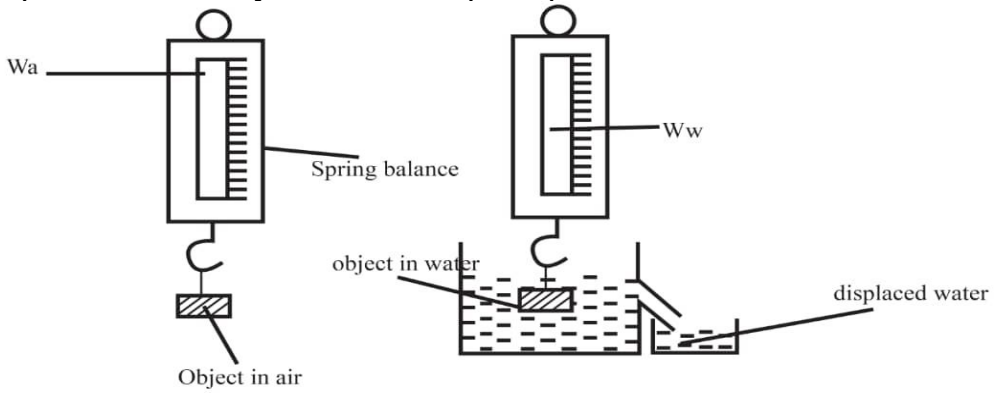
1a (i) When a body sis wholly or partially submerged in a fluid the upthrust is equal to the weight of fluid displaced.

(ii) Experiment to verify Archimede's principle.



- An object is weighed in air using a spring balance to obtain W_a
- The object is weighed when completely immersed in water using a spring balance.
- The weighed, W_w of water collected in the beaker is obtained.
- By using a spring balance, the beaker is weighed with displaced water and when it is empty.
- It is found that weight of displaced water is equal to upthrust thus Archimede's principle.

(b) Relative density $= \frac{upthrust\ in\ liquid}{upthrust\ in\ water}$

$= \frac{W_a - W_l}{W_a - W_w}$

$= \frac{0.52-0.36}{0.52-0.32}$

$= \frac{0.16}{0.2}$

$= 0.8$

But

Relative density $= \frac{Density\ of\ liquid}{Density\ of\ water}$

$0.8 = \frac{Density\ of\ liquid}{1000}$

Density of liquid $= 0.8 \times 1000$

$= 800 kgm^{-3}$

(c) (i)
- Tension acts down wards.
- Upthrust acts upwards.
- Weight acts downwards.

(ii) Tension $= upthrust - weight$

$= v\rho g - mg$

$= \left(\frac{3}{4} \times 40\right)(1 \cdot 04 \times 100) \times 10 - (10 \times 10)$

$= 312000 - 100$

$= 311900N$

2(a) Velocity is the rate of change of displacement while speed is the rate of change of distance.

(b)(i) The ticker timer is moving with uniform velocity.

(ii) The ticker timer is accelerating.

(c)(i) Period $= \frac{1}{f}$

$= \frac{1}{50}$

$= 0.025$

But

Acceleration $= \frac{change\ in\ velocity}{time\ for\ the\ change}$

But distances were not given and therefore the initial and final velocities can't be obtained.

(d)(i) Grace is acted on by three forces that is accelerating force (ma), the weight, (mg) and the normal reaction (R) and $R = m(g + a)$. Therefore, the reaction on the person is greater than the actual weight and more energy is required.

(ii) According to Newton's second law of motion, $f = \frac{m(v-u)}{t}$, increasing the time of reaction reduces on the force exerted by a ball on the goal keeper. So the hands are drawn back to increase the time of reaction with the ball.

