = ½ x 10 x t^2 t= 3 s;   (3mks)

(ii)   the initial horizontal velocity of the ball.
            S –V at;   50 Va x 3;   VA   = 16.7 ms -1
(iii)   V = U + at;
 V = O + 10 x 3; = 30ms-1   (total 13 marks)

   2ai)   work= force x distance;
                = 2000 x 3.0 x 10;
                   6000J;

ii)   Power = <u>work done</u>
                    time

            =   <u>60000</u>
                       6
            =   10000w;

iii)   12.5 kW
            % efficiency = <u>work output</u> = <u>power output</u>
                        = work input = power input

            =   12.5 x 103

   iii)   Force is centripetal   = <u>mv^2</u>
                                    r

$$= \frac{20 \times 4.24}{4}$$

$$= 89.9V \qquad \text{Total 14 marks}$$

3 a)   Specific latent heat of vaporization is the quantity of heat required to change 1 kg of a liquid at boiling point completely to vapour at the same temperature and atmospheric pressure

     B   i)   I   Mass of condensed steam $= 123 - 120 = 3g$;

               II   Heat gained by water
                   $= 0.070 \times 4200 \times 25J$;
                   Heat gained by calorimeter
                   $= 0.05m \times 390 \times 25$; $= 487.5J$;
                   $= 7837.5J$;

         ii) $Q = mL$;

         II $Q = 0.003 \times L$
                   $0.003 \times L = 7837.5$;
                   $L = 2.61 \times 10^6 \text{ J kg} -1$

4.   a i)   I 4cm;   II   A = 2cm;

    ii)   I   0 to A- 9cm containing 2 ¼ waves
           time for 1 wave $= 0.04$ s
                 $f = \frac{1}{7}$; $= \frac{1}{0.04}$ f = 25Hz;

    II $V = f$;   15 x 0.04 $= 1 \text{ ms}^{-1}$

Ai   to allow all radiations to penetrate;
 (ii)   On entry radiation ionizes argon gas
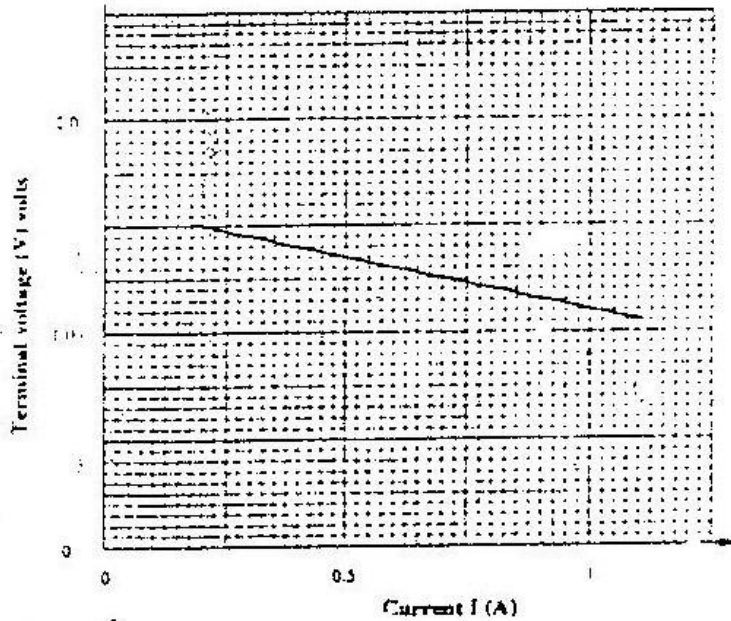   Avalanche of ions flows between terminal causing condition;
    Pulse of current flows;   Pulse registered as particle;

iii) Quenching the tube;

5. a) e.m.f is total work done in transferring unit charge from on terminal of battery to the other;

b)

(ii)   i) $E = V + Ir$;

(iii)   From the graph determine the;   current (A)

  I internal resistance = slope of graph

$$\text{Slope} = 1.2 = 0.90$$
$$1.0 - 0.5$$
$$= 0.3$$

$$0.53$$
$$= 0.6\,\Omega$$

(c) Current through shunt = 3.0 -0.03 = 2.97a;
   Pd across g= Pd across shunt = 10x 0.03; 4 marks
   Resistance of shunt Ir = 10 x 0.03
   = 2.97 x r= 10 x 0.03
   $R = 0.101\ \Omega$

SECTION II

6 a)   Water is heated and gently stirred;
   Values f pressures and temperature are recorded to intervals;

Temperature is converted to K and atmospheric pressure p added to P;
Graph of pressure p against (K)
Plotted giving straight line;

b)
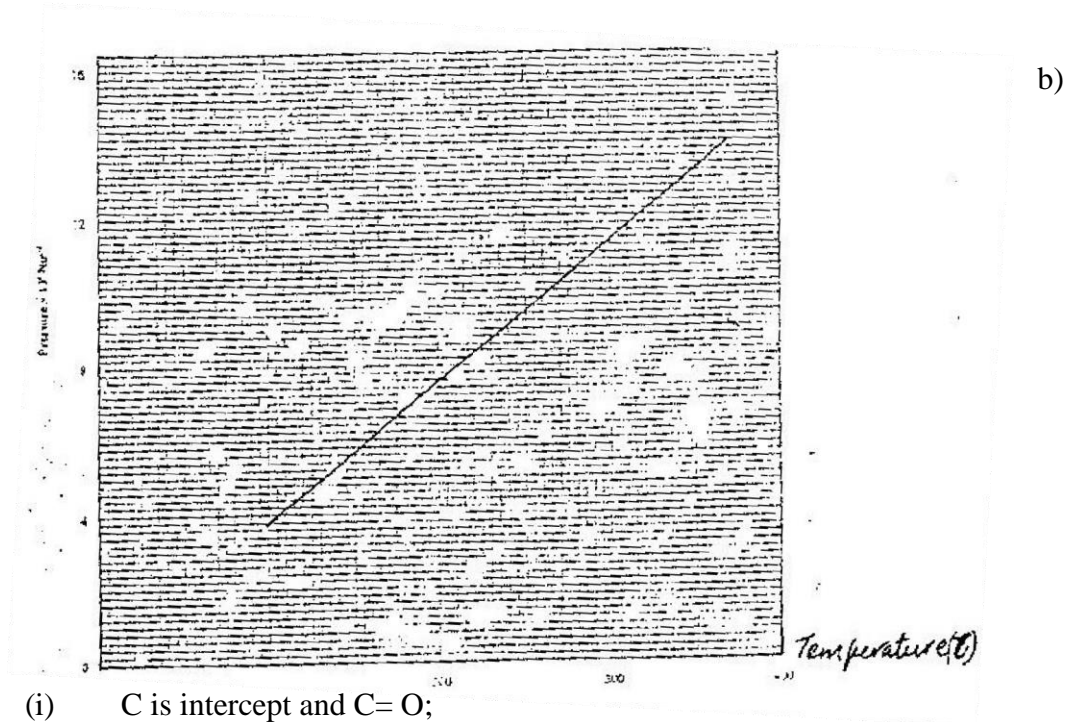
(i)   C is intercept and C= O;
       K is gradient given by

       Gradient = 15.2 x 10-4 x 10
                  ———————————
                    400-105
                = 11.2 x 103
                  ————————
                     295
                = 37.97 pak-1

(ii)   Gas would liquidify;
(c)   270C = 300k
       3270C = 600k
       P1=p2
       ——
       T1=T2
       2.1 x 105m= p2
       ————————
       300   600
       P2 = 4.2 x 105 Pa

7. a) i) The candle is placed at a distance u from lens and screen position adjusted until sharp image is obtained; the distance v between lens and screen is measure;
Process is repeated for other values of V;

For each set of u, v, f is found $1/f = 1/u + 1/v$; average f determined;

   (ii)   Image is virtual and so not formed on screen

c)   m = v= 2

$^v/_{15} + ^1/_{30}$;

$=1/f = 1/15 + 1/30$

F= 10cm

PHYSICS PAPER 1 2004 MARKING SCHEME

1. $15.5 + 0.33 = 15.83$mm/1.583cm
2.   Air in the balloon expands/volume of balloon increases; displaces more air raising the up thrust of air;
3   i)   Stability reduced/Lower /less stable

-Upper section heavier/hollow section becomes heavy/more massive top   -
Raising the c.og of the block.
4. Density of water is low/It will result to a very log barometer/ very long tube

5.
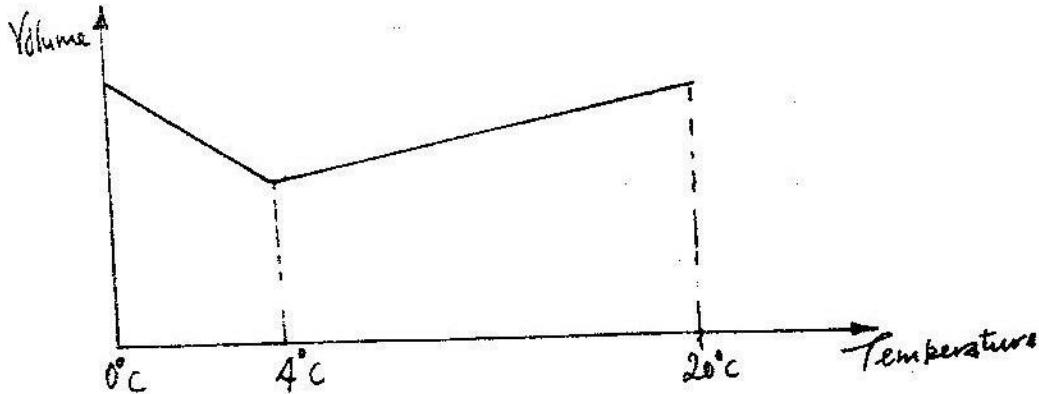
NB at 4^0 c graph must be curved

- 4^0 must be marked
- If drawn using a ruler N0 mk
- If 20^0 c is marked, it must be higher than 0^0c

6.   Wooden Block
   Wooden block is a poor conductor of heat all the heat goes in melting the wax.

7.   NB- Check correct rays with arrows.
        - at least one angle on each reflecting surfaces must be marked.
8.
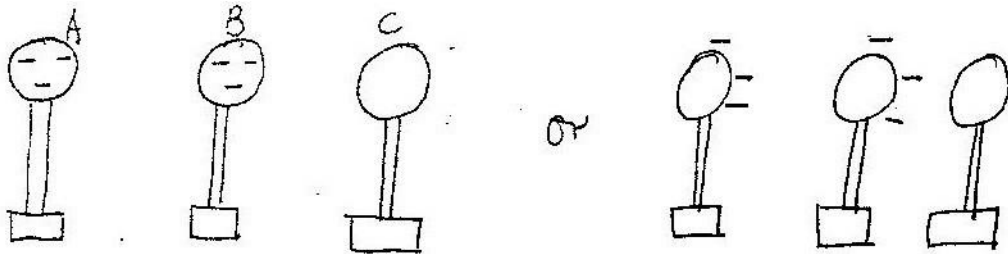
9.   To depolarize/ oxidizer/ reduces polarization/oxidizes H_2 to H_2 to H_2 0/Changes H_2 to $H_2$0/ removes H_2 (any give 1 mark)

10.   Adding detergent/Impurities/increasing temp/heating (Any give 1mk)

11.
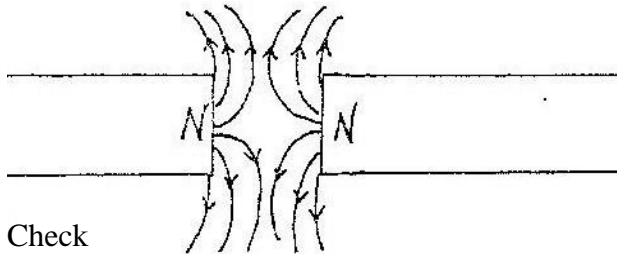
Check
-correct pattern
- correct direction

NB- at least 4 lines of forces must be shown
    -       Lines of forces must start at the
        poles.

12.
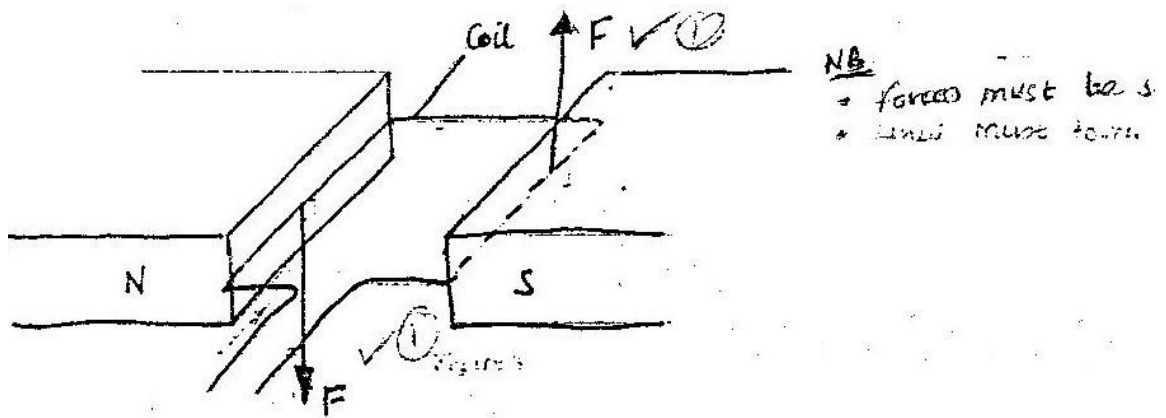
NB forces must be straight

Lines must touch a conduct

13. Increasing current/increasing no. of turns or length of coils/ increase strength of field same as moving magnet close to core & using U shaped winding coil on soft iron core/increasing the angle between conductor and the field. (give any 2mks)

14. Sum of clockwise moment=sum of anticlockwise moments

W x20= 30 x 5

2w=15

Higher, reducing the current.

16. Either in (10b)current from each cell is less than in (10 a)

Or

Power supplied in 10(b) is less than in 10(a)

17. Distance= Area under graph

$= 2x \ ^{1}/_{2} x2x \ 20$

$= 40m$

Or $s = ut+ 1/2at^2$

$S=2(20) + ½(-10)4$

$S= 20$

$S=2x20$

40m

18. W= Fd

Mg sin θ

$= 60x \ 10x0.5x4$

$= 1200J$

19. Electromagnetic   Mechanical

-can travel through vacuum   - Cannot travel through a vacuum

-Travel at speed of light	- Travel at varying speeds
-are faster	- are slower
- Does not necessarily Refuse a material media	- Refuse a material media

20.   Either $p=VI = V^2/r$

        When V reduces power reduces
        So rate of heating reduces

    Or V=IR

    P=I^{2}R (reducing IR reduces power so rate of heating reduces.

21.   E=pt t=450- 150 =300s

    E= 50x300

    1= 150,000J

22.   Q=ml

    15000=0.1x1   1= 150,000J/kg

23.
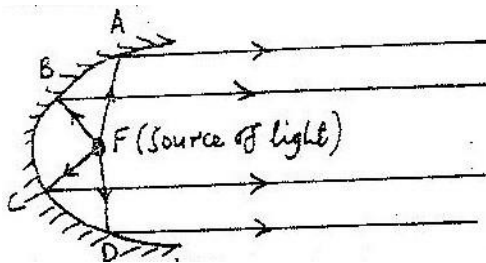
24.   -Correct rays must be refracted to the eye and should be diverging. -Dotted lines should show image position. (-should not have arrows-must intersect within container)
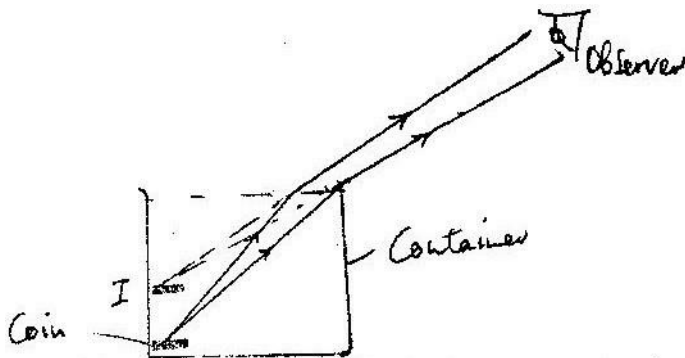
25.   Plasticine increases mass of body since momentum is conserve or weight of trolley/normal reaction increases so fiction forces increases or Mass of trolley increases, the driving force being constant.

26.   Either on closing on closing s$_1$ while s$_2$ open

    Q= CV = 3C

    When s$_1$ is open s$_2$ closed charge is shared between the two capacitors

CT=C+C=2θ

Since q is the same equal to $3C_1$ the new pd=V_1

$Q=CTV_1 =3C$

$V_1 \quad =1.5V$

Or

S_1 closed S_2 open lower capacitor charges to 3V

S_1 open S_2 closed lower capacitor charges the upper to same charge (p.d)

Final pld = $^3/_2$ V = 1.5V

Or

Q=CV=3C

S_2 closed charge is shared

CV= Q/2

$V= _{QC/2C} = _{3C/2C}= 1.5V$

27.   Either V1/T1=V2/T2

$_{200/293}$=V2/353

      V2=241ml

Or V= KT

200=293K

K=0.6828

V_2=0.6828 x 353

V_2= 240.96 ml

The other answers for

V_2 240.9/240.94ml

28.   X-rays   Gama Rays

-produced by fast moving electrons   -As a result of disintegration of nucleus

-Produced due to energy changes in

Level of atoms   -due to energy changes with nucleus

                                 Of atoms

-Produced when energy changes in

Electronic structure of atoms   -produced due to change in nucleus

                                 Of atoms.

