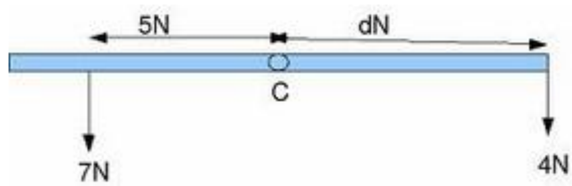
The City School

North Nazimabad Boys Campus

Physics for class 9 and 10

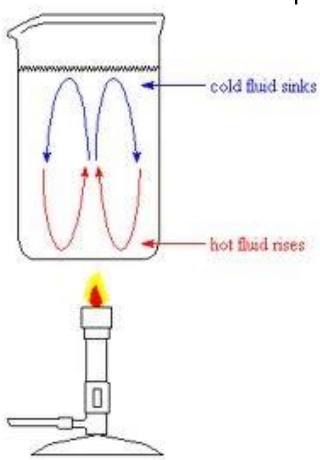
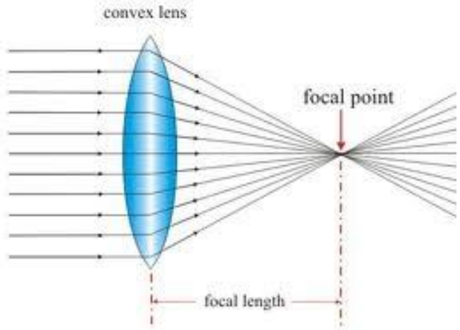
Friday 20th March 2015

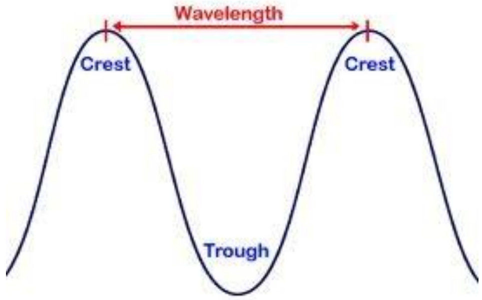
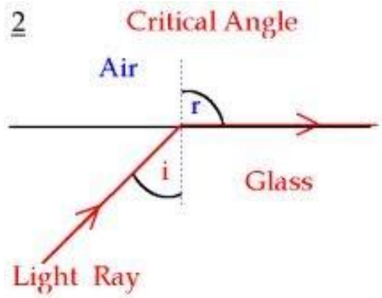
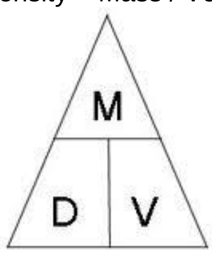
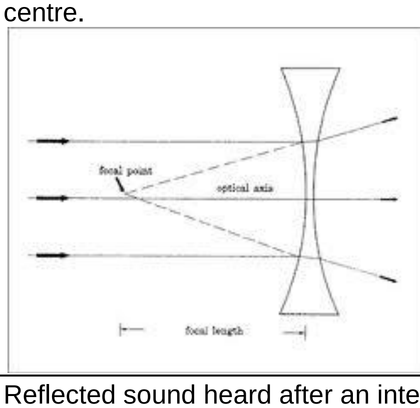
Important Formulae