(e) Mass $= 40kg$

Distance $= (20 \times 20)$

$= 400cm$

$= 4m$

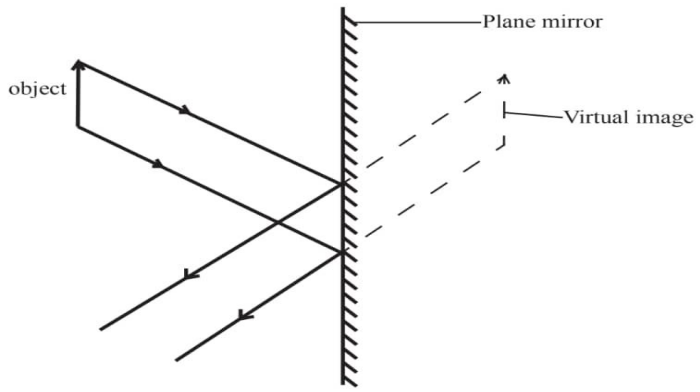
Time, t $= 4s$

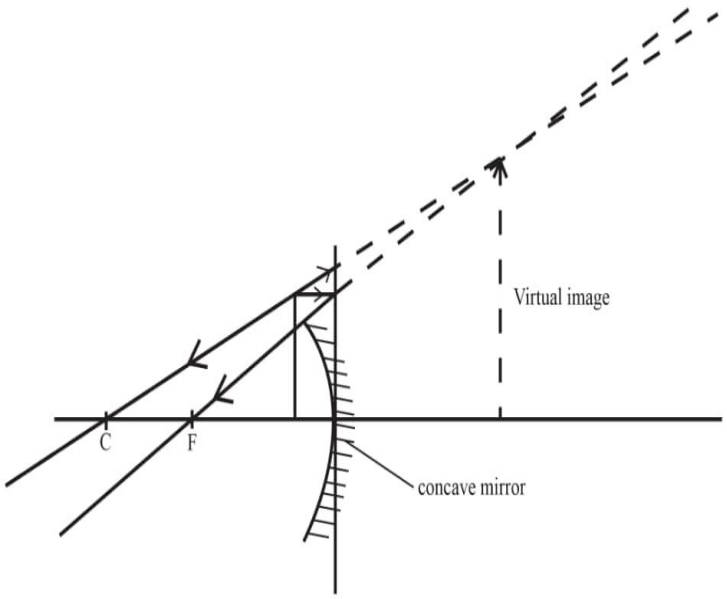
Power $= \frac{force \times distance}{time}$

$= \frac{40 \times 10 \times 4}{4}$

$= 400w$

3(a)(i)





(b) Experiment to determine the focal length of a converging lens

_Using an illuminated object O at a measured distance , u, move the screen towards and away from the lens until a clear image of the cross wires is obtained on the screen.

_ The image distance V is measured and recorded.

_The procedure is repeated for various values of u and the corresponding values of V measured and recorded.

_Calculate the average values of U and V .

The focal length, f of the mirror is then determined from;

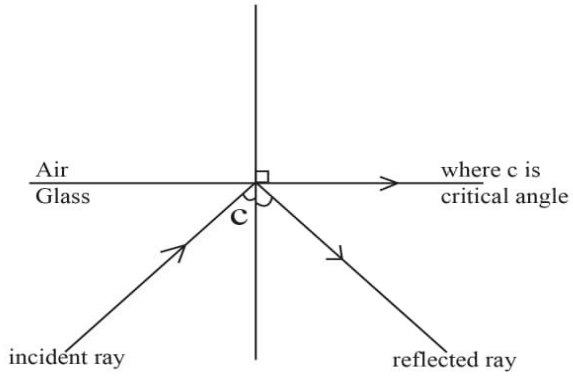
Accept hypermetropia
Accept myopia

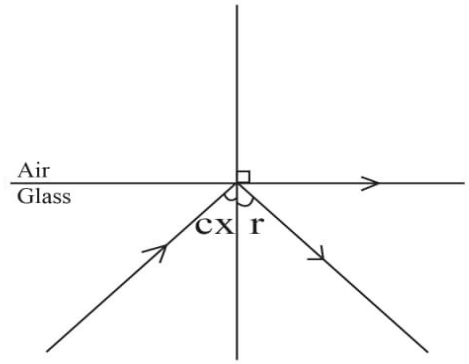
c(i) ___

Is the process by which objects at different distances are focused by the cilliary muscles changing shape, so that the focal length of the lens changes.

(ii) Long sightedness. This is corrected by using spectacles containing converging lens.
Short sightedness. This is corrected by using spectacles containing diverging lens.