(Any one comparison give 1mk)

29.   T=Mv2/r   or T sin θ -mv/r   or tanθ $=^{V2}/_{rg}$

$81=MV2/r$ $\theta=86.46$ $V^2=0.499\times86.4$

$81=5v2/0.5$ $r=0.488$ $V^280.63$

$V=9m/s$ $V^2=0.499\times81 \times 0.9981/0.5$ $V=8.979$ m/s

$V^2=80.70$

$V=8.983m/s$

30
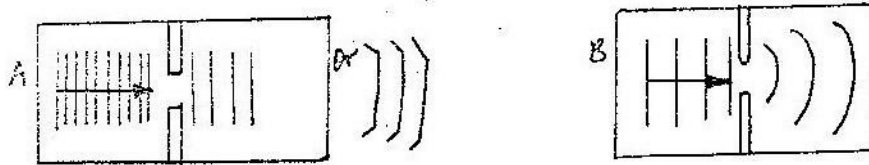
    NB.   At least three ware forms must be drawn.
      Ware length (spacing) must be maintained

31.
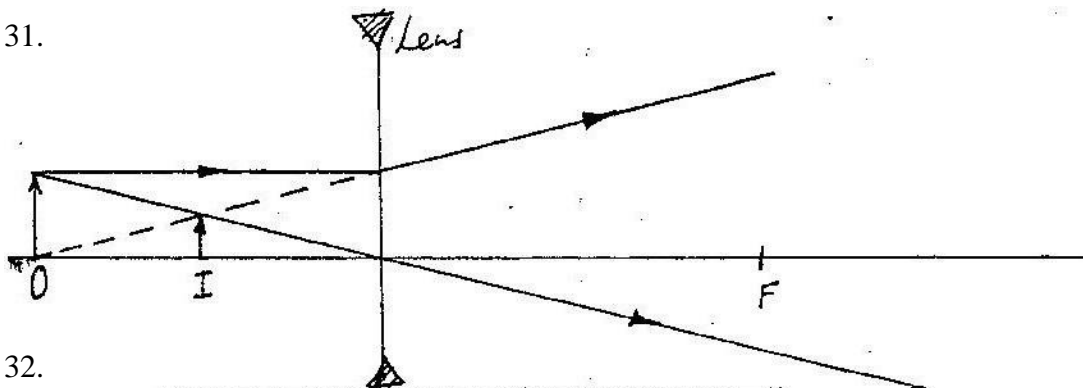
32.
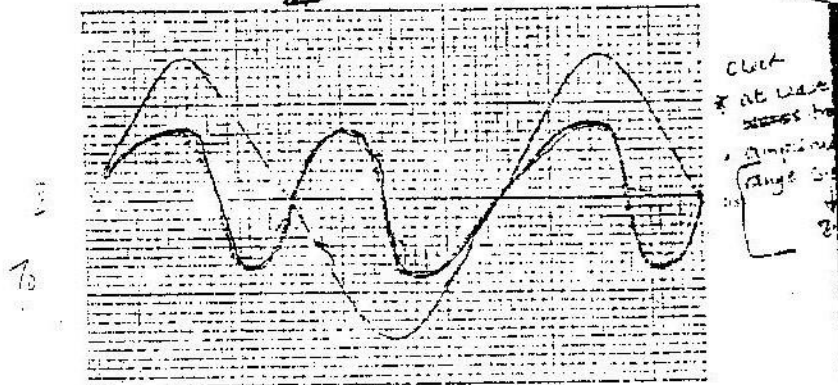
  Check-at least Three complete troughs/Crest
-       Amplitude range 6.5 squares

      8.5 squares

33.   X-rays (Hard)   Soft-rays
          -Shorter Wavelength   -Longer wavelength
          -More energetic   -Less penetrating
     -High Frequency   -Low frequency
          -Produced by high voltage   -Produced by low voltage.
  -Produced by fast moving electrons -Produced by slow moving e
                                           -electrons

34. $hf_0 = W_c = \theta$
     Fo $= W_c/h = 32 \times 16 \times 10/6.62 \times 10{-34}$
          $= 7.73 \times 10^{14} H2$ or $7.732 \times 10^{14} H2$ or $7.734 \times 10^{14} H2$

          $=$ $7.73 \times 10^{14} H2$ or $7.732 \times 10^{14} H2$ or $7.734 \times 10^{14} H_2$

PHYSICS PAPER 2 2004 MARKING SCHEME

1. a)
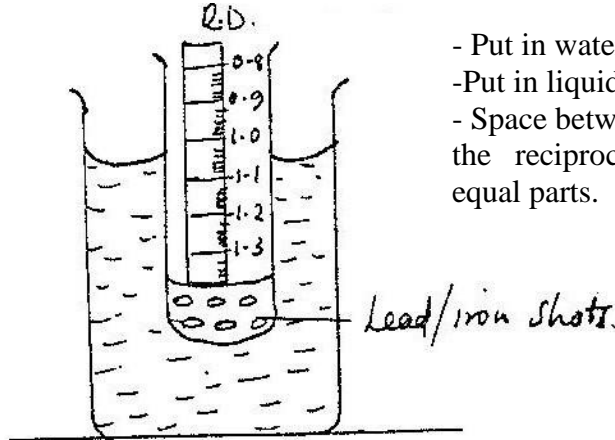
- Put in water and mark
- Put in liquid and Mark
- Space between the 2mks which represent the reciprocals of densities is divided into equal parts.

b)

Figure 1
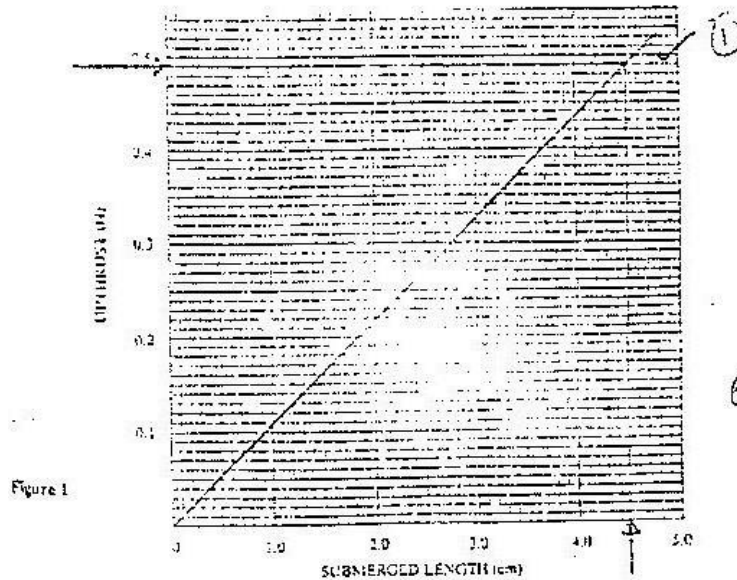
i) Up thrust=0.49N

ii) Up thrust=weight of liquid displaced (Archimedes Principle) = 0.4N

Mass of Liquid   =0.049kg=49g(converting m to kg or g)

Volume of liquid   = 6.2 x 4.5

                           = 27.9cm^3

Density = Mass/Volume   = 4.9/27.9g/cm^3 = 1.760kg/m^3

2. a)   i)   Mass m_1 of melted ice/mass of water. Time t_1 take

   ii)   Q=m1   Vit=ml

              P=$^{ml}/_t$ p=Vi=^{m}l/$_t$

        iii)   Part of heat produced by heater is wasted temperature of ice may be lower than zero.

    b)   i)   When oil drop is placed at the centre of tray, oil spreads on water until it is one molecule thick producing patch (monolayer)

ii)   Volume of drop=$4/3\Omega r^3$ =$\Omega r^2 h$(r=radius of drop)   Volume of
        patch =$\Omega r^2 h$ (h=Thickness of molecule) $4/3\ \Omega r^3 = \Omega r^3/\Omega r^2 h$
        (equating)

   H=$4/3\Omega r3/\Omega r^2+2=4x(0.25)^3/3x(100)^2$ $2.1x10^{-6}$mm

        Because oil does not necessary spread to a monolayer/ one molecule thick
                or Big errors in radius of oil drop and patch or errors in
                measurement of diameter/radius.

iii)   Put oil in a burette and read level, let 100 drops fall and read new
        level, obtain radius using $^4/_3\Pi r^3 =$ Volume or

        Obtain thin wire and make Kink; deep in oil and let drop form on kink use a milimetre
        scale to measure diameter of drop.

3. a) i)   Produce alcohol vapour

            Cools alcohol vapour below condensation temperature or cools air so that
            alcohol vapour condenses.

ii)   Radiation from source ionizes air along its path; alcohol condenses
       around these ions; forming droplets or traces; nature of traces   identifies
       radiation.

iii)   Can detect,__ While electroscope on , can identify nature of radiations, is
       more sensitive.)

  b)i)
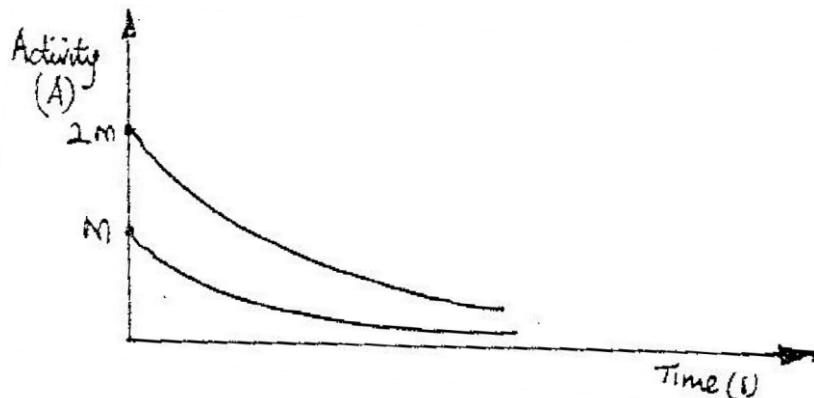
   ii)   Delayed
$1x10^{20}$_____ $\frac{1}{2}$ x 10^{20} - _____ $\frac{1}{4}$ x 10^{20} _____ $1/8$ x 10^{20}
            = 0.125 x 10^{20} = 1.25 x 10^{20}

        Left   1 x 1020 ----------- 1/8 = 0.875 x 1020
    (Subtraction)   = 8.75 x 1019 Atoms.

4. a) i) 0.30cm   ii)
0.65-0.25=0.4 Sec.
iii) f=$1/T$ = $1/0.4$ 2.5 HZ

iv) $V = fx = \frac{V}{x} = \frac{200}{25} = 80\text{cm} = 0.8\text{m}$

i)
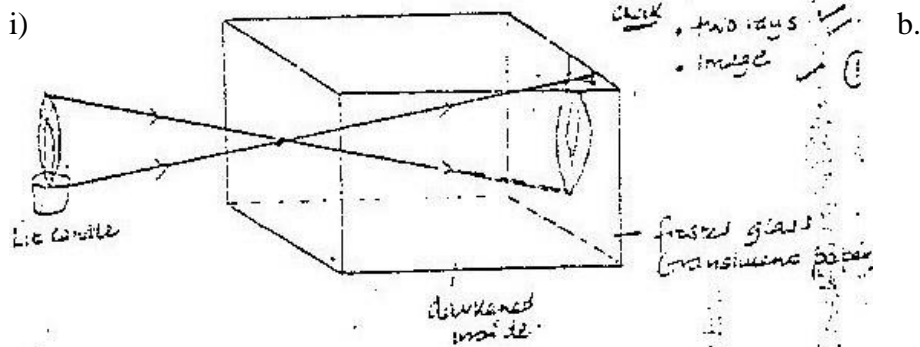
ii) $m = \dfrac{\text{ht of Image}}{\text{ht of object}} = \dfrac{\text{distance of image}}{\text{distance of object}}$

$\frac{h0}{200} = 25/5 \quad h0 = 200 \times 25/5 = 100\text{m}$ 5.

a)   i)   -Increasing me of turns/coils

-Increasing speed (rate) of rotation

b)   In a motion produces Eddy currents. These cause force to act on plate causing damping in B Eddy currents are reduced by slots

c)   Rms = V peak/2

V peak = $12 \times 14142 = 16.97v = 17v$

6   a) One turning fork is loaded with a small amount of plasticine sounding together again one can produce detectable beats.

b)   i) $\frac{1}{f} \times 10^{-3}$ (H_3^{-1}) 3.91 3.5 2.9 2.3 2.1 2..0
12-11 0.65 0.57 0.48 0.39 0.34 0.32

ii)   Slope (Gradient) = $\frac{V}{2}$ = (0.67-0.10)m/4.0-0.75)x $10^{-3}H3^{-1}$
$V = 340 \,^{10m}/_{s}$

iii)   Sound waves entering tube is reflected at water surface forming standing wares with incoming wares, when an antinode is at the mouth loud sound is heard. By adjusting length of air column this can be achieved.

7.   i) Photoelectric effect- is the emission of electrons from a surface when radiated with radiations of sufficient frequency.

Correct circuit must work i.e cathode connected to (-ve) Emphasize on mA cell connected and v in parallel

ii)   Slope = 1.28-0.10/(7.7-4.8) x 10 14

h= Slope x e

= 1.18 x 1.6x 10-19/29 x1014

= 6.51 x 10-34JS

(5.82 – 6.66) x 10-34 JSAlt – Selecting 2 pts from graph

                                          - Substitution in simultaneous equs

                                          -Value of h

                                          -Value of $\varnothing$

    Fs (Threshold Frequency) = 4.55 x1014 (where graph cuts the axis)

                        Range $(4.4 – 4.6)$ x 20^{14}

Work function $\varnothing = 6.51$ x 10^{-34} x 4.55 x 10^{14} =
2.96x 10^{-19}J

Range $(2.56-3.06)$ x 10^{-19}J

c)   ½ mv2 max = hf-$\varnothing$ hf= 6.51 x 10x
3x10^{15} KE max = 1.953 x 10^{-18} – 6.4 x
10^{-19}

              = 1.31 x 10^{-18}

    Range $(1.12 – 1.31)$ x 10^{-18}J

PHYSICS PAPER 232/1 K.C.S.E 2005 MARKING SCHEME

1. Volume of 55 drops   =8ml   accept cm^3
   Or Volume of one drop   =8/55
                                          = $0.1454/0.1455/0.145/0.15cm^3$

2.
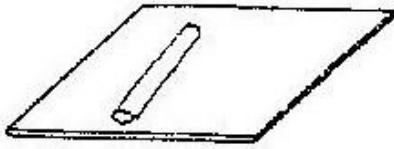
3.   Water in A expands reducing/lowers density
   This reduces/lowers up-thrust on block causing tipping to side A

4.   There is extra/ more/higher/ increased pressure in (b) due to the wooden block increasing
        distance d_2

5.   Reduce/ minimize the transfer of heat by radiation OR Reduce the loss of heat OR
        gain of heat by radiation.

Figure 5
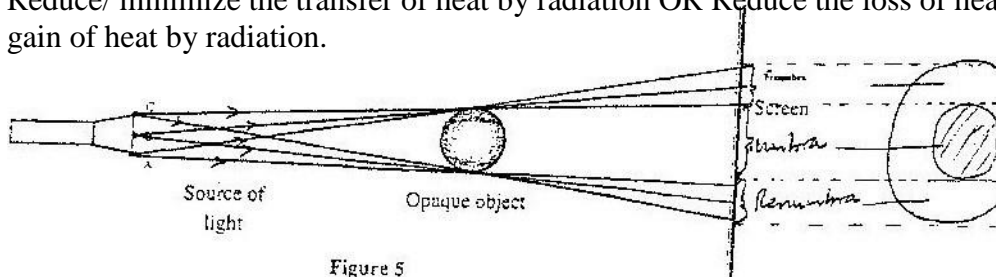
6.   2 sec of rays with arrows labeling of umbra (totally dark) and partly dark
        (Penumbra)

7. A or tube with air

   Gas molecules move faster/quicker than water molecules OR Diffusion of gases is faster/more
   than in water/Grahams law the density of air is less than that of water

At least 3 lines and direction from positive to negative.
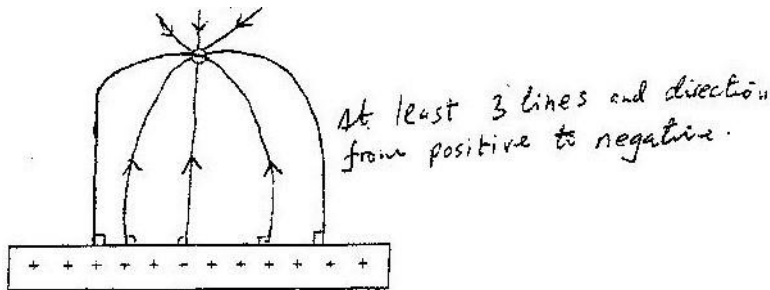
Figure 6 8.