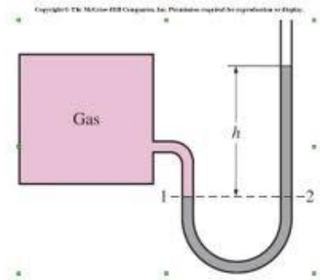
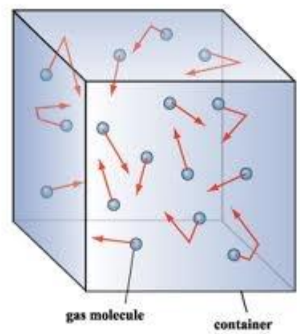
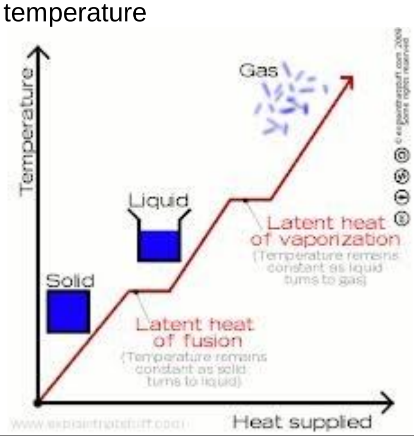
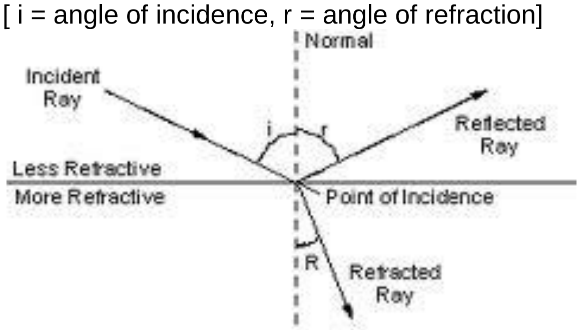
Density	$\rho = \frac{m}{v}$	ρ = density, kg/m^3 m = mass, kg v = volume, m^3
Weight	W = mg	W = weight, N m = mass, kg g = gravitational acceleration, m/s^2 or N/kg
Force	F = ma	F = force, N m = mass, kg a = acceleration, m/s^2
Moment of a force about a point	$\tau = Fd$	τ = moment of a force, Nm F = force, N d = perpendicular distance from pivot to the line of action of the force, m
Object in equilibrium with parallel forces acting on it	sum of clockwise moments = sum of anti-clockwise moments about the same pivot sum of upward forces = sum of downward forces	
Work done	W = Fd	W = work done, J F = force, N d = displacement, m
Kinetic energy	K.E.= 1/2 mv^2	K = kinetic energy, J m = mass, kg v = velocity, m/s
Potential energy	P.E. = mgh	Ep = potential energy, J m = mass, kg g = gravitational acceleration, N/kg or m/s^2 h = gain/loss in height

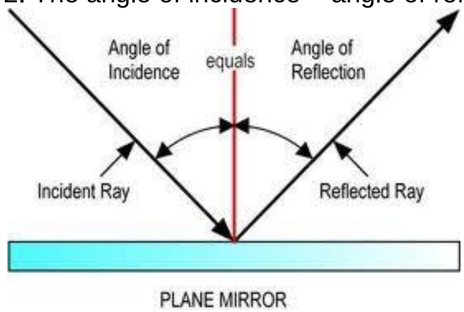
Efficiency	$E = \frac{\text{useful energy converted}}{\text{total input energy}} \times 100\ \%$ $= \frac{\text{output power}}{\text{input power}} \times 100\ \%$	
Power	$P = \frac{W}{t} = \frac{E}{t} = \frac{Q}{t}$	P = power, W W = work done or energy transferred, J t = time, s E = energy transferred/used, J Q = thermal energy transferred, J
Pressure	$P = \frac{F}{A}$	P = pressure, Pa or Nm^{-2} F = normal force, N A = area, m^2
Liquid pressure	$P = h\rho g$	P = pressure at depth h, Pa or N/m^2 ρ = density, kg/m^3 g = acceleration due to gravity, m/s^2
Boyle's Law	$P_1V_1 = P_2V_2$	P_1 = pressure of gas at state 1, Pa or cm Hg or atm P_2 = pressure of gas at state 2, Pa or cm Hg or atm V_1 = volume of a gas at state 1, m^3 or cm^3 V_2 = volume of a gas at state 1, m^3 or cm^3
Specific heat capacity	$Q = mc\theta$	Q = heat absorbed/released due to change of temperature, J m = mass, kg c = specific heat capacity, J/(kgK) θ = change in temperature, K
Specific latent heat of vaporization or fusion	$Q = ml$	Q = heat absorbed/released due to change of state, J m = mass, kg l = specific latent heat of fusion or vaporization, J/kg

Wave equation	$v = f\lambda$ $f = \frac{1}{T}$	v = wave speed, m/s f = frequency, Hz λ = wavelength, m T = period, s
Refractive index	$n = \frac{c}{v}$ $n = \frac{\sin i}{\sin r} = \frac{v_1}{v_2}$	n = refractive index i = angle in air/vacuum r = angle in medium c = speed of light in vacuum, m/s v = speed of light in medium, m/s
Critical angle	$\sin \hat{c} = \frac{1}{n}$	$\hat{c}$ = critical angle