(iii)





(iv) On a hot day, light from the sky is gradually refracted away from the normal as it passes through layers of warm but less dense air near hot road.
The refractive index of warm air is slightly smaller than that of cool air, so when light meets a layer at critical angle, it suffers total internal reflection thus to the observer the road appear to have a pool of water.

(d)
$n_w \sin i = n_g \sin r$
$1 \cdot 33 \sin 41 = 1 \cdot 50 \sin r$
$0 \cdot 8726 = 1 \cdot 50 \sin r$
$\sin r = \frac{0.8726}{1.50}$
$\sin r = 0.5817$
$r = 35 \cdot 6°$

4(a) Period is the time taken to complete one cycle while frequency is the number of complete cycles per second.

(b) This is because the particles in solids are very close together and they produce vibration easily that is solids are more dense.

(c) Frequency , $f = 9 \cdot 0 \times 10^6 Hz$
Velocity , $v = 3 \cdot 0 \times 10^8 ms^{-1}$

From $v = f\lambda$

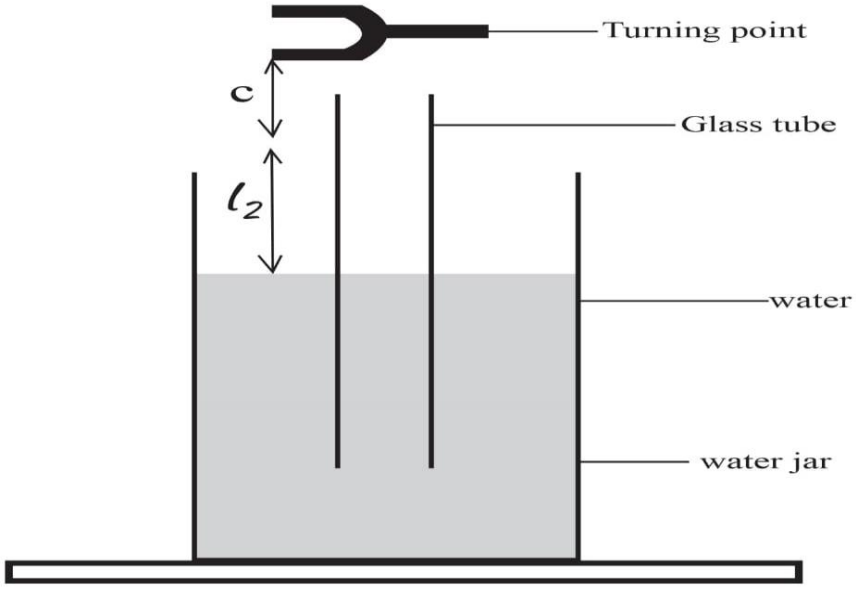
$3 \cdot 0 \times 10^8 = 9 \cdot 0 \times 10^6 \lambda$

$\lambda = \frac{9 \cdot 0 \times 10^6}{3 \cdot 0 \times 10^8}$

$= 33 \cdot 33m$

(d)(i) Open pipes are preferred to closed pipes because they give both odd and even harmonics hence better quality sound.

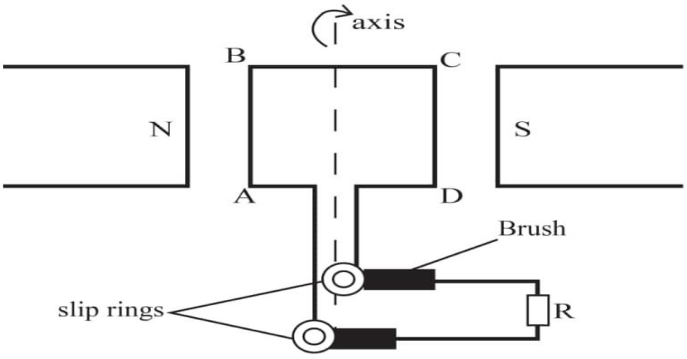
(d)(ii) Experiment to demonstrate resonance sound.