9.   A-Positive
   B-Negative

10.   C- Ammonium jelly/chloride /paste/solution/NH_4Cl
   D-Mixture of carbon and manganese (iv) oxide/MnO_2

11.   In (a) cohesive forces between water molecules are greater than adhesive forces between water and wax while in (b) adhesive forces between water and glass molecules are greater than cohesive forces between water molecules.

12.
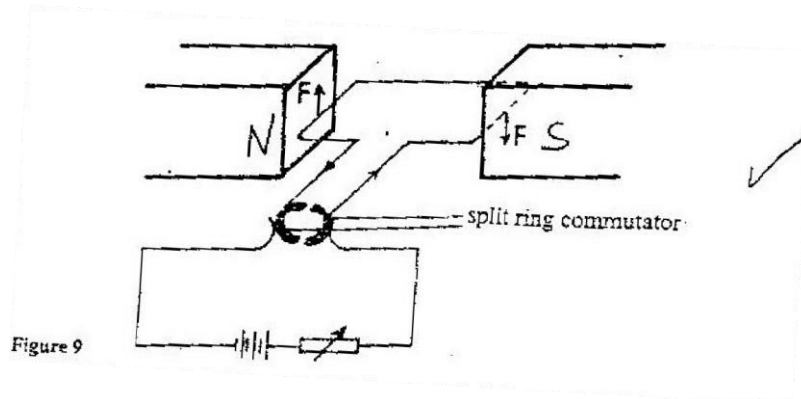
Figure 9

13.   to make the rotation continuous by changing the direction in the coil every half cycle/turn also accept changing direction of the current every half cycle/turn/maintaining the direction of current in field.

14. $S = nt + \frac{1}{2} st^2$ where t is the time to reach the ground

$15 = 0 + \frac{1}{2} St^2$ since the initial velocity is zero and $t = 3 = 1.732$

Horizontal distance= Horizontal speed x t = 300x 3 o 519.62m

15.   Efficiency = Ma/VR OR Ma/VRx 100%

$0.75 \quad = \quad \dfrac{600/400}{V.R}$

V.R   =   2

ACT

M.A $\dfrac{600}{400} = 1.5$

$\dfrac{1.5}{V.R} = 0.75$

V.R=2

16. =4cm or 0.04m from the graph

V = fλ= 5 x 0.04

= 0.2ms-1 or 20cm/s

17 The pitch decreases as the siren falls

The higher the speed away from the observer, the lower the frequency heard and so the lower the pitch hard.

18.

rheostats
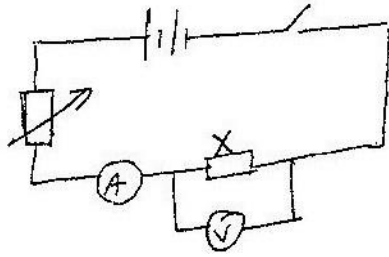
Accept cells in parallel and other symbols of

19   (i)

$$= V^2/\text{-}R$$
$$2500 = 240\ 2/R$$
$$R = 23.04 \text{ or } (23.03)$$

(ii) P=IV

I P/V $= 2500/240 = 10.417A$

V $= V/I = 240/2500$

2500

$= 23.04R\ (23.03)$

(iii) P= IV and V=IR or I^2 R

R= $\dfrac{240 \times 240}{2500}$

R= 23.04R

20. The liquid is boiling

21.

Figure 11

22.

Figure 12

2 Rays: Each correct ray 1 mark
Image position 2.2 +0.1 cm from mirror.
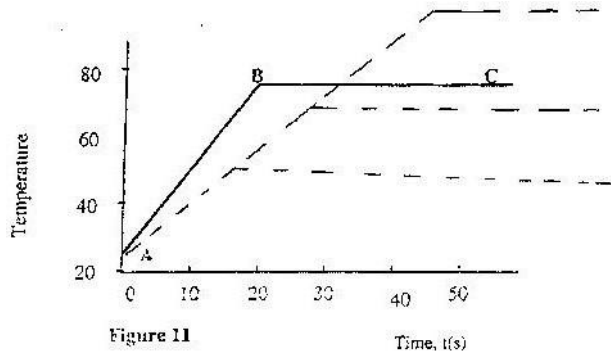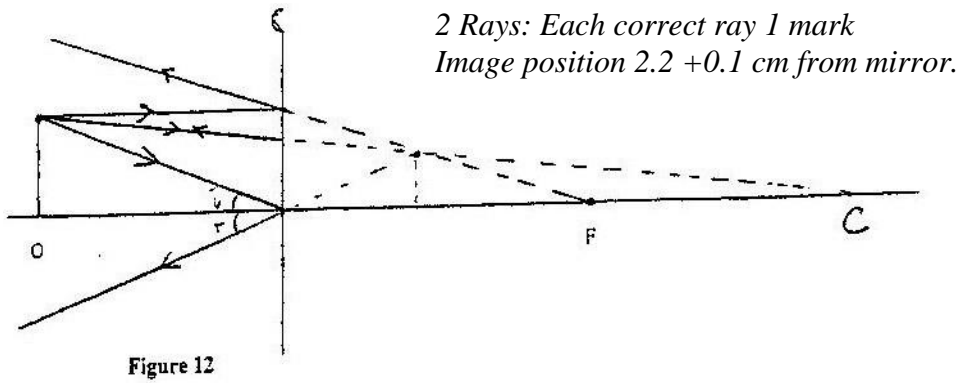
23. C=47^0-10^0 =37^0 + 7=37^0

24. $n = \dfrac{i}{Sin\ C}$ $\dfrac{n}{n}$

$= I = \dfrac{1}{Sin\ 37}$ $\dfrac{1}{0.6018}$

n =1.66/1.551/1.662 Allow TE from question 23 and allow all the marks.

25.
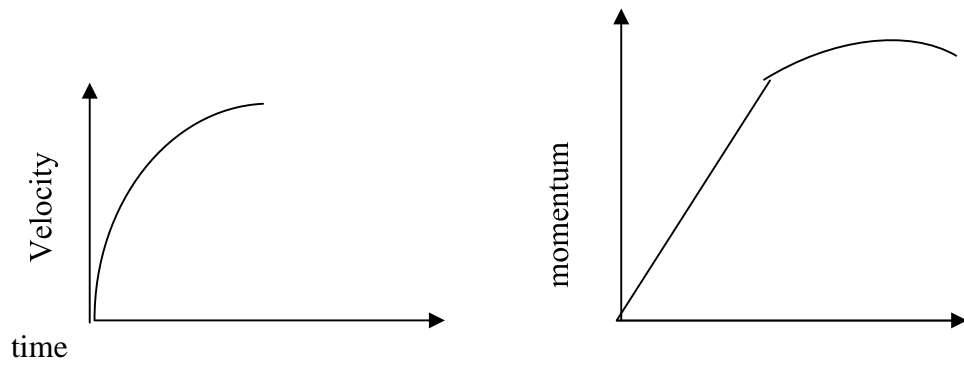
26.   1. At steady rate, the sum of pressure, the potential energy per unit volume and kinetic energy per Unit volume in fluid in a constant.

2.   Provided a finish is non-viscous, incompressible and its flow steamline and
        increase in its velocity produces a corresponding decrease in pressure

3.   When the speed of a fluid increases, the pressure in the fluid decreases and vice versa.

27. 273+ -281.3 = 8.3K (accept – 8.15 was use.)

28.
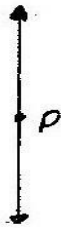
(i)   (ii)
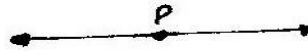
29.   (i) $F = MV^2/r$
                        $4800 = \dfrac{800 \times V^2}{20}$

                        V = 10.95m (allow 10.09 of a slide is used) *Alternatives.*

                (ii) $V_{max} = \sqrt{Mrg}$ but $Fr = M\mu g$
                                                          $M = \dfrac{Fr}{Mg}$ $= \dfrac{4800}{800 \times 10}$
                                                                                      $= 0.6$

                (iii) $F = Ma$
                        $4800 – 800 \times a$, $a = 6m/s^2$
                        $A = v^2/r$
                                OR
                        $6 = V^2/20$
                        $V = 10.95$

                (iv) $F = MR, M = F/R = \dfrac{4800}{800} = 0.6$

                        Tan ɵ = 0.6
                        $V^2 = rg \tan ɵ$
                                OR
                        $V^2 = 20 \times 10 \times 0.6$
                        $V = 10.95$

30.   Image changes from real to virtual
        Image changes from inverted to upright
        Image changes from behind lens to the same side as object.

31.	In excited state the electron is in a higher (outer) energy level. As it falls back it releases energy and may fall in steps releasing different energies

32.	(radiations) (proton) packets energy.
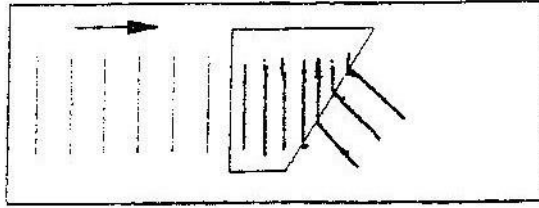
33. To withstand the high temperature (immerse heat) prevent the target from melting due to high temperature or immense heat.

34.	Methylated spirit evaporates faster/highly volatile than water taking latent

35.	heat away faster from the hand.
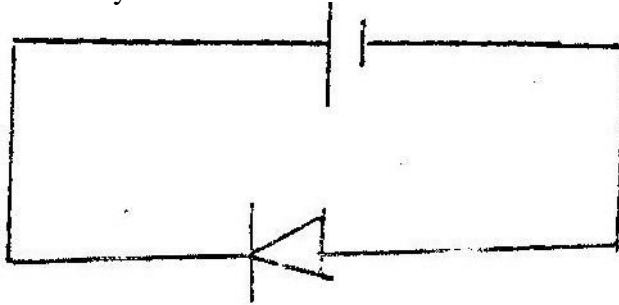
36.	m- Alpha ($\propto$) particle/ radiation/decay		n- Beta (β)

x- Polonium (P_o)

37.	When the switch is closed and nails attracted.
	When the switch is opened, the nail on the iron end drops first.

38.	Conductor allows charge to be distributed/movement/spread.

Figure 18
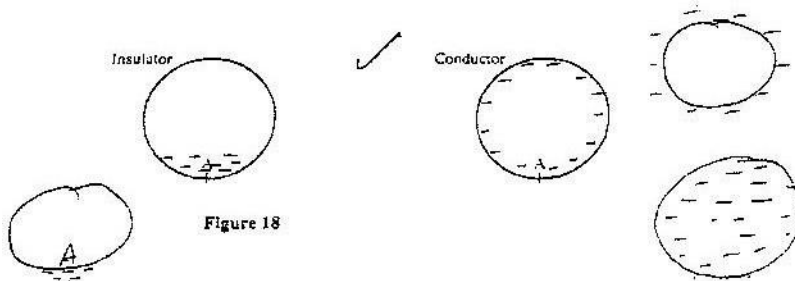
PHYSICS PAPER 232/2 K.C.S.E 2005 MARKING SCHEME

1.
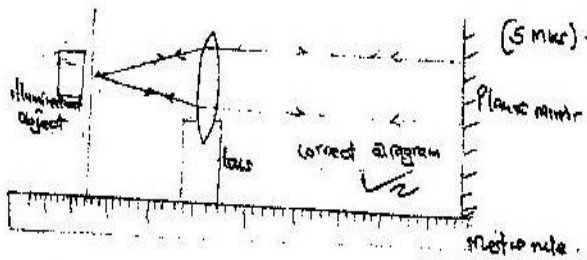
Correct diagram

With distance between lens and object being greater than facal length f; (a) Adjust the lens distance until a sharp image of object is formed besides object

(b) Distance between the lens and the object is measured and repeated several times

(c) The average of the distance is the focal length of the lens

Alt Method: No parallax method is also marked
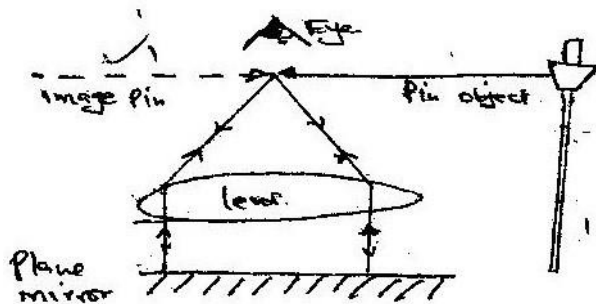
Correct rays 1 mark

Lens on plane mirror 1mark

The pin is adjusted until there is no parallax between the object pin and the pin image. The distance between the lens and pins is the focal length of the lens

(b) On the graph paper
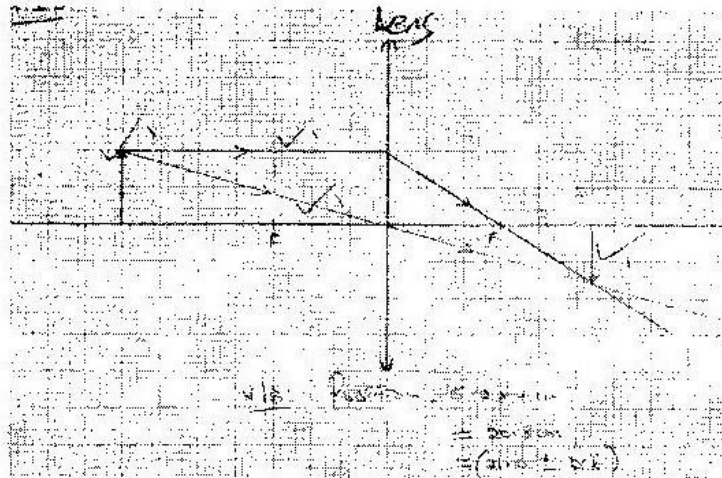
NB: position = 5.2 x 4 cm

= 20.8 cm

= 21 ± 1 cm

(c) (i) Long sightedness/ hypermetropia/ presbiopia

(ii)

2.   (i) Distance traveled by the effort in one revolution $= 2\pi R$

Distance traveled by load $= 2\pi r$

Velocity ratio (V.R) = $\dfrac{\text{effort distance}}{\text{Load distance}} = \dfrac{2\pi R}{2\pi r} = \dfrac{R}{r}$

Therefore V.R = $\dfrac{R}{r}$

(ii) V.R = $\dfrac{R}{R} = \dfrac{8cm}{5\ cm} = 1.6$

Efficiency = $\dfrac{M.A}{V.R} = \dfrac{80}{100}$

But M.A = $\dfrac{\text{Load}}{\text{Effort}} = \dfrac{20N}{E}$

Therefore $\dfrac{20N}{E} \div 1.6 = 0.8$

$\dfrac{20N}{E} \times \dfrac{1}{1.6} = 0.8$

Effort E = 20N

$1.6 \times 0.8 = 15.6\ (3)\ N$

$= 15.6N$

(iii) When the load is large, the effect of friction and weight of the moving parts is negligible

NB friction and weight of moving parts to be mentioned

3.   Total resistance R $= 6\ \Omega + 5\ \Omega + 1\ \Omega = 12\ \Omega$

Total current $1 = {}^V/_R$ Check correct substitution

(ii) P.d across each capacitor $= 1R$

$= 0.25 \times 11$

$$= 2.75v$$

Charge $= CV = 1.4 \times 2.75 \times 10^{-6}$
$$= 3.85 \times 10^{-6}C$$

4.   (a) (i)   Pure Silicon or germanium is doped with prevalent impurity i.e. phosphorous.
      (ii)   Four of the fire valence are paired with semi- conductor electrons
      (iii)   The fifth electron is left unpaired and so conducts
   NB; Doping pairing and conducting must be mentioned

   (b)   (i) In the first half – cycle A is a positive making D_2 and D_3 to be forward
                    biased, so current flows through D_2 R and D_3 to B.
      In the second half – cycle, B is positive making D_4 and D_1 forward biased. The
      current flows through D_4 R and D_1 to A
      (ii)
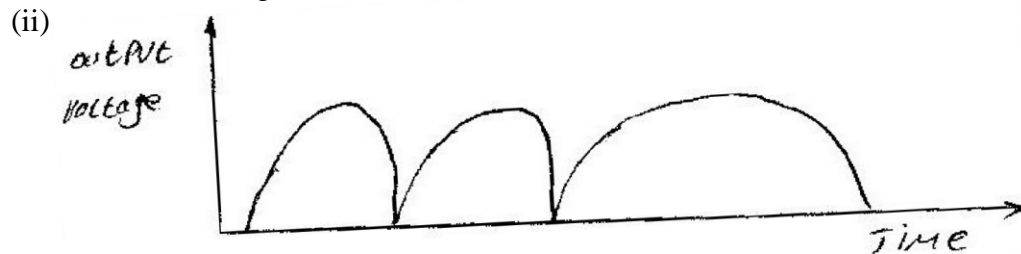
      (iiii)   The capacitor is charged when p.d is rising and stores charge
                It discharges through the resistor when p.d is falling
                This makes output smooth i.e reduces humps