Convection	The process by which thermal energy is transmitted from one place to another by the movement of the heated particles of gas or liquid. 
Converging lens	A lens that can bring a parallel beam of light passing through it focus to a point. It is thicker in the middle than at the edges. 
Coulomb (C)	The SI unit of electric charge.
Crest	The highest points on a wave

	
Critical angle	The angle of incidence in the optically denser medium for which the angle of refraction in the less dense medium is 90^o Total internal reflection occurs when the angle of incidence is greater than the critical angle. 
Density	Mass per unit volume of a substance Density = Mass / Volume 
Diverging lens	A lens that causes parallel beams of light to diverge. It is thicker at the edges than at the centre. 
Echo	Reflected sound heard after an interval of silence.
Electric current	The rate of flow of charge. I = Q / t [I = current, Q = charge, t = time]
Kelvin (K)	SI unit for temperature K = ^oC + 273
Kinetic energy	The energy a body possess due to its motion.

<table>
<tr><td></td><td>
</td></tr>
<tr><td>Kinetic theory of matter</td><td>All matter is made up of large numbers of tiny atoms or molecules which are in continuous motion.

</td></tr>
<tr><td>Latent heat of fusion</td><td>The energy needed to change a substance from solid to liquid without a change in temperature

</td></tr>
<tr><td>Latent heat of vaporization</td><td>The energy needed to change a substance from liquid to gas without a change in temperature
(See image above)</td></tr>
<tr><td>Law of charges</td><td>Like charges repel and unlike charges attract</td></tr>
<tr><td>Laws of refraction</td><td>1. The incident ray, refracted ray, and normal all lie in the same plane at the point of incidence.
2. The ration sini/sinr is constant
[i = angle of incidence, r = angle of refraction]

</td></tr>
<tr><td>Law of reflection</td><td>1. The incident ray, reflected ray, and normal all lie in the same place at the point of</td></tr>
</table>

<table>
<tr><td></td><td>incidence
2. The angle of incidence = angle of reflection

</td></tr>
</table>

Physics worksheet # 4

Q1. Represents a ray-tracing experiment which uses a transparent prism.

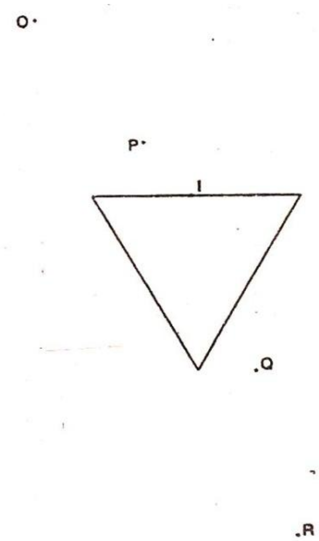
(a) (i) The path of an incident ray, which meets the face of the prism at I, is marked by the points O and P. On Fig. 1.1 draw the line that represents the incident ray and continue this line to meet the right hand edge of the page. Label this line incident ray.

(ii) The path of emergent ray, which emerges from the prism surface, is marked by the points Q and R. On Fig 1.1, draw the line which represents the emergent ray. Produce this line backwards and draw it to meet the top of the page. Label this line ‘emergent ray’.

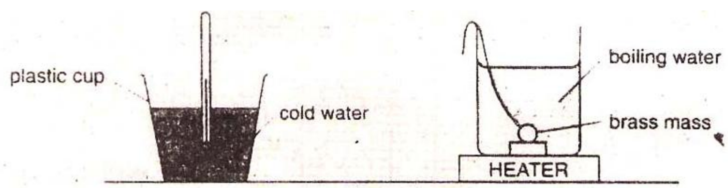
(iii) Label the pint of intersection of your two lines with the letter D. The smaller angle between the two lines is known as the angle of deviation d. measure both of the small angles and so obtain a value for the angle of deviation d.

d = *………………...*

(b) Suggest a reason why you were asked to draw long lines after the intersection at D.