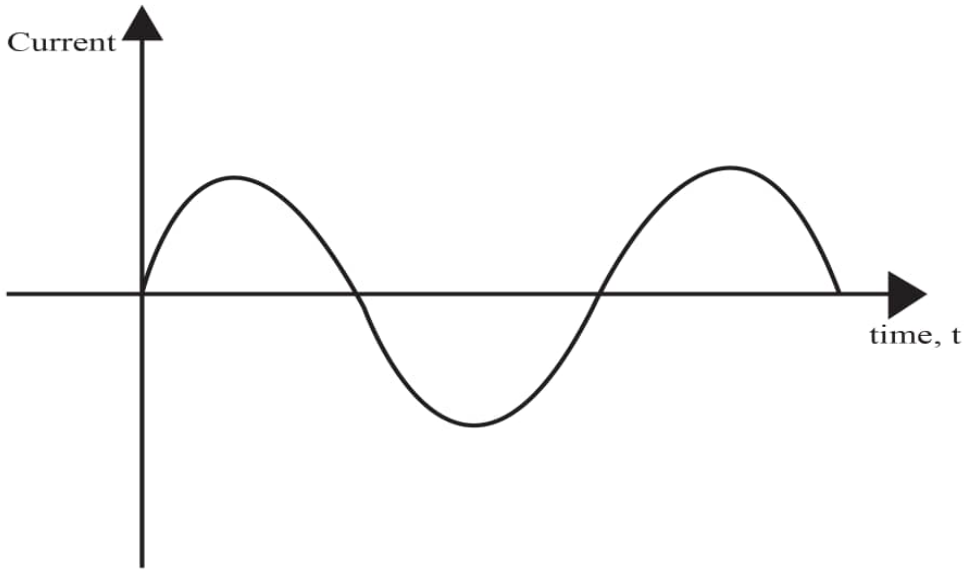
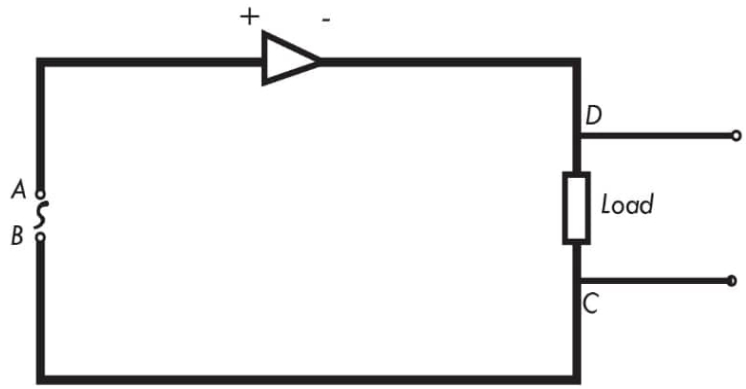


- Assemble the apparatus as in the diagram above.
- Put a vibrating turning fork of known frequency just above the resonance tube.
- Gently lower the resonance tube until the 1st loud sound occurs.
- Raise the resonance tube until the 2nd loud sound occurs.

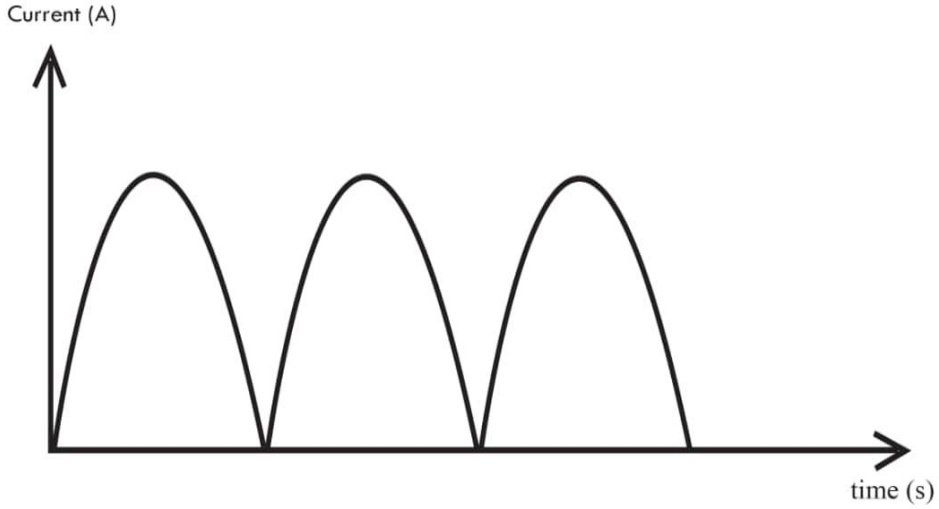
This demonstrates resonance of a sound.