   (c)   hfe $= \Delta Ic$
                       ΔI_B

                  $120 = \underline{\Delta Ic}$
                     20B/A
                  Therefore $\Delta Ic = 120 \times 20$ MA $= 2.4mA$

             Output p.d charge $= R_L \times \Delta IC$
                                 1000R x 2.4 mA
                                 $= 2.3v$

5.   (a)   Extension is directly proportional to the extending force
          provided the elastic limit is not exceeded.
          (b) (i)   3.2 N or 3.3 N

             (ii)   At 5 cm F = 1.45N
                     Stress = F/A = 1.45

$$0.25 \text{ x } 10^{-4}\text{m}^2$$
$$= 5.8 \text{ x } 10^4 \text{ Pa}$$

NB: can work with N/cm²
Accept 5.6 – 5.8) x 104 pa

(iii) Strain = Ext   = 5   = 0.025
        Original length   200

(c) ED and DC

6.   Angular velocity is the ratio of angle covered (angular displacement) to the
      time interval or $W = \dfrac{\theta_2 - \theta_1}{t_2 - t_1}$

(b) $w = \dfrac{300 - 170}{13} = 10 \text{ radis}^{-1}$

10t = 170
T = 17 sec

(a)(i)

Graph's
@ c axo labelling — 1
      line   — 1
      scale   — 1   Total mark
5 plots   — 2   = 5
[3 - 4 plots   — 1]
Below 3   — 0

TENSION T (N) vs ω^2 (rad.s^{-1})
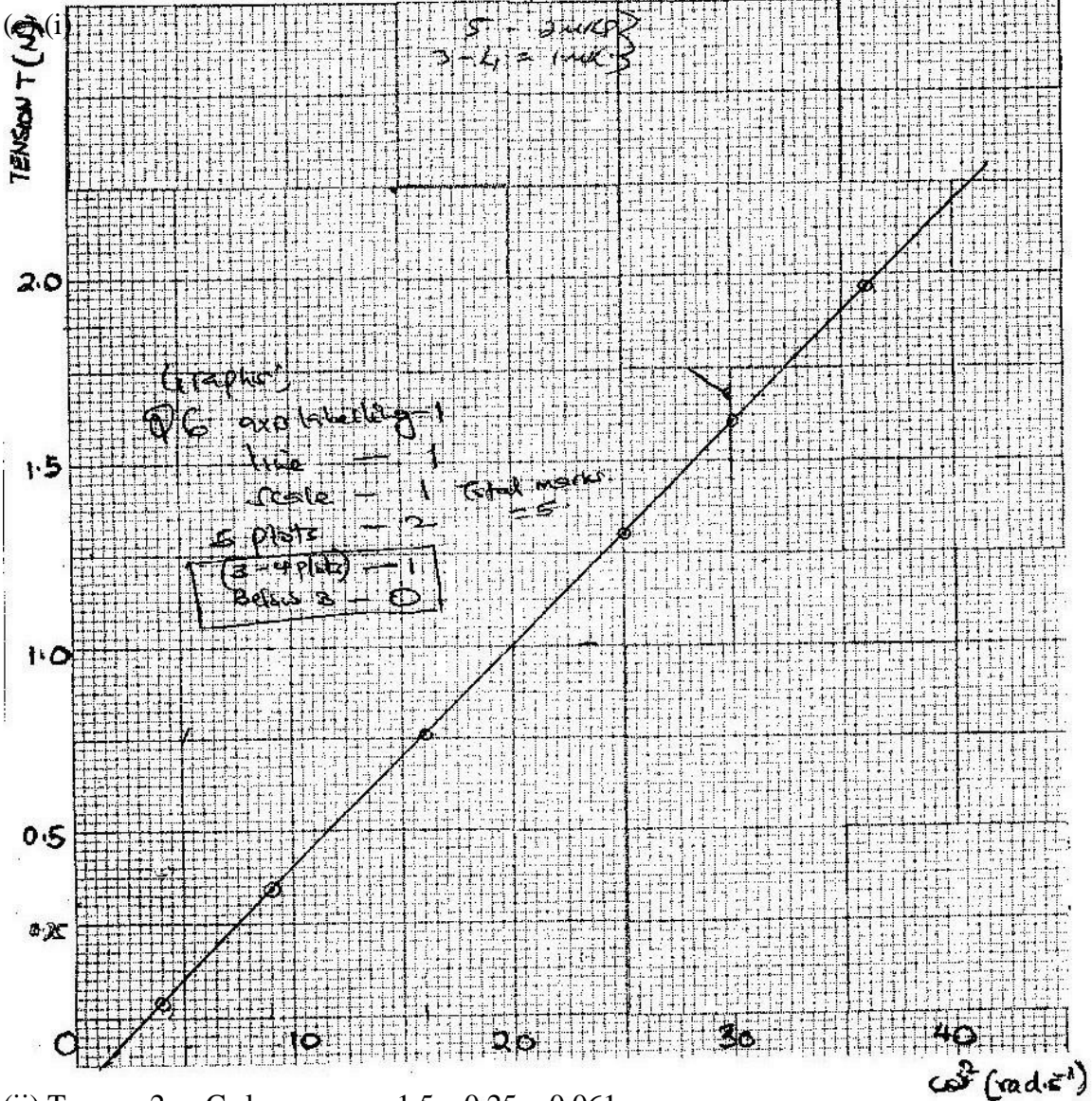
(ii) T = mω^2r – C   slope = mr = $\dfrac{1.5 - 0.25}{28.5 - 8.0}$ = 0.061

M = $\dfrac{0.061}{30 \times 10^{-2}}$ = 0.203 Kg (0.2 kg)

iii) Extent graph (calculate) C = 0.2

It represents frictions between table and body

7. (a) Radioactivity is the spontaneous disintegration of unstable nuclei so as to stabilize
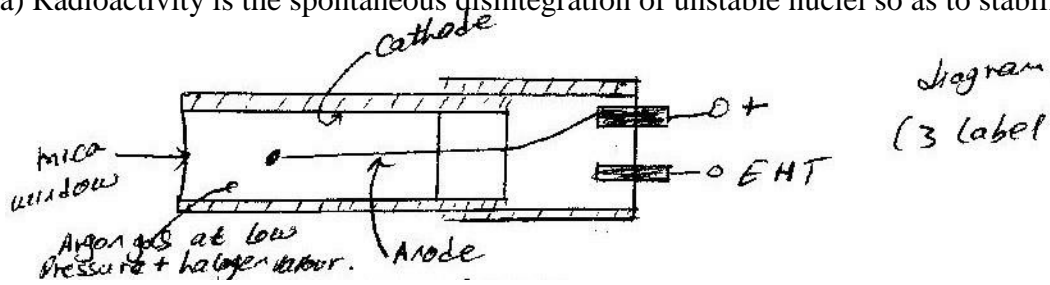
When radiation enters via mica windows, the argon gas is ionized; the electrons going to the anode and positive ions going to cathode; thus a discharge is suddenly obtained (PULSE) between anode and cathode and registered as a particle by counter. The discharge persists for a short time due to the quenching effect of halogen vapour.

(c) Half life average t ½ = 24.5 min (error transfer)

(d) t(min   40   28   16   4

                             $\frac{12}{}$ $\frac{12}{}$ $\frac{12}{}$

       Activity 480   960   1920   3840

       3 half –

lives   t = 4 min

Activity (dissint. per minute).

Time (min.)
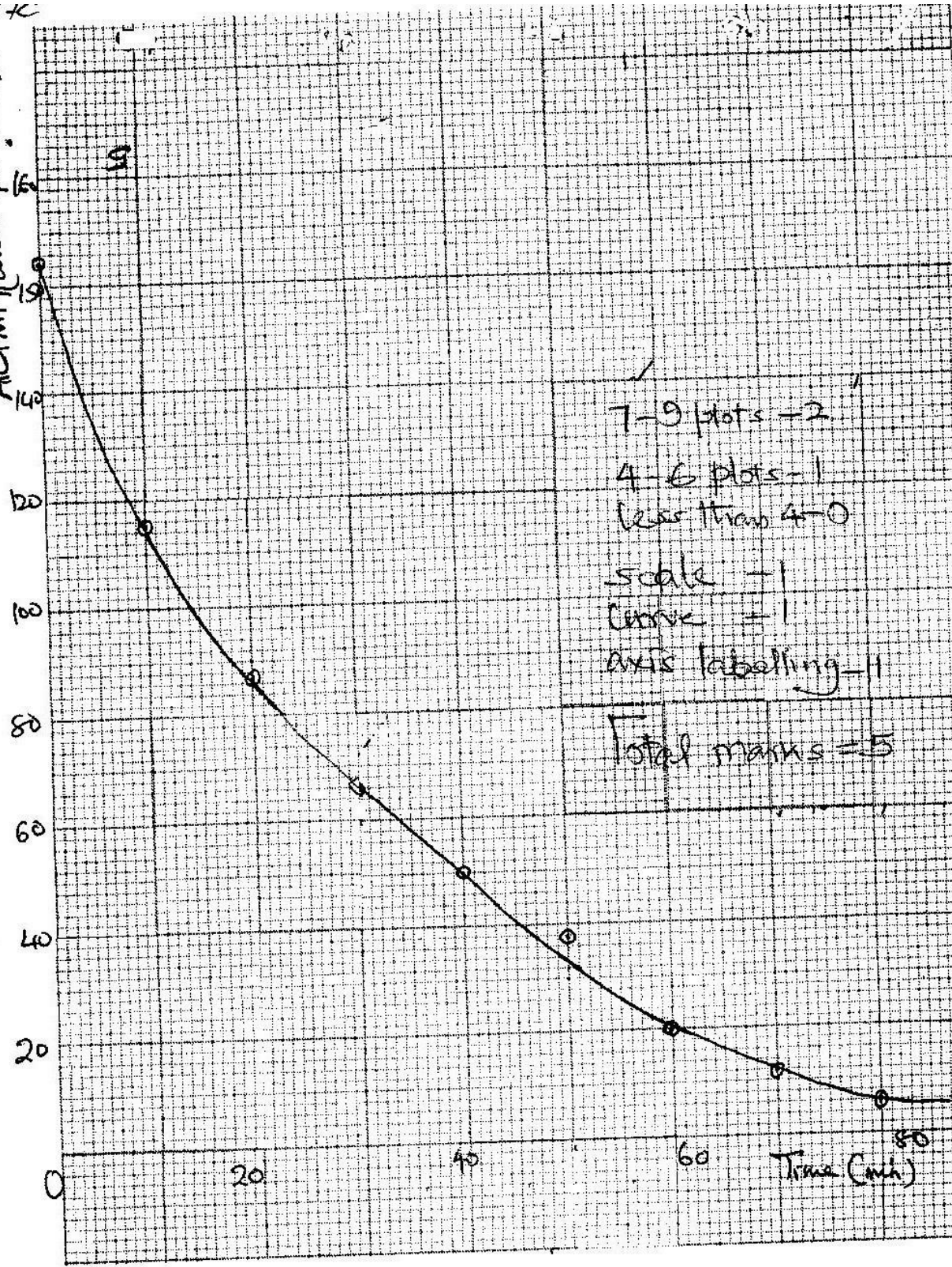
7-9 plots —2
4-6 plots—1
less than 4—0

scale —1
curve —1
axis labelling—1

Total marks =5

1. Volume $= 68cm^3$
    Mass $= 567g$

    Density $= m = \dfrac{567}{V \quad 68}$

    $= 8.34$ gcm^{-3} (3 marks)

2.
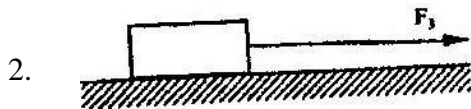
3. Pressure at a point in a fluid is transmitted equally to all points of the fluid and to the walls of the container. (1 mark)

1. On heating, the bimetallic strip bends; This causes the position of the centre of gravity of the section to the left to shift to the right causing imbalance and so tips
    to the right (2 marks)

5. Lower spring extend by 15 cm;
    Upper springs extended by 10 cm;
    Total $= 15 + 10 = 25$ cm (3 marks)

6.
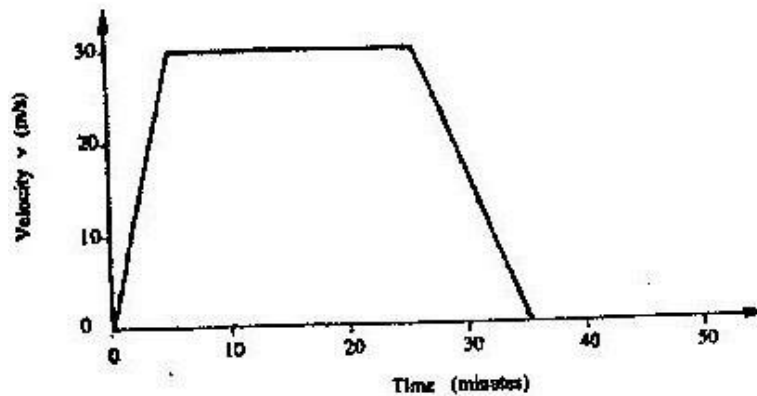
7. Effect of weight of second pulley reduces efficiency of A. Load in B is larger and so effect of friction is less in B increasing efficiency. (1 mark)

8. In B some of the heat is used up in melting the ice, while in A all the heat goes to raise the temperature of the water to reach boiling point (2 marks)

9.
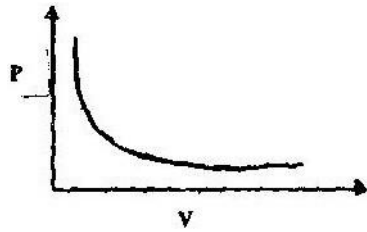
10. At F, radius of curve is smallest and so greatest centripetal force is required to keep luggage on carrier; ($F = \dfrac{mv^2}{R}$)   (2 marks)

11. $A_1V_1 = A_2V_2$; $\pi \times 6^2 \times V_1 = \pi \times 9^2 \times 2$;

$\quad = 4.5 \text{ ms}^{-1}$ (3 marks)

12. As the temperature changes the volumes of the gases in the balloons change differently. The change in volume and hence the change in upthrust will differ.
(2 marks)

13. $Ft = \Delta mv$;

$\quad 720 \times 0.1 = 0.6 \times v$;

$\quad = 120 \text{ms}^{-1}$ (3 marks)

14. (a) In solids the molecules are held in position by intermolecular forces that are very large. In liquids the molecules are able to roll over one another since the forces are smaller   (1 mark)

(b) (i) Volume $= 4/3\ \pi\ r^3$

$\quad\quad = 4/3\ \pi \times 0.025^3$

$\quad\quad = 6.54 \times 10^{-5} \text{ cm}^3$ (2 marks)

(ii)   Area $= \pi\ r^2$

$\quad\quad = \pi \times 10^2$

$\quad\quad = 314 \text{ cm}^2$ (2 marks)

(iii)   A x diameter of molecule $=$ volume;

$\quad\quad 314 \times d = 6.54 \times 10^{-5}$

$\quad\quad d = 2.1 \times 10^{-7} \text{ cm}$ (3 marks)

(c) (i) The oil is assumed to have spread to thickness of one molecule (1 mark)

(ii)   Sources of errors:

$\quad\quad\quad$ Getting the right oil

$\quad\quad\quad$ Measuring drop diameter

Measuring diameter of patch

Getting drop of a right size   (any 2 x 1 = 2 marks)

15.   (a)

Make diameter of springs different

Make number of turns per unit length different

Make lengths of springs different   (any 2 x 1 = 2 marks)

   (b) (i) 2.2 N ; 2.2 ± 0.1

   (c) (ii) Spring constant = gradient

$= \dfrac{2.1}{4.1 \times 10^{-2}}$

$= 5/Nm^{-1}$

For each spring k= 102 Nm^{-1} (1 mark)

(iii) Work = Area under graph

$= \dfrac{0.75 + 1.65}{2} \times 1.7 \times 10^{-2}$

$= 2.04 \times 10^{-2}$ J   (3 marks)

16.   (a) A gas that obeys the gas laws perfectly   (1 mark)

   (b)   (i) By changing pressure very slowly or by allowing gas to go to original
           temperature after each change   (1 mark)

       (ii) k is slope of graph

$K = \dfrac{(2.9 - 0) \times 10^{5}}{(3.5 - 0) \times 10^{6}}$

K = 0.083 NM

        (iii) Work done on the gas   (4 marks)

        (iv) Use dry gas   (1 mark)

Make very small changes in pressure   (any 1 x 1 = marks)

   (c) Since pressure is constant

$\dfrac{V_1}{T_1} = \dfrac{V_2}{T_2}$

$T_1 = 273 + 37 = 310k$

$T_2 = 273 + 67 = 340k$

$\dfrac{4000}{310} = \dfrac{V_2}{340}$

$V_2 = 4387$ litres   (4 marks)