Q2. A known mass X of brass at a temperature of 100°C is placed into 30cm³ of cold water at room temperature 16.7°C. The highest temperature Y reached by the cold water is measured and recorded.



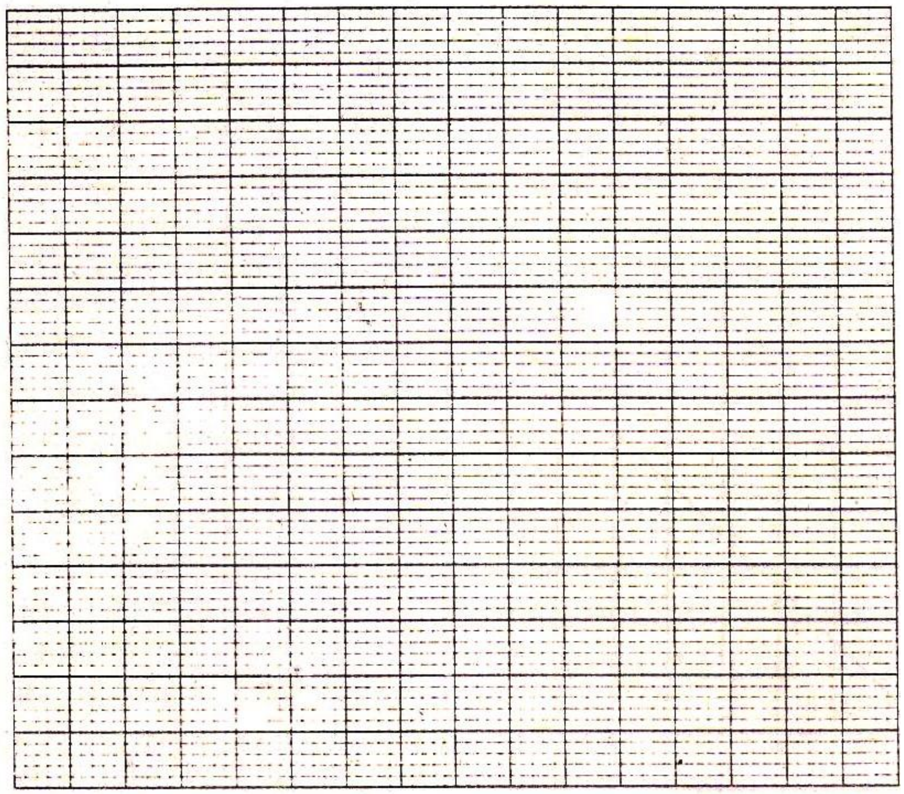
The experiment is repeated using different masses of brass to obtain five sets of readings of Y and X. The results of the experiment are shown in

Y/°C	21.8	25.4	27.5	31.1	34.5
X/g	20	40	50	70	90

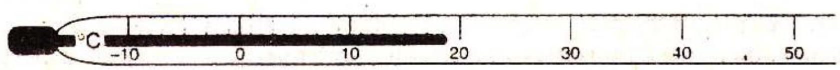
(a) On the graph grid on page 10, plot the graph of Y/°C (y-axis) against X/g (x-axis)

Start your y-axis at the point Y/°C = 21 and your x-axis at the pint X/g = 10. The graph is slightly curved. The temperatures are given to the nearest 0.1°C. Choose a scale that allows you to plot each point to 0.1°C.

(b) The brass is heated for at least 60s. State why this is good experimental practice.



(c) The thermometer shown in Fig. 5.3 is full size. Before taking a reading, the thermometer is held so that the mercury thread is just touching the temperature scale, as shown.