5(a)(i) A.C generator



	− When the coil rotates with uniform angular velocity in the magnetic field, in accordance to Fleming's Right hand rule. − The magnetic flux density linked with it changes and an emf is induced in the coil. − The induced emf is led away by means of slip rings. − When side AB and CD inter-change positions, the current reverses the direction and the coil continues rotating in the clockwise direction. − Therefore, the induced emf generated flows flowing a sinusoidal wave.	
(ii)	Variation of current with time for an ac generator.  	
5(b)(i)	Half wave rectification.  In the first half cycle, when A is positive and B negative, current flows through the diode to the load in the direction DC In the 2nd half cycle, when A is negative and B positive, current doesn't flow through the diode. Therefore, current flows through the load in one direction.	

(ii) Current versus time.



(c) $\frac{V_s}{V_p} = \frac{N_s}{N_p}$

$\frac{V_s}{240} = \frac{60}{1200}$

$1200V_s = 60 \times 240$

$V_s = 12V$

$V_s = I_s R$
$12 = I_s \times 3$
$I_s = 4A$
$P_{out} = I_s V_s$
$= 4 \times 12$
$= 48W$
Efficiency $= \frac{power\ output}{power\ in\ put} \times 100\%$
$= \frac{80}{100} = \frac{48}{P_{in}}$
$P_{in} = 60W$
$P_{in} = V_p I_p$
$60 = 240I_p$
$I_p = 0 \cdot 25A$

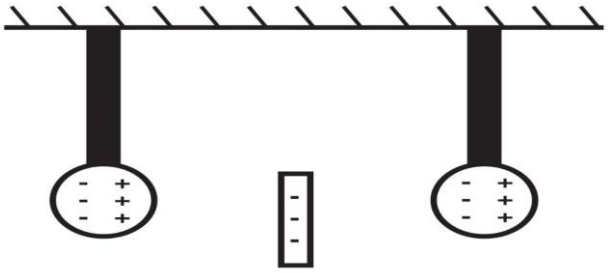
6(a)(i) Like charges repel and unlike charges attract.

(ii) The insulator with loosely held electrons to the one with tightly held electrons. The insulator that loses electrons becomes positively charged while the other becomes negatively charged.

(b)(ii) Electrostatic induction is the acquisition of charges in an un charged conductor from a charged body placed near it but not in contact with it.

(ii)

Charging two metal spheres positively by induction.



- A negatively charged rod is placed between the two spheres.
- The spheres are earthed at the same time, this results in electrons to flow to the earth.
- The earth connection is removed when the charged rod is still in position.
- The charged rod is removed and the conductors are found to have the same positive charge.

(c)(i)

$emf, E = 1 \cdot 5V$

$\frac{1}{v} = \frac{1}{v_1} + \frac{1}{v_2}$

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

$\frac{1}{v} = \frac{2}{1}$

$v = 0.5\Omega$

Consider 3Ω and 6Ω in parallel.

$R = \frac{R_1 \times R_2}{R_1 + R_2}$

$= \frac{3 \times 6}{3+6}$

$= \frac{18}{9}$

$R = 2\Omega$

Consider 2Ω and 4Ω in series.

$R = R_1 + R_2$

$= 2 + 4$

$= 6\Omega$

From

$E = I(R + r)$

$1 \cdot 5 = I(6 + 0 \cdot 5)$

$I = \frac{1 \cdot 5}{6 \cdot 5}$

$I = 0 \cdot 23A$

(ii)

Power $= I^2R$

$= 0 \cdot 23^2 \times 4$

$0 \cdot 2116W$

(d)
- Increasing the magnitude of the current.
- Increasing the number of turns in the coil.
- Placing an iron ore inside the coil.