17. (a) A body fully or partially immersed in a fluid experiences an upthrust equal to the weight of the fluid displaced   (1 mark)

(b) (i)

Weight in air   Weight in water   Weight in spirit
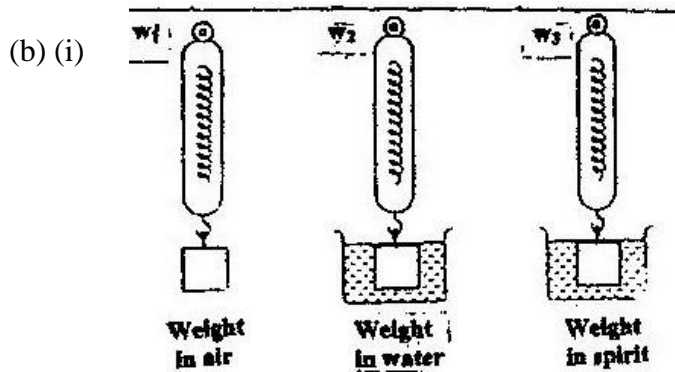
(ii)   100g: $U_w = 0.12N$ $U_s = 0.09N$
        150g: $U_w = 0.18N$ $U_s = 0.14N$
        200g: $U_w = 0.24N$ $U_s = 0.18N$ (2 marks)

(ii) Relative density = upthrust in spirit
                    Upthrust in water

        = average $\left(\dfrac{0.09}{0.12}, \quad \dfrac{0.14}{0.18}, \quad \dfrac{0.18}{0.24} \right)$

        = 0.76   (3 marks)

(c) Weight of air displaced $= \rho V g$
                    1.25 x 1.2 x 10N
                    =15N;
                    = upthrust

    Weight of helium $= \rho V g$
                    0.18 x 1.2 x 10N
                = 2.18N;
    Weight of fabric = 3N
    Forces downwards   = 2.16 + 3 = 5.16N;
    Tension   = 15 – 5.16
                = 9.84 N   (4 marks)

18. (a) Specific latent heat of fusion of a substance is the quantity of heat required to melt completely one kilogram of the substance (at its normal melting point) to liquid without change of temperature.   (1 mark)

        (b) (i) $Q = ml$

$= 0.02 \times 334000J$

$= 6680J$ (2 marks)

(ii) $Q = mc\theta$

$= 0.02 \times 4200 \ (T-0)$

$= 84 \ TJ$ (2 marks)

(iii) Heat lost by warm water

$= mc\theta$

$= 0.2 \times 4200 \ (60- T)$

Heat lost by calorimeter $= mc\theta$

$0.08 \times 900 \ (600 – T)$ (2 marks)

(iv) Heat gained = Heat lost

$6680 + 84T = 0.2 \times 4200 \ (60 –T) + 0.08 \times 900 \ (60-T)$

$6680 + 84T = 50400 – 84OT + 4320 – 72T$

$996T = 48040$

$T = 48.2^0C$ (4 marks)

K.C.S.E 2006: MARKING SCHEME
PHYSICS PAPER 2

1.
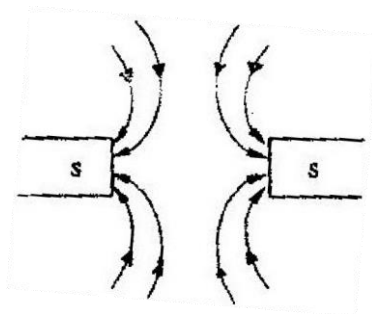
2. Magnification =

Im age dist = ht of image

Object dist   height of object

10   = 16

3.

600   h

H = 9.6 m   Charge concentration at tip   (3 marks)
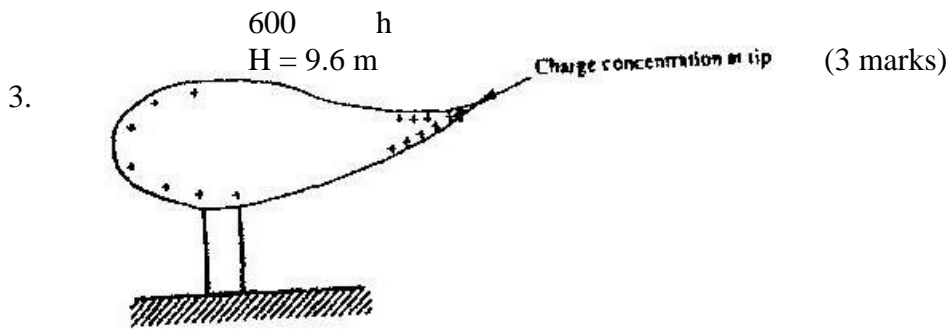
4. To allow escape of gases (H_2 and O_2) from battery

5. (i) Longitudinal wave
    (ii) Length of the spring, from one point to a similar point of vibration

6.

7.
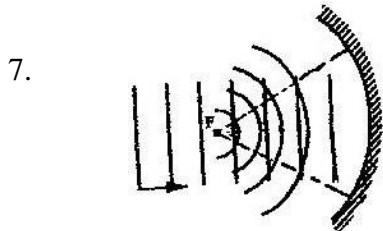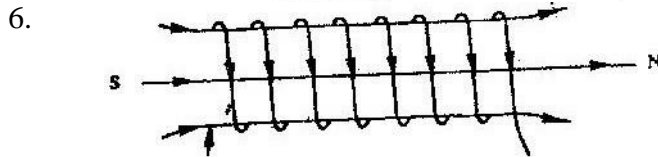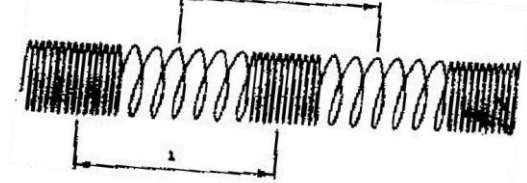
Reflected waves are curved. Either converging circular reflected waves.
Converging to F; OR two perpendicular lines from the surface of one of the
curves meeting at F.   (2 marks)

8. Distance moved by sound waves = 2x;
    2x = speed x time

    X = $\frac{330 \times 1.8}{2}$

    = 297m   (3 marks)

9.

Constant temperature

No mechanical strain   (1 mark)

10.   Work function of a metal is the minimum energy required to set free (release) an electron
from the surface of the metal   (1 mark)

11.   Threshold frequency K.E of electron = 0 hence velocity of the electron would be zero; (No motion) thus photo electric effect cannot be observed (2 marks)
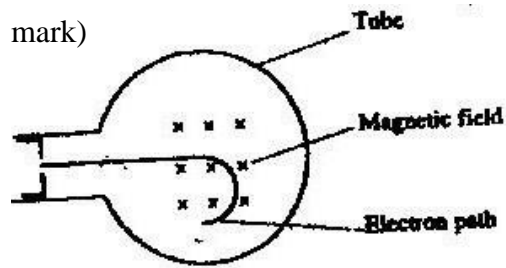
12.   Straight beam from gun to screen OR no gravitational effect on the beam. (1 mark)

13.

14.   Resulting X- rays have shorter wave length/ hard/ high frequency because electrons have higher K.E   (2 marks)

15. $a = 234 + 4 = 238$

    $b =$ $92 - 2 = 90$

    (2   marks)

16.
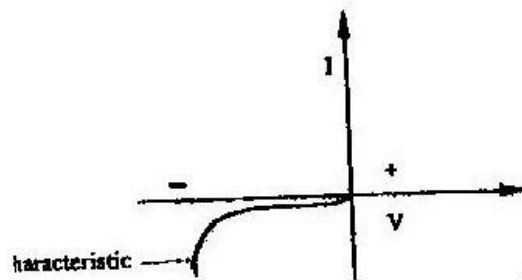
17. (a)   Charge Q, on C_1 is given by

        Charge $Q_1 = C_1 V$;

        $= 0.3 \ \mu F \ x \ 4.5$;

        $1.35\mu C$;   (3 marks)

(b) $C_T = C_1 + C_2$;

        $= (0.3 + 0.5) \ \mu F$

        $= 0.8 \ \mu F$ (2 marks)

(c)   (i) 4.5v   (1 mark)

    (ii) Observed on voltmeter p.d drops to less than 4.5 (1 mark)

    (iii) The drop of p.d in C (ii) is because the charge on C_1 is distributed to C_2. Since values of C_1 and C_2 remain constant, when Q on C_1 reduces, then $Q = C_1 V$ implies V must reduce also, hence voltmeter reading

reduced.

18. (a) (i)
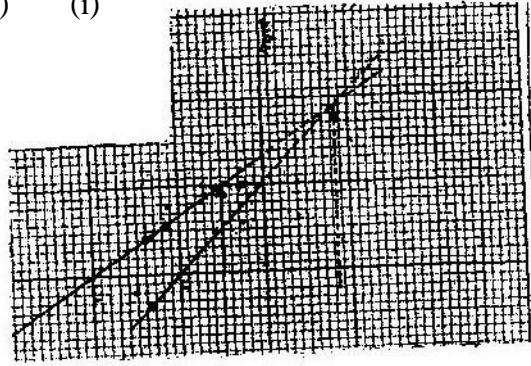
(ii) Image at 10cm from mirror (using scale) (2 marks)

(iii) Magnification

$$\frac{\text{Size of image}}{\text{Size of object}} = \frac{4.0 \text{ cm}}{2.0 \text{ cm}} = 2$$

OR

$$\frac{\text{Image distance}}{\text{Object distance}} = \frac{2.0 \text{ cm}}{1.0 \text{ cm}} = 2$$

(b) (i) I   Image distance

$$\frac{I}{f} = \frac{I}{v}$$

$+ \frac{I}{u}$

$$\frac{I}{v} = \frac{1}{5} - \frac{I}{20} = \frac{3}{20}$$

$$v = \frac{20}{3} = 6.67 \text{ cm}$$

II   Magnification

$$= \frac{v}{u} = \frac{6.67}{20} = 0.33;$$ (2 marks)

(ii) Image characteristics: real, inverted, diminished, less bright

(2 marks)

1. (a) Refr. Index $n = \frac{\sin i}{r}$ $\frac{\text{velocity in air}}{\text{velocity in substance}}$ Sin

OR

$n = \frac{\text{Real depth}}{\text{Apparent depth}}$ (1 mark)

(b)   (i)
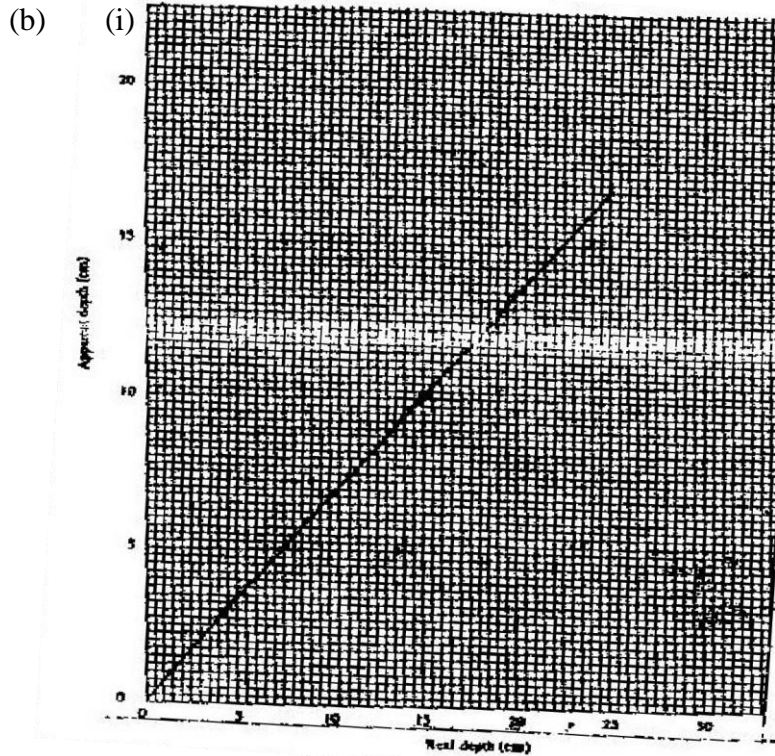
(ii) Slope of graph = $^{16}/_{24}$ = 2/3

Refr. Index n = $\dfrac{Real}{Apparent}$ = $\dfrac{I}{slope}$

$= \dfrac{3}{2} = 1.5$ (4 marks)

(c) n= $\dfrac{\sin 90;}{\operatorname{Sin}\theta}$ ⇒sin θ = $\dfrac{1;}{16}$ ⇒θ = 38.7^0 = critical angle   (3 marks)

20. (a) (i) P = slip rings
          Q = Brushes   (2 marks)

(ii) 0-90 magnetic flux cut changes from high to low. (decreasing);
90 – 180 magnetic flux change from low to high. (increasing) At each peak 0 – 180 magnetic flux change is maximum though in different directions, (position of coil).   (3 marks)

(b) (i) $\dfrac{\epsilon_s}{\epsilon_p} = \dfrac{N_s}{N_p}$; ⇒$\epsilon_s$ = 240 x $\dfrac{60}{1200}$ = 12 volts   (2 marks)

(ii) $P_p = P_s$ (power) or $l_s V_s = l_p V_p$

$$I_S = I_p \frac{V_p}{V_s} = 0.5 \times \frac{240}{12}; = 10A;$$

(3 marks)

21. (a) (i)   P   = Ring circuit   (1 mark)

X   = Neutral (point or terminal)

Y   = Live (point or terminal)   (2 marks)

(ii)   I   Purpose of R – or fuse; is a safety element in a circuit against excess current

II   R is connected to Y but not X to ensure that when it breaks a circuit any gadget/ appliance connected does not remain live.   (1 mark)

(iii)   Earthing is necessary in such a circuit to guard against electric shocks.

(b)   Cost of electricity

1.5 kw x 30h x 8 Kshs = Kshs 360/=

KCSE 2007 PHYSICS MARKING SCHEME
PAPER 1

1.	$0.562 - 0.012 = 0.550$ cm $5.62 - 0.12 = 0.55$ cm 5.5 mm	Or $5.62 - 0.12$ 5.5	1 mk
2.	Density $p = m/r$ $D = m/v = \dfrac{1.75g}{(0.550)^3 cm}$ formula substitution $= 10.5 g/cm^3$ answer $10500 kg/m^3$	- accept g/mm^3 - allow transfer of error	3 mks
3.	$V_2 V_4 V_1 V_3$ (correct order)		1 mk
4.	Sucking air reduces pressure inside the tube; so that atmosphere pressure forces the liquid up the tube		1 mk
5.	Look for symbols $P_A gh_A = Pagh_B$ formula or correct $P_{Ag} \times 24 = 1200 g \times 16$ substitute substitution $P_a = 800$ kgm^{-3} answer answer		3 mks
6.	Radiation		1 mk
7.	X_2 is made greater than X_1 / X_1 is made shon X_2 X_2 is made larger than X_1 Since B receives radiation at a higher rate, it must be moved Further from sources for rates to be equal: since A receives radiation at a lower rate than B. $F_1 d_1 = f_2 d_2$		2 mks
8.	Taking moments and equating clockwise movements $=$ anticlock movements 0.6 N $x \ 7cm = mg \ N \times 30cm$; $W =$ $mg = 1.4$ N:		3 mks
9.	Distance $=$ area under curve between 0 and 3. 0 second; $= 120 \times 3 \times 0.2 = 72M$: Trapezium Rule (3 trapeziua) Mid $–$ ordinateral $= 70.5$		
10.	Acceleration $=$ slope of graph at $t = 4.0$ s Or $a = \dfrac{\Delta V}{\Delta t}$ or trapezium rule (6 trapezia) $= 72m$ $= \dfrac{16 \times 3}{17 \times 0.2} = 14.11$ m/S^2 $(12 – 14.5)$ m/s^2 or trapezium (1) or 1 triangle $= 76.5m$		2 mks
11.	Pressure, impurities::		2 mks

12.	Kelvin (K) in words (one triangle used follow)	2 mks
13.	The pressure of a fixed mass of a gas is directly proportional to its absolute (Kelvin) temperature provided the volume is kept constant P & T volume constant	1 mk
14.	Since the quantity of water A is smaller, heat produces grater change of temperature in A; This causes greater expansion causing the cork of temperature in A; this cause greater expansion causing the cork to sink	
	further. Per unit volume/ greater decrease in density/ lower density in A	
	SECTION B	
15 (a)	**Smoke particles** Show the behavior or movement of air molecule Smoke particles are larger than air molecules/ visible and light enough to move when bombarded by air molecules	2 mks)
	Lens Focuses the light from the lamp on the smoke particle; causing them to be observable **Microscope** Enlarge the smoke particle So that they are visible/ magnifies smoke particles	2 mks) 2 mks)
(b)	Smoke particle move randomly / zigzag / haphazardly Air molecules bombard the smoke particles/ knock, hit Air molecules are in random motion	3 mks
(c)	The speed of motion of smoke particles will be observed to be higher smocking particles move faster, speed increases, increased random motion	1 mk
16(a)	A body at rest or motion at uniform velocity tends to stay in that state unless acted on by an unbalanced force/ compelled by some external force to act otherwise.	1 mk
(b) (i)	$S = \dfrac{\Delta u}{Nd}$ or $\dfrac{98.75 - 0}{16 - 0}$ $(m/s)^2$ $= 6.17 ms^{-2}$	3 mks
ii iii	$20k = s = 6.09$ depend on (i) $K = \dfrac{6.09}{20}$ $= 0.304$ Increase in roughness increases k and vice versa Uniform speed in a straight line – uniform velocity	2 mks 1 mk