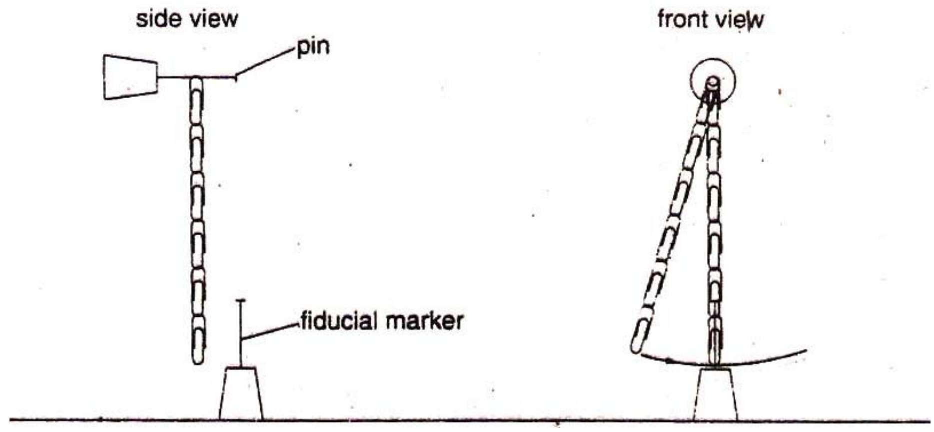


(i) Estimate the temperature reading shown by the thermometer

temperature = ……………..°C

(ii) State two things you could do to estimate the temperature as accurately as possible.

Q3. A chain of paper-clips is suspended from a horizontal pin.



The bottom paper-clip is pulled to one side and then released.,

A student measure the time T for one oscillation of the chain of paper-clips, which is about 1 second.

To obtain an accurate value for T, the following instructions are supplied by the teacher.

- Measure the time for more than one oscillation.
- Repeat each reading several times
- Count the oscillations from the center of the swing.

(a) (i) Suggest a suitable number of oscillations for each reading

number = ……………………………………

(ii) Explain why this is a suitable number of oscillations.

(b) Explain why it is important to repeat each reading.

(c) Explain why it is important to count the oscillations from the centre of the swing.

(d) The student removes several paper-clips from the chain and repeats the experiment.

The following readings are obtained.

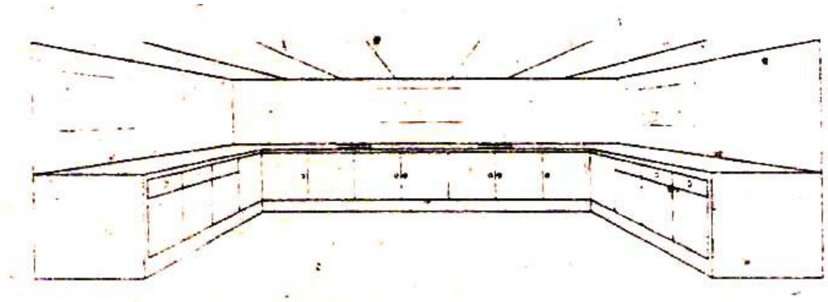
Number N of paper-clips in chain	T/s
22	1.37
18	1.24
14	1.09
10	0.93
6	0.73

Suggest a reason why the smallest number of paper-clips in the chain is 6.

(e) On the grid below, plot the graph of T on the y-axis against N on the x-axis.

Draw a smooth curve of best fit.

Q4. A group of students determine the approximate volume of air in their empty school laboratory.



(a) State

(i) the measuring instrument used

(ii) the measurements taken

(iii) how the volume of the air is calculated

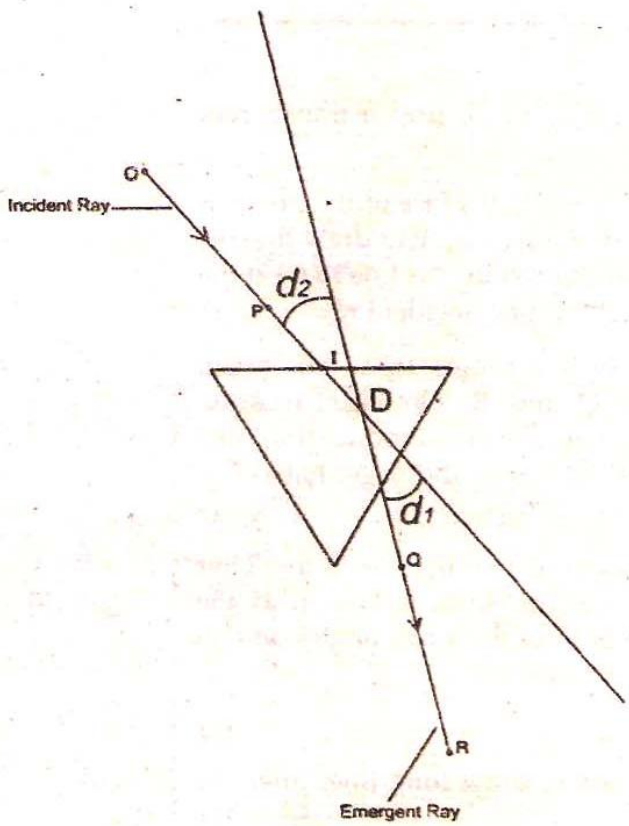
(b) State two possible sources of error in their answer.