7(a) Convection is the transfer of heat from regions of high temperature to regions of high temperature to regions of low temperature by movement of the fluid its self.

Radiation is the flow of heat from one place to another by means of electro-magnetic waves.

Conduction is the flow of heat through matter from regions of high temperature to regions of low temperature by movement of matter as a whole.

(b)(i) A woolen carpet is a bad absorber as well as a bad emitter of heat radiation while as a bare cemented floor is a good absorber as well as a good emitter of heat radiation

(ii) Because they allow the less dense hot air out of the room.

(c)(i) Heat required $= pt$

$= 50 \times 10 \times 60$

$= 30{,}000J$

Heat energy $= mc\theta$

(ii) $30{,}000 = 5 \times c \times 12$

$c = \frac{30{,}000}{5 \times 12}$ $\quad$ $c = \frac{30{,}000}{60}$

$= 500Jkg^{-1}k^{-1}$

The specific heat capacity is $500Jkg^{-1}k^{-1}$

(d)(i) Saturated vapour is the vapour which is in thermo dynamic equilibrium with it's own liquid.

(ii) At high altitudes, the air pressure is low so a liquid boils at a low altitude, the air pressure is high so a liquid boils at a high temperature.

(e) $mass, m = 400g = 0.4kg$ $\quad$ $height, h = 80m$

$heat\ energy = energy\ lost$

$= mgh$

$= 0 \cdot 4 \times 10 \times 80$

$= 320J$

But

$heat\ energy = mc\theta$

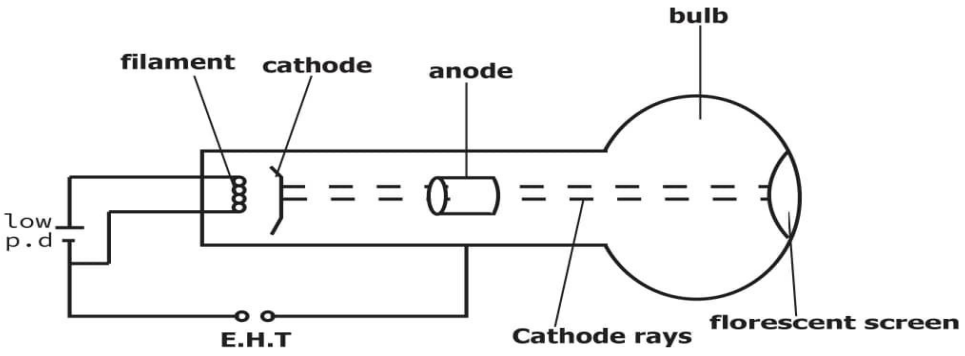
$320 = 0 \cdot 4 \times 150 \times \theta$

$320 = 60\theta$

$\theta = 5 \cdot 3℃$

8(a) Cathode rays are streams of fast moving electrons

(b)(i)



(ii) The cathode is heated by a low p.d applied across the filament.

The cathode then emits electrons by thermionic emission.
The emitted electrons are then accelerated by a high p.d applied between the filament and the anode so that they move with a very high speed to constitute the cathode rays.

(iii)
- Measurement of frequency.
- Displaying wave forms.
- Displaying pictures in TV sets.
- Measurement of phase difference.
- Measurement of a.c and d.c voltage.

(c)(i) ${}^{216}_{84}P$ — ${}^{212}_{83}R + {}^{0}_{1}e + {}^{4}$ He

(ii)

No of atoms	Time(s)
3.2×10^{10}	0
1.6×10^{10}	15
0.8×10^{10}	30
0.4×10^{10}	45
0.2×10^{10}	60
0.1×10^{10}	75
0.05×10^{10}	90
0.025×10^{10}	105
0.0125×10^{10}	120

(d) The number of atoms present after 2 minutes is 1.25×10^{8} atoms
The cathode is heated to emit electrons by thermionic emission using a low voltage.
A high p.d is applied across the anode to accelerate the electrons towards the anode.
When the cathode rays strike the target, about 99% of their kinetic energy is converted to heat energy and 1% is converted to x-rays.