(c)	Applying equation $V^2 - u^2 = 2as$ $V^2 - 0 = 2 \times 1.2 \times 400$ Momentum $p = mv$ $= 800 \times \sqrt{2 \times 1.2 \times 400}$ $= 24787.07$ $= 24790$	4 mks
17.(a)	Quantity of heat required to change completely into vapour 1 kg of a substance as its normal boiling point without change of temperature; Quantity of heat required to change a unit mass of a substance from liquid to vapour without change in temp	1 mk
(b) (i)	So that it vaporizes readily/ easily	1 mk
(ii)	In the freezing compartment the pressure in the volatile liquid lowered	
	suddenly by increasing the diameter of the tube causing vaporization in the cooling finns, the pressure is increased by the compression pump and heat lost to the outside causing condensation. Acquires heat of the surrounding causing the liquid to vaporize	
(iii)	When the volatile liquid evaporates, it takes away heat of vaporization to form the freezing compartment, reducing the temperature of the latter. This heat is carried away and disputed at the cooling finns where the vapour is compressed to condensation giving up heat of vaporization	
(iv)	Reduces rate of heat transfer to or from outside (insulates) Reduces / minimizes, rate Minimizes conduction/ convertion of heat transfer	1 mk
(c) (i)	Heat lost $= ml_v + mc \, \Delta\theta$ = formula Heat lost by steam $= 0.003 \times 2.26 \times 106 =$ substitution Heat lost by steam water $= 0.003 \times 4200 (100-T)$ Total $= 6780 + 126 (100 - T)$ $= 8040 - 12.6T$	3 mks
(ii)	Heat gained by water $= MC \, \theta$ $= 0.4 \times 4200 (T- 10)$ Or $= 1680 \, T - 16800$	1 mk
(iii)	Heat lost $=$ heat gained OR correct substitute $1680 (T - 10) = 6780 \; 12.6 (100-T)$; Allow transfer of error $1680T - 16800 = 6780 + 1260 - 12.6T$ $1692 .6 \, T = 24840$	1 mk

	$T = 14.7^0C$ 14.68	15 mks
18.(a)	Rate of change of velocity towards the centre Acceleration directed towards the centre of the motion Acceleration towards the centre of orbit/ nature of surface	2 mks
(b) (i)	Roughness / smoothness of surface. Radius of path/ angular velocity/ speed (Any two)	2 mks
(ii)	II) $_A$> (l)$_B$ (l)$_C$ (correct order)	1 mk
(c)	$F = m(l)^2 r$ $F = MV^2$ $V=rw$ For thread to cut r $w = \underline{3.049}$ F= 5.6 N $5.6 = 0.2 \times v^2$ 0.15 (l) = 13.7 radius $V^2 = 4.2$ = 13.66 13.66 v = 2.0494	4 mks
19 (a)	A floating body displaces its own weight of the fluid on which it floats	
(b)(i)	To enable the hydrometer float upright / vertically	1 mk
(ii)	Making the stem thinner/ narrower (reject bulb)	1 mk
(iii)	Float hydrometer on water and on liquid of known density in turn and marks levels; divide proportionally and extend on either side/ equal parts	2 mks
(c)i)	Tension; upthrust; weight	3 mks
(ii)	As water is added, upthrust and tension increase; reaching maximum when cork is covered and staying constant then after weight remains unchanged as water is added	3 mks 11mks

K.C.S.E 2007 PHYSICS MARKING SCHEME
PAPER 2

1.
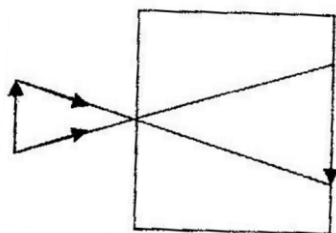
Rays
Image and object must be labeled
Image must be enlarged

Alkaline cell lasts longer than lead acid cell/ remain unchanged longer
Alkaline cell is more rugged than lead acid cell/ robust/ can withstand rough

2.

handling
Alkaline cell is lighter than lead – acid cell (any one   (1 mark)

3. X is north   (both correct)
   Y is north   (1 mark)

4.
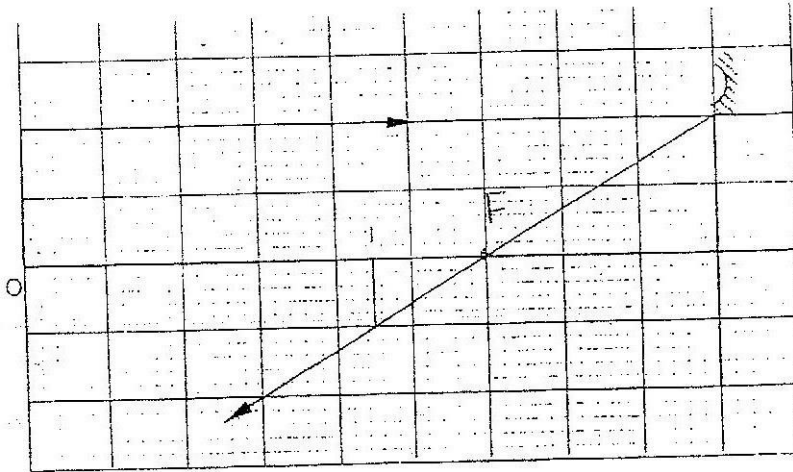
Correct rays
F marked

5. $T = \dfrac{0.007S}{3}$ (T)

$F = {}^1/_T = 3/0.007$ (f)
= 429H$_z$ 428.57 − 434. 80H$_2$ (3 marks)

6.

Less bonding   Higher bonding

7.

Refracted away from normal

8. $l = 1.5$: or $l = E$

$$R + r \qquad R + r$$
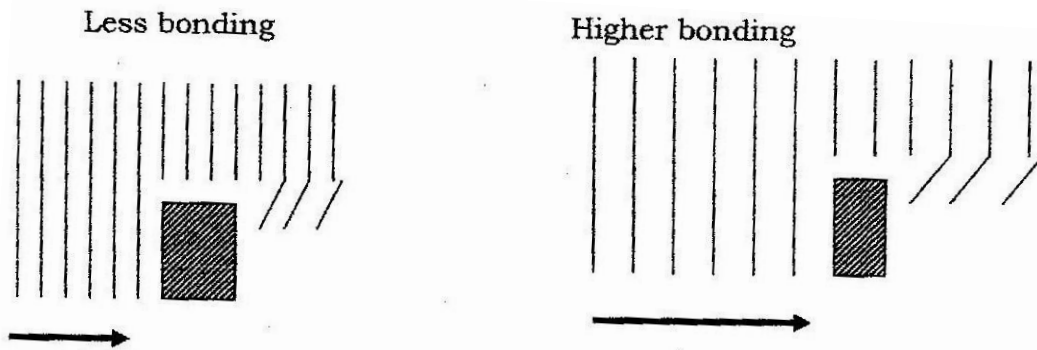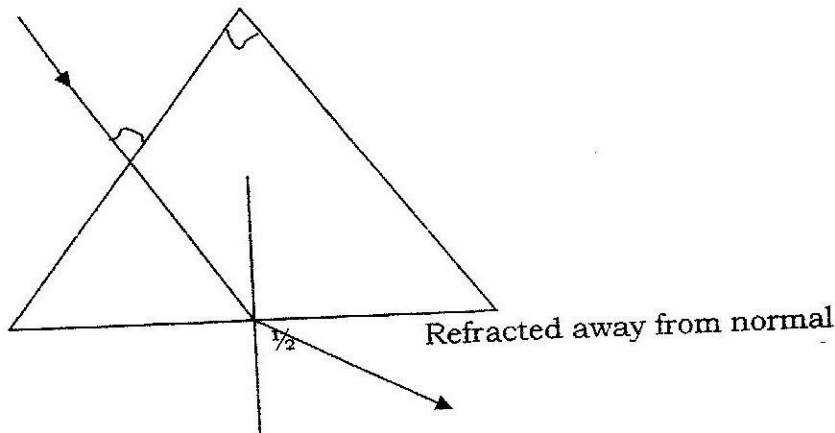
$$0.13 = \underline{1.5}$$
$$\qquad\qquad 10 + r$$

$R + 1.5\Omega;$

$R = 1.5\ \Omega$ \qquad (3 marks)

9. \qquad $R_1 = \dfrac{V^2}{P}$ \qquad\qquad $R_2 = \dfrac{V_2;}{8P}$

$\dfrac{R_1}{R_2} = \dfrac{V^2}{P} \times \dfrac{8P}{V^2}$

$= 8$ \qquad (3 marks)

10. \qquad The process of the eye lens being adjusted to focus objects at various distances

\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad (1 mark)

11.
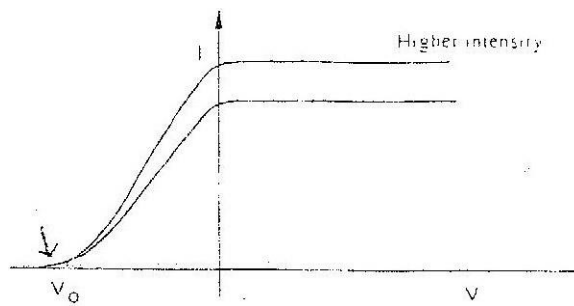
12. \qquad The higher the intensity implies greater number of electrons and hence higher saturation current \qquad\qquad\qquad\qquad (1 mark)

13. \qquad $a = 234$

\qquad $b = 82$

14.

15 (a)

ignore circle

V_o

R

Correct circuit ::
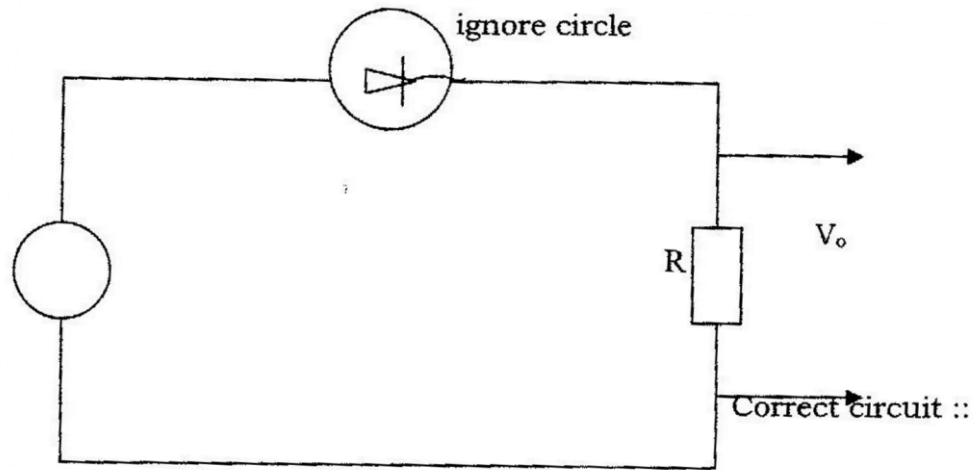
The ratio of the pd across the ends of a metal conductor to the current passing through it is a constant (conditions must be given)

Also $V/_1 = R$

(b) (i) It does not obey Ohm's law; because the current – voltage graph is not linear through line origin / directly proportionate

(i) Resistance $= V/_1 =$ inverse of slope ; gradient $= \dfrac{\Delta 1}{\Delta V}$

$= \dfrac{(0.74 - 0.70)\ V}{(80 - 50)\ mA}$

$= \dfrac{0.4V}{30 \times 10^{-3}\ A}$

$= 1.33\Omega$

$1.20 - 1.45\ \Omega$ (range)　　　　　　　　　　　(3 marks)

(iii) From the graph current flowing when pd is 0.70 is 60.MA

Pd across $R = 6.0 - 0.7 = 5.3v$

$R = \dfrac{5.3\ V}{36mA}$

$= 147\Omega$

$= 139.5 - 151.\ 4\Omega$　　　　　　　　　　　(3 marks)

(c) Parallel circuit　　$1/30 + 1/20 = 5/60$ or $60/50$

$R = 12\ \Omega$

Total resistance $= 10 + 12 = 22\Omega$　　　　　　(2 marks)

(ii) $1 = V/_R = {}^{2.1}/_{22} = 0.095A$　　　　　　　　　(1 mark)]

(iii) V = lR   = 10 x $\underline{2.1}$
                                                22
                                          = 0.95

16.

Correct sketch

Correct lens
Correct effect
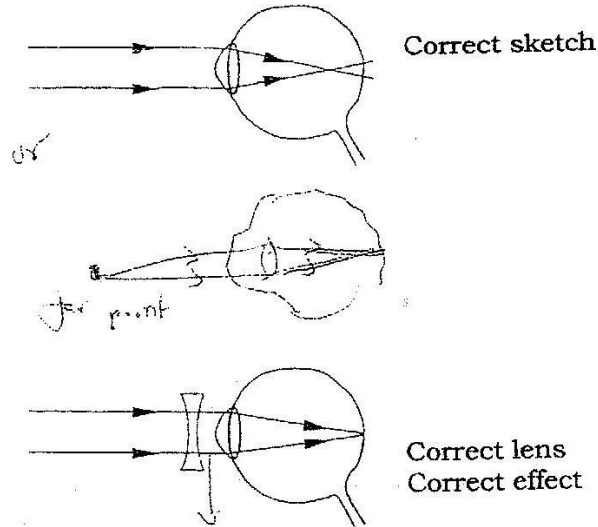
Diverging effects should be seen   (2 marks)

(b)   (i)   A   diaphragm
                   B   Film   (2 marks)
       (ii)   The distance between the lens and the film / object is adjusted; so that
               the image is formed on the film
               Adjust the shutter space/ adjust the aperture   (2 marks)
       (iii)   Shutter – opens for some given time to allow rays from the object to fall
               on the film creating the image impression/ exposure time is varied A
                   (diaphragm) controls intensity of light entering the camera (3mks)
               B   (film) – coated with light sensitive components which react with
                        ight to crate the impression register/ recorded or where image is
                        formed.
(c)   (i) magnification = v/u = 3
            Since v + u = 80
                   U = 80 – v
                   $\dfrac{v}{80 - v}$ = 3
                   V= 240 – 3v
                   V= 60cm   (3 marks)
       (ii)   From above u = 20cm

               $^1/_f$ = 1/v + 1/u = 1/60 + 1/20   (2 marks)

F = 15cm   (15 marks

17.   (a)   The induced current flows in such a direction that its magnetic effect
      oppose the change producing it.
      (b)   As the diaphragm vibrates, it causes the oil to move back and forth in the
               magnetic cutting the filed lines, this causing a varying e.m.f to be induced
               in the coil which causes a varying current to flow. (1 mark) (ii)
                   Increasing number of turns in the coil – increasing of the coil
               Increasing the strength of the magnet (any two correct)   (2 marks)

      $\dfrac{Vp}{Vs} = \dfrac{Np}{Ns}$

      $\dfrac{400}{Vs} = \dfrac{1200}{120}$

      $Vs = 40V$

      (ii) $I_p = 600/400 = 1.5A$ (2 marks)

      (iii) $Ps = P_p = 600W$

      $I_s = {}^{600}/_{40} = 15A$ (1 mark)

18.   (a) (i) A   Grid
             B   Filament   (2 marks)

      (ii)   Filament heats cathode
   Electron boil off cathode (theremionic emission) (2 marks)

      (iii)   Accelerating   (1 mark)
                   Focusing

      (iv)   Across X - plates   (1 mark)
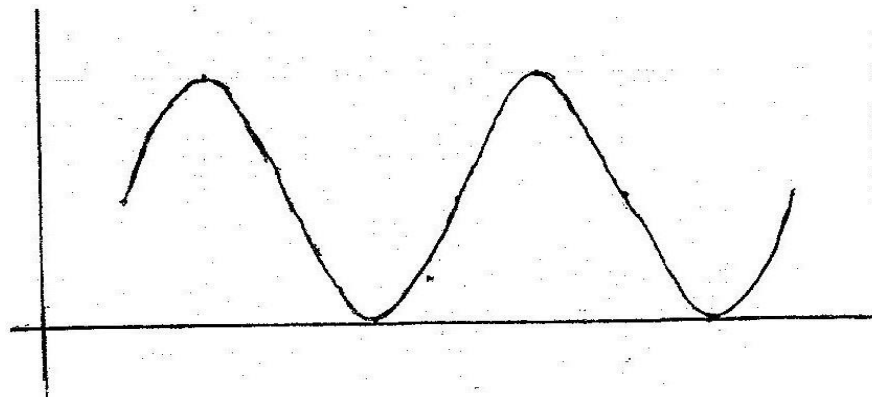

      (v)   To reduce collisions with air molecules that could lead to ionization

      (b)   Height   = 4 cm
                   Peak value   = 4 x 5
                   = 20V
      (ii)   2 wavelength = 16 cm
                   T   = 8 x 20 x 10^{-3}
                       = 0.16S

$$f = 1/T = 1/0.16$$
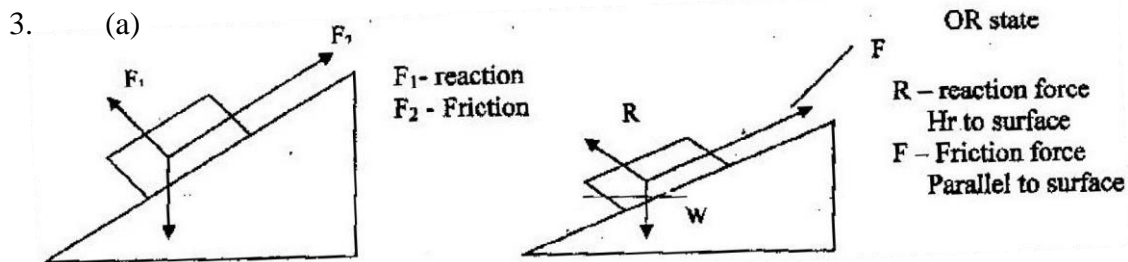$$= 6.25H_z$$

(iii)

EXAMINATIONS
PHYSICS PAPER 1
MARKING SCHEME.