Answer Key

Ans1.

Solution

(a) (i),. (ii) and (iii)



COMMENT on ANSWER

(a) (iii) The angle of deviation '*d*' is the angle through which a ray of light is deviated from its original path as it passes through the prism.

$d_1 = 28°$

$d_2 = 28°$

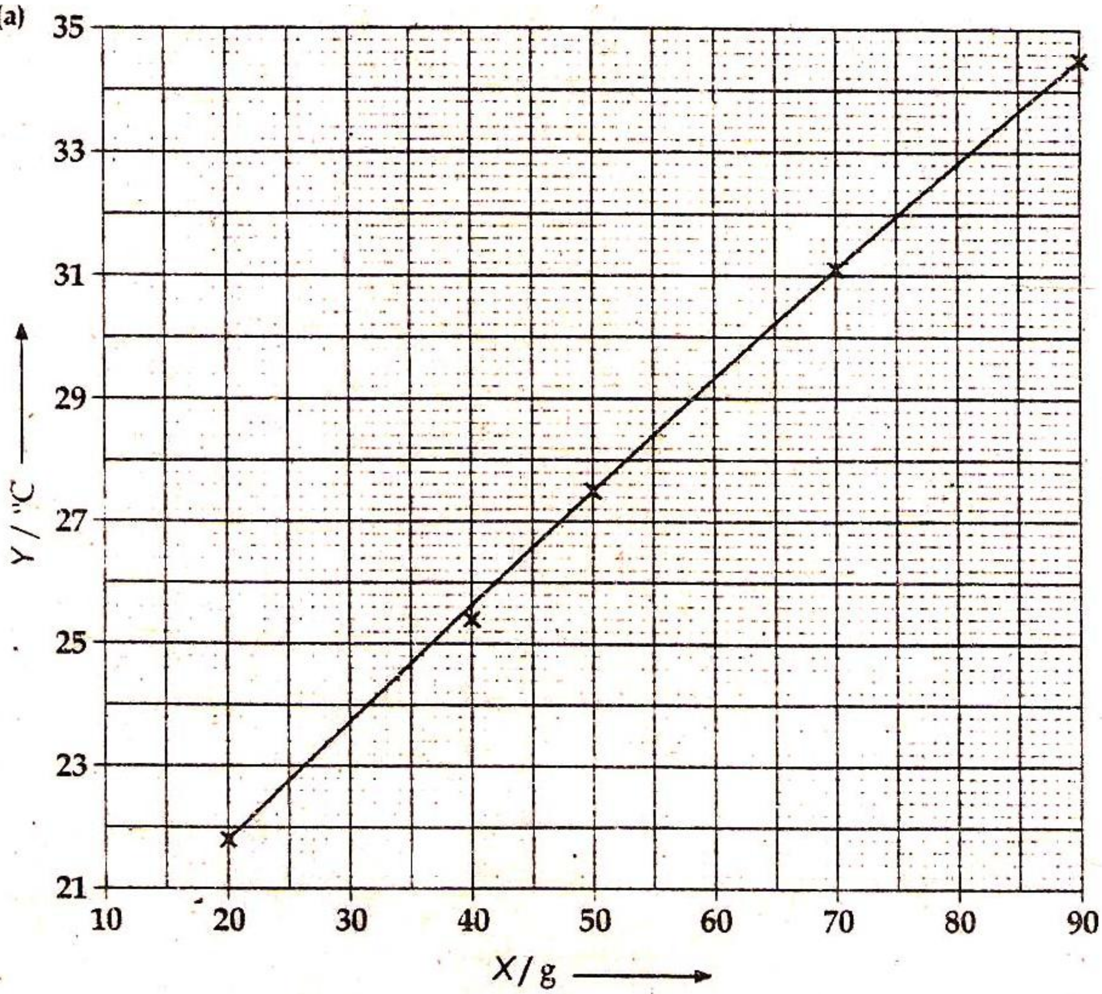
$$d = \frac{d_1 + d_2}{2} = \frac{28 + 28}{2} = 28°$$

$d = 28°$

Ans 2.