1.   Water $V = \dfrac{Mw}{I}$ or $MW = \dfrac{ML}{P}$ $RD = \dfrac{ML}{ML} = P$

2.   For liquid $V = \dfrac{ML}{P}$ $P = \dfrac{ML}{MW}$ $P = \dfrac{ML}{MW}$

$P = \dfrac{ML}{MW}$

3.   (a)

        b)   R – Increases OR   R – Approaches W
             F – Reduces   F – Reduces

4.   - Atmospheric pressure is higher than normal/ standard or boiling was below - Pressure of impurities

5.   When flask is cooled it contracts/ its volume reduces but due to poor conductivity of the glass/ materials of the flask water falls as it contraction is greater than that of glass.
              (3 mks are independent unless there is contradiction)

6. Heat conductivity/ rates of conduction/ thermal conductivity (NB: If heat conduction no mark)
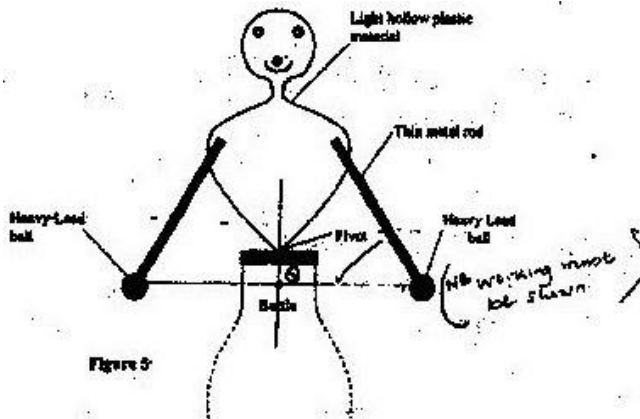
7. X sectional area/diameter/thickness/radius

8. $P_1 = pgh$ or $Pr = PA + heg$
   $= 1200 \times 10 \times 15 \times 10^{-2}$ $= 8 \times 10^{-4} + 15 \times 1200 \times 10^{-2} \times 10$
   $= 1800$ pa $= 8.58 \times 10^4$ pa
   Total pressure
   $=$ 8.58×10^4 pa
          (85800pa)

9. - Intermolecular distances are longer/ bigger/ in gas than in liquids
   - Forces of attraction in liquids are stronger/ higher/ greater/ bigger/ than in gases

10. (In the diagram)

Figure 5

11. Stable equilibrium
    When it is tilted slightly Q rises/ c.o.g is raised when released it turns to its original position

12. This reduces air pressure inside the tube, pressure from outside is greater than inside/ hence pressure difference between inside and outside causes it to collapse.

13. Diameter coils different/ wires have different thickness/ No. of turns per unit length different/ length of spring different.
    (x- Larger diameter than Y
    Or in one coils are closer than in the other

14. Heated water has lower density, hence lower up thrust

15.　(a) Rate of change of momentum of a body is proportional to the applied force and takes in the direction of force.

　(b)　(i)　$S = ut + \frac{1}{2}at^2$

　　　　　　$49 = 0 + \frac{1}{2} \times a \times 7^2$

　　　　$a = 2M/S^2$

　　　　(ii)　$V = u + at$　　or　　$v^2 = u^2 + 2as$

　　　　　　$= 0 + 2 \times 7 = 14m/s$　$v^2 = 0^2 + 2 + 2 \times 2 \times 49$

　　　　　　　　　　　　　　　　$V2 = 14m/s$

　(c)　(i)　$S = ut + \frac{1}{2}gt^2$　either $V^2 = u^2 + 2gs$

　　　　　$1.2 = 0 + \frac{1}{2} \times 10 \times t2$　$v = u + gt$

　　　　　　　　　　　　　　$V^2 = 0^2 + 2 \times 10 \times 1.2$

　　　　$T = \sqrt{\dfrac{1.2}{5}}$　　　　$v = 24 = 4.899$

　　　　　　　　　　　　　$4.899 = 0 + 10t$

　　　　$= 0.49s$　　　$T = 0.4899s$

　　　(ii)　$s = ut$

$u = \underline{8} = \underline{2.5} = 5.10215.10^3 m/s$　　　t　　0.49

　　　　Heat energy required to raise the temperature of a body by 1 degree Celsius/ centigrade of Kelvin

　　　　Measurements　　　　　　　or
　　　　Initial mass of water and calorimeter M_1
　　　　Final mass of water & calorimeter, M_2
　　　　Time taken to evaporate $(M1 - M2)$, t
　　　　Heat given out by heater = heat of evaporation= ML
　　　　$Pt = (m1 - m2)1$
　　　　$L = pt \dfrac{}{M1 - M2}$

　(c)　(i)　$= CDT$
　　　　　　$= 40 \times (34 - 25) = 40 \times 9 = 360J$

　　　(ii)　MWCWDT
　　　　　　$100 \times 10^{-2} \times 4.2 \times 10^3 (34-25) = 3780J$

　　　　(iii)　MmCMDT　　　　or sum of (i) and (ii)

$$= 150 \times 10^3 \times cm \, 6 \qquad 360 + 3780$$
$$= 9.9 \, cmJ \qquad\qquad = 4140J$$

(iv) $150 \times 10^{-3} \times cm \times 66 = 4140$ heat lost = heat gained +   heat

by water   gained

by

$cm = 4140$ $9.9 \, cm = \dfrac{360 + 3780}{150 \times 10^{-3} \times 60}$

$cm = \dfrac{4140}{0.15 \times 60}$

418J/Kgk   418J/Kgk

17.   (a) Lowest temperature theoretically possible or temperature at which/ volume of a gas/ pressure of gas/K.E (velocity) of a gas is assumed to be zero

     (b)   Mass/ mass of a gas

         Pressure / pressure of a gas/ pressure of surrounding

     (c)   (i) $4 \times 10^{-5} \, m^3 /40 \times 10^{-6} m^3 / 40cm^3$

         (ii) $-275^0C - 280^0C$

         (i) a real gas

                Liquefies/ solidifies

     (d) $\dfrac{P_1 V_1}{T_1} = \dfrac{P_2 V_2}{T_2}$ but $V_1 = V_2$ If $\dfrac{P}{T_1} = \dfrac{P_2}{T_2}$ is used max marks 3

         $P_2 = \dfrac{P_1 T_2}{T_1} = 9.5 \times 104 \times \dfrac{283}{298}$ $P2 = \dfrac{P_1 T_2}{T_1}$

         $= 9.02 \times 10^4 pa$ $= 9.5 \times 10^4 \times \dfrac{283}{298}$

         $= (90200pa)$ $(90200 \, pa)$

           $(90.2 \times 10^3 \, pa)$ $(90.2 \times 10^3 pa)$

18.   (a) VR $=$ $\dfrac{\text{Effort distance}}{\text{Load distance}}$

 (b) (i) Pressure in liquid is transmitted equally through out the liquid

                 NB; if term fluid is used term in compressive must be staled

                 Work done at RAM = work done on the plunger

(ii)   P x A x d   = P x a x d or vol of oil at plunger = at RAM

A x D = a x d   a x d = A x D

$\underline{d} = \underline{A}$ $d = \underline{A}$ D   a   D   a   VR = $\underline{A}$ VR = $\underline{A}$ a

a

(c)   (i)   MA = $\dfrac{\text{load}}{\text{Effort}}$

$\dfrac{4.5 \times 10^3}{135}$

= 33. 3 (33 $^1/_3$)

(ii)   Efficiency = $\dfrac{MA}{VR}$ x 100%   OR efficiency = $\dfrac{MA}{VR}$ = 33.3

= $\dfrac{33.3}{45}$ x 100%

= 74%

= 0.74

(iii)   % work wasted = 100% - 74%

= 26%

19.   (a) When an object is in equilibrium sum of anticlockwise moments about any point is equal to the sum of clockwise moments about that point

(b)   (i)   V = 100 x 3 x 0.6 = 180cm^3 W = Mg

M = VP   OR   = Pvg

180 x 2.7 = 486 g   = $\dfrac{2.7 \times 3 \times 0.6 \times 100 \times 10}{100}$

W = Mg

$\dfrac{486}{1000}$ x 10   = 4.86N

= 4.86 N

(ii)   Taking moments about F pivot; 20F = 15 x 4.86

F = $\dfrac{15 \times 4.86}{20}$ = 3.645

Or

F = taking moments about W, 15R = 35F – (i)
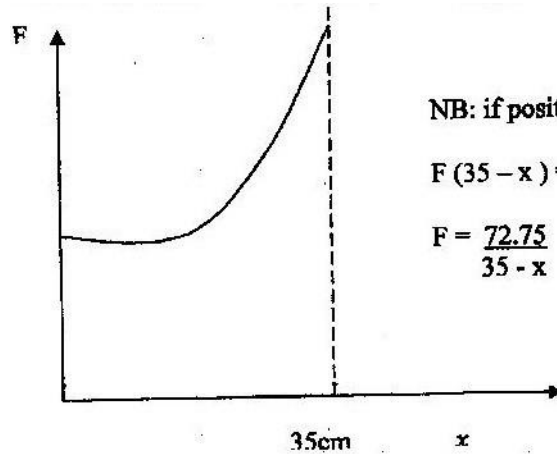
F + W = F = R – 4.86 – (ii) substitute

F = R – 4. 86 ---- 1

F = 3.645N

OR

Taking moments about $F = 20R = 4.86 \times 35$

$R = 8.51$ and $F = R - W$

F=   F $8.51 - 4.86 = 3.645N$

(iii)

NB: if position of W is constant

$F(35 - x) = 4.86 \times 15$

$F = \dfrac{72.75}{35 - x}$

35cm   x

(iv)   As x increase/ anticlockwise moments reduces/ moments to the left reduces/ distance between F and pivot reduces F has to increase to maintain equilibrium

K.C.S.E 2008 MARKING SCHEME
PHYSICS PAPER 2

1. BC   - Total absence of light; umbra, completely dark
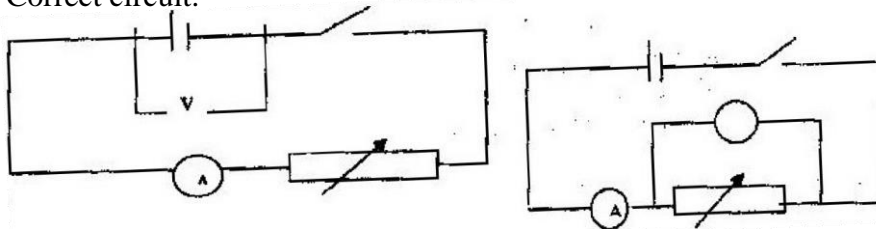
- Total darkness

      Rays are completed blocked from this region by the object 2.

    Leaf in A falls a bit while leaf in B rises a bit

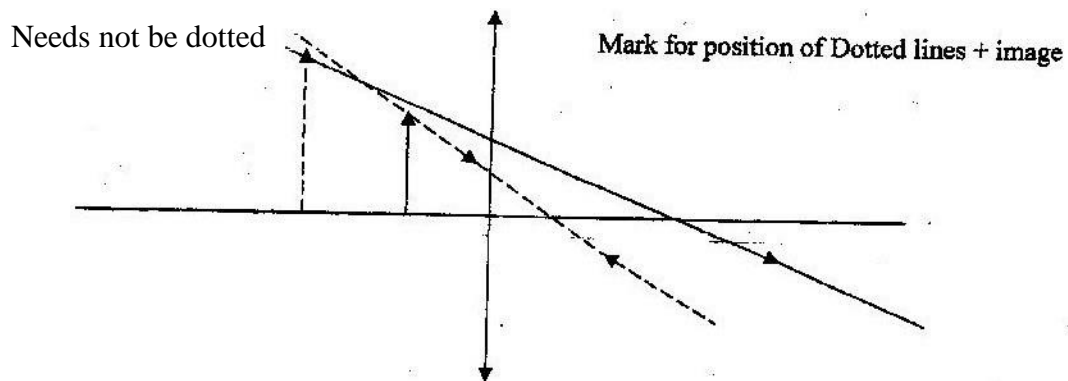   The two leaf electroscope share the charge

    Correct circuit.

3.

4.   Hammering causes the domains or dipoles to vibrate when setting, some domains themselves in the N- S – direction due to the earth's magnetic field causing magnetisatioa.

5.

Needs not be dotted

Mark for position of Dotted lines + image

6.   When the switch is closed, 1 flows the iron core in the solenoid is magnetized attracting the flat spring this causes a break in contact disconnecting current.

Magnetism is lost releasing the spring

- Process is repeated (make and break circuit)

7. Movement equals 1.75 oscillations

T $= 0.7/ 1.75$

$= 0.4$ sec

$F = 1/_T$

$= 1/_{0.4} = 2.5$ HZ.

8.

spacing .
Direction must be correct

Current flows in the resistors
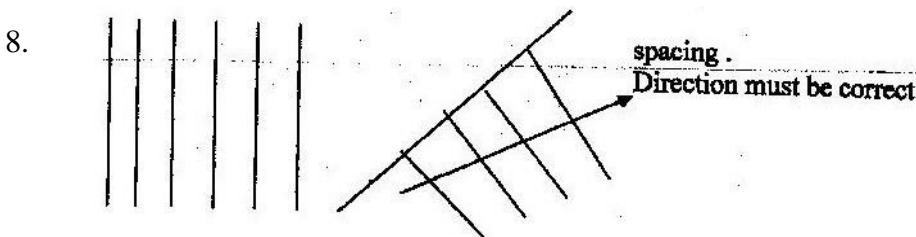
9.   (i) V = O volts

ReasonNo current

(ii) V = 3 volts

10. $P = V_2/R$ $P = 220^2/240^2/100$

$R = \dfrac{240^2}{100}$

$= 84$ J/S

11.   Short sightedness/ myopia

Extended eyeball/ lens has short focal length/ eye ball too long any two

12.   Spot moves up and down

13.   Frequency increases

Accept   Becomes hard

Wavelength decreases

Strength / quality

14. Beta particle

Gain of an electron OR

Mass number has not changed but atomic number has increased by 1

Atomic number has increased by one

Nature will not affect the speed

15. (a)   Temperature

Density

(b) Graph

(i)   46.5 m

accept 46
m to 47
m

(ii) $T = \dfrac{4x}{V}$

$V = \dfrac{4x}{t}$ or slope $= \dfrac{4}{v}$

$= \left(\dfrac{0.51}{43}\right)^{-1}$

$= V = 43 \times {}^{4}/_{0.51} = 337$ m/s

(iii)   For max internal observer is at one end and so the distance $= 2L$

$337 \times 4.7 = 2L$

$L = 792$ M

(c)   (i)   Distance moved by sound from sea bed $= 98 \times 2$ m

$V = \dfrac{98 \times 2}{0.14}$

$= 1400$ M/S

(ii)   Distance $= v \times t$

$1400 \times 0.10/2$

$= 70$m

16. (a) Light must travel from dense to less dense medium

Critical angle must be exceeded $(< i > c)$

(b)　$1n2 = \dfrac{\text{Sin i}}{\text{Sin r}} = \dfrac{\text{Sin I}}{\text{Sin r}}$

$= \dfrac{\text{Sin 90}}{\text{Sin }\theta}$　OR $= \dfrac{\text{Sin }\theta}{\text{Sin 90}}$

$= \dfrac{I}{\text{Sin }\theta}\dfrac{I}{n}$

$= 1/\sin\theta$

(c)　(i) At greatest angle θ, the angle must be equal to critical θ angle of the medium

$\text{Sin }\theta = \sin\ c$

$= \frac{1}{2}$

$= 1/1.31 = 0.763$　$\theta = 49.8^0$

Angle $< 49.8^0$

(ii)　$X = 90^0 - \theta$

$= 40.2^0$

(iii)　$\text{Sin }\theta / \sin X = 1.31$
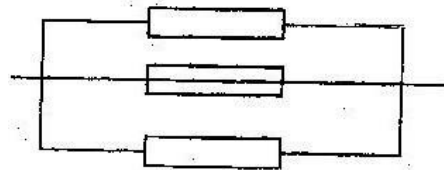
$\text{Sin }\theta = 1.31 \sin 40.2^0$

$= 0.846^0$

$= \theta = 57.8^0$

17.　(a) (i)

(ii)
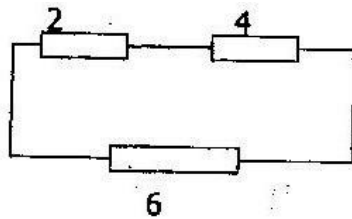
(b)　(i)　　　　　　　　　　　　　　　　Open circuit p.d $= 2.1$ v

(ii) Different in p.d　$=$ p.d across

$2.1 - 0.8 = 0.1$ r

$0.3 = 0.1$ r r$=$

0.3

0.1

$= 3n$

(iii)   When I is being drawn from the cell, the p.d across the external circuit is the one measured

$01 \times R = 18$

$R = 1.8/0.1$

$= 18 \, n$

18.   (a) Flux growing/ linking

No flux change

Flux collapsing

Switch closed: Flux in the coil grows and links the other coil inducing an

E.M.F

Current steady: No flux change hence induced E.M.F

Switch opened: Flux collapses in the R.H.S coil inducing current in opposite direction

(b)   (i) Reduces losses due to hystesis (or magnetic losses)

Because the domain in soft- iron respond quickly to change in magnetic (or have low reluctance) i.e easily magnetized and demagnetized.