Solution

(a)



(b) It is a good experimental practice to heat the piece of brass for a suitable period of time to ensure that it attains the temperature of the boiling water i.e.

(c) (i) temperature = 18.8^{o}C

(ii) 1. Avoid parallax error by making the line of sight perpendicular to the scale of the thermometer.

2. The thermometer is positioned so that the mercury thread appears to touch the scale.

Ans 3.

Solution

(a) (i) 20 oscillations

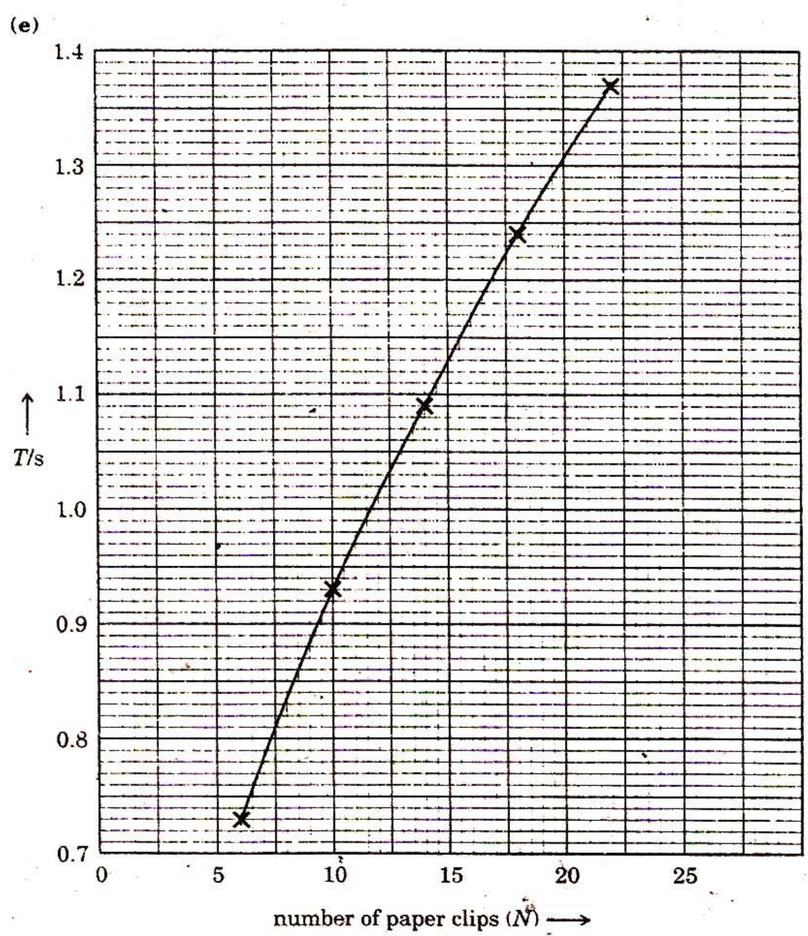
(ii) The time for one oscillation (T) is to small and cannot be measured accurately with a stopwatch because it will be include a large human reaction error in starting or stopping stopwatch.

(b) Repeating a reading and taking the average reduce the error and increases the accuracy of the reading.

(c) The paper clip is moving fastest when passing through the centre of the swing, so any error made in starting or stopping the stopwatch is minimum.

(d) The oscillations of the chain of less than 6 clips are too fast to be counted.

(e)



Ans 4:

Solution

(a) (i) A tape measure

(ii) length (l), width (w) and height (h) of the room

(iii) volume = l x w x h

(b) 1. The walls are not flat due to the cupboards which would cause error in the measurements.

2. Parallax error caused when taking readings from the tape measure during the measurement of the dimensions