(ii) Reduces losses due to eddy current

Because laminating cuts off the loops of each current

Reducing them considerably

(c)   (i) $\dfrac{VP}{V_s} = \dfrac{NP}{N_s}$ $P = I_sV_s$

$I_s = \dfrac{800}{40}$

$\dfrac{400}{V_s} = \dfrac{200}{200}$

$V_s = 40 \, Volts = 20A$

(ii) P_p P_s

$800 = 400 \, I_p$

$I_p = \dfrac{800}{400}$

$= 2A$

19.   (a) (i)   Hard X – Rays

(ii)   They are more penetrating or energetic

(b)   (i)   A cathode rays/ electrons/ electron beam

B Anode/ copper Anode

(ii) Change in P.d across PQ cause change in filament current OR temperature of cathode increases
This changes the number of electrons released by the cathode
hence intensity of X- rays

(iii) Most of K.E is converted to heat
(iv) High density

(c) Energy of electrons is = QV= ev
$$= 1.6 \times 10^{-19} \times 12000$$

Energy of X- rays $= Hf$
$$= 6.62 \times 10^{-34} \times f$$
$$6.62 \times 10^{-34} \times f = 1.6 \times 10^{-19} \times 12000$$
$$F = \frac{1.6 \times 10^{-19} \times 12000}{6.02 \times 10^{-3f}}$$
$$= 2.9 \times 10^{18} Hz$$

Accept ev = Gf
$$F = {}^{ev}/_{g}$$

K.C.S.E PHYSICS YEAR 2009

1. Volume run out= 46.6 cm^3

   Density $= {}^{m}/_{v} = 54.5 / 46.6 = 1.16953$

   $= 1.17$g/ cm^3

2. $T^2 = 4 \Pi \; {}^{2L}/_{g}$

   $= 1.7^2 = \dfrac{4 \Pi^2 \times 0.705}{g}$

   g= 9.63m/s^2

3. Needle floats due to the surface tension force

   Detergents reduces surface tension, so the needle sinks

4.   When equal forces applied, pressure on B is greater than on A due to smaller area./ pressure

differences is transmitted through to liquid causing rise upward. Force on A is greater than

hence upward tension.

5.   Molecules inside warm water move faster than in cold water. For Kinetic energy in warm

water is higher than in cold water/ move with greater speed/ molecules vibrate faster in warm

water.

6.   Prevents/ holds, traps breaks mercury thread/ stops return of mercury to bulb when

thermometer is removed from a particular body of the surrounding

7.   Dull surface radiate faster than bright surface

P- Looses more of the heat supplied by burner than Q OR

Q- shinny surface is a poorer radiator/ emitter of heat thus retains more heat absorbed Or

P- Dull surface is a better radiator/ emitter i.e. retains less of the heat absorbed. (there

must be a comparison between P & Q)

8.   Heat travels from container to test tube by radiation so the dull surface P, gives more heat to

the test tube.

9.   Center of gravity located at the intersection of diagonals

10.   Parallel

F= 2 ke

40= 2 x ke

$E_1 = 40/2k = 20/k$

Single = f= ke_2

$$20 = ke_2$$

$$E_2 = 20/k$$

$$E_T = e_1 + e_2$$

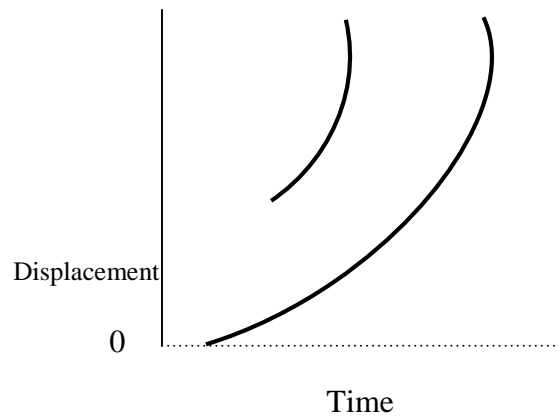$$20 = 20/k + 20/k$$

$$20k = 40$$

$$K = {}^{40}/_{20} = 2N/cm$$

OR Extension of each spring = 10

$$K = 20N/10 \text{ cm}$$

- 2N/ cm

11.   Air between balloon is faster that than outside so there is pressure reduction between.

12.

13.   The lowest temperature possible/ Temp at which ideal gas has zero volume (Zero pressure) or

molecules have zero / minimum energy OR

Temperature at which a gas has min internal energy/ zero volume

14.   V= r x 21   OR T = 1/33 = 0.030303

= 0.08 x 21 V 33m/s   T = 2V / w =

= 16.6m/s   w = 2v/0.0303 = 207.525

                                   V= rw

                                   0.08 x 207. 5292

                                   = 16.5876m/s

SECTION B (55 MARKS)

15.   (a)   - Pressure

              - Dissolved impurities

    (b)

         (i)   BPt = 78^0C

         (ii)   (I) Δt = 4.5 min

              Q = pt = 50 x 4.5 x 60J
              = 13500J

              (II) Q = 70 - 16 = 54^0C *(accept 54 alone or from correct working)*

              (III) Q = MC $\Delta\theta$

    C= 13500J

     0.1kg x 54k

    = 2500J/ kj

    (iii) Δ t = (7.3 – 6.8) min = 30s

$Q = pt = ml = 30x\ 50J$

$L = \dfrac{30 \times 50}{0.18} = 83.33 \times 10^5 J/kg$

16. (a) Efficiency $= \dfrac{\text{work output}}{\text{Work input}} \times 100\%$ (equivalent)

OR Ratio of work output to work input expressed as a percentage

(b) (i) work effort $= F \times S$

$= 420\ N \times 5.2\ N$

2184J

(ii) Distance raised $= 5.2 \sin 25 = 2.2\ m$ (2.1976)
Work done $= 900N \times 2.2\ m$

$= 1980J$

(iii) Efficiency $= \dfrac{\text{work output}}{\text{Work input}} \times 100\% = \dfrac{1980}{2184} \times 100$

$= 90.7\%$

17. (a) A floating body displaces its own weight of the fluid on which it floats

(b) (l) $w = T + U$

(ii) Vol $= 0.3 \times 0.2 \times 0.2 m^3$

Weight $= mg = 0.3 \times 0.2 \times 0.2 \times 10500\ kg/m^3 \times 10$

= 1260N

(iii) Vol of liquid = vol of block

Weight of liquid displaced = Vpg

0.3 x 0.2 x 0.2 x 1200 x 10N

= 144N

(iv) T = w - u

1260 – 144N

1116N

(c)   Weight of solid = weight of kerosene displaced

= 800 x 10 x 10^{-6} x 10 = 0.08 N

Mass = 0.008 kg

Vol = 50 cm3 Density m/v = 0.008/50 x 106 m3

18.   (a) The pressure of a fixed mass of an ideal gas is directly proportional to the Absolute temperature if the volume is kept constant.

(b)

(i)   Volume increases as bubble rises because the pressure due to liquid

column is lowered; therefore the pressure inside bubbles exceeds that of

outside thus expansion.

(ii)   (I) Corresponding pressure = 1.88 x 10^5 Pa

(II) I/v = 1/1.15 = 0.87 cm^{-3}

(iii) Δ P = (1.88 – 0.8) x 10^5 pa = 1.08 x 105 Pa

ΔP = ℓgh = ℓ x 0.80 x 10

$$P = \frac{1.08 \times 10^5 \text{ kg/m}^3}{0.80 \times 10}$$

$$= 13500 \text{ kg/m}^3$$

(iv)   Pressure at top = atmospheric

0.8×10^5 pa

c. $p_1v_1/T_1 = p_2v_2/T_2$ $= \dfrac{2.7 \times 10^5 \times 3800}{298} = \dfrac{2.5 \times 10^5 \times v_2}{288}$

$25^0C = 298$ k $= 3966 \text{ cm}^3$

$15^0c = 288k$

19. (a) Rate of change of angular displacement with time
    Acc. Without (rate)

    (b)

        (i) Mass, friction, radius (any two)

        (ii) Oil will reduce friction since frictions provide centripetal force; the frequency
             for sliding off is lowered. (c)

        $v^2 = u^2 + 2$ as

            $= 0 + 2 (0.28)h$

            $V = \sqrt{0.56 \times 1.26}$

            $= rw$

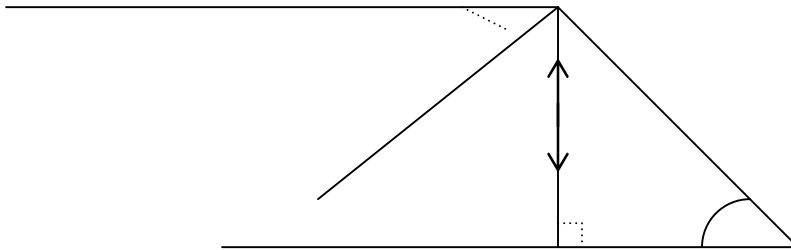 $= 0.84 = 0.14 \times w = \dfrac{0.84 = 6}{0.14}$ rad s

PHYSICS PAPER 2 YEAR 2009

SECTION A

1. Infinite (very many, uncountable, several

2.

3. Negative change

4. Allow gassing/ release of gases

   OR, release H_2 and O_2 produced at the electrodes

5. Increase the magnitude of l

   Increase the number of turns per unit length

   Use of U shaped iron core

6. $F = 0.5$ sec

   $F = 1/T$

   $= 1/0.5$

   $= 2$ Hz

7. $1.33 = 3/v \times 10^5$

   $V = 3 \times 10^5$

   $\quad 1.33$

   $= 2.26 \times 10^8$ m/s

8. $T = 1A$

9. $(L-q)$ cm

10. (i) Movement of magnet causes flux linkage to change   E.M.F is produced in

the cell.

(ii)   When 1 flow from Q to P, a N. pole is created which opposes the

approaching pole (long's law).

11. Increases in P d increases 1 in filament OR. Increase in P d increases heating effect this

produces more electrons by Thermionic Emission.

Hence results on more intense x - rays

12. $^{2d}/_{05} = {}^{2d}/_{0.6} + 34$ OR $V = {}^{d}/_{t}$

$D = 17/0.2 = 85$ m $= \dfrac{17 \times 2}{0.1}$

Speed $= \dfrac{2 \times 86}{0.5}$ $= 340$ m/s

$= 340$m/s

13. Diode in (a) is forward biased while in 6 (b) is reversed biased Or Battery in 6 (a) enhances

flow of e. across the barriers while in 6 (b) barriers potential is increased.

SECTION B (55 MARKS)

14. (a)   Capacitances decreases

Area of the overlap decreases

(b)

(i) Parallel, $Cp = 5 + 3 = 8$ pf

Whole circuit ¼ + 1/8

$C = {}^{32}/{}_{12} = 2.6 + Pf$

    (ii) $Q = CV$

       $= 8/3 \times 12 \text{ PC}$

       $= 32 \text{ PC}$

    (iii) $B = Q/C$ OR $Q_B = {}^{5}/{}_{8} \times 32$

$= \dfrac{32 \times 10^6}{8 \times 10^6}$ $= 20 \text{ PC}$

    $= 4 \text{ V}$ $V_B = \dfrac{20 \times 10^{-6}}{5 \times 10^{-6}}$

                             $= 4V$

15.   (a) Increase in 1 causes rise in temp

    Rise in temp causes rise in R

    (b) $R = v/l$

       $\dfrac{2.5}{1.2}$

       $= 2.1 \ \Omega$

    (c) Read off P d across Y = P.O.V from graph

    (d) Power $P = IV$

       $= 0.8 \times 3$

       2.4 watts

16.   (a) (i)

White light

R

V s

2nd refraction
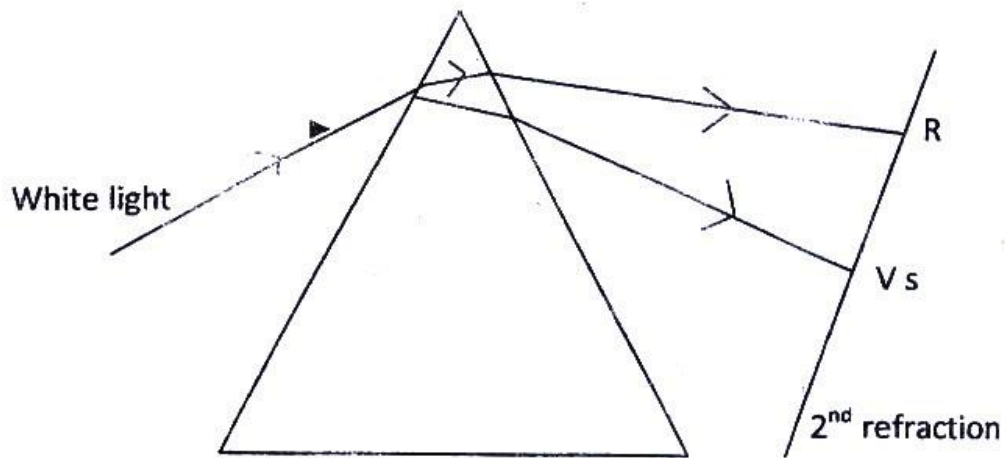
(ii)   Highest reading near red light

Red light has more heat than violet OR

Red light is close to ultra red which has more heat energy

(b)   Depth = 11.5 − 3.5 = 8.0 cm
         = $\frac{11.5}{8}$ = 1.4375

17.   (a) β = particle

(b) (i) Ionizes attracted towards electrodes

Collusions with other molecules cause avalanche of ions which on

attraction to the electrodes causes the discharge.

(ii)   are attracted towards electrodes

Collusion with other molecules causes avalanche are of ions which on

attraction to the electrodes causes

(c) (i) x = 36

   Y = 92

(ii)   Small, decreases in mass

   Loss of mass

   Mass defec

(iii)   Each of the neutrons produced at each collision further collision with

   Uranium atom causing chain reaction.

18.   (a) (l) Electrons are emitted from Zn plate

   Reduced of charge on the leaf

(ii)   Any electron emitted is attracted back to the electroscope

(iii)   Photons of infra red have to lower f than U – V have energy to eject to the

   electrons.

(b) (i) Number of electrons emitted will increases

(ii)   Max K.E of the emitted electrons will increase

(c)   (i) $V = \lambda f_0$

   $F_0 =$ $\dfrac{3.0 \times 10^8}{8.0 \times 10^{-7}}$

   $= 3.75 \times 10^{14}$ Hz

      (ii) $W = hf_0$

   $= 6.63 \times 10^{-34} \times 3.75 \times 10^{14}$
   $= \underline{2.49 \times 10^{-19} J} = 1.55\, eV \times 10^{-19}$

      (iii) $KE_{MAX} = hf - hf_0$

$$= h\,(8.5 - 3.75) \times 10^{14}$$

$$= 6.63 \times 4.75 \times 10^{14}$$

$$= 3.149 \times 10^{-19}\ \text{joules}$$

$$= 1.96828\ e$$

19. (a)

   (i)   Attach two identical dippers to the same vibrator, switch on and the
         circular waves produced OR

         Use one straight vibrator with two identical slits to produce coherent
         waves.

   (ii)   Constructive - Bright
          Destructive – Dar

   (b)   C I – Two waves arrive at a point in phase

 DI – Crest meets a trough and gives a zero intensity

       - Path diff is ½ odd number of λ