BALU
ECE
UVCE

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(ECE)

PHYSICS PRACTICALS

VIVA-VOCE

1. MOMENT OF INERTIA OF AN IRREGULAR BODY & RIGIDITY MODULUS

1. *Define moment of inertia.*

The moment of inertia of a body about an axis is defined as the sum of the products of the mass and the square of distances of various particles from the axis of rotation. Thus $I=\Sigma mr^2$

2. *What is the physical significance of moment of inertia ?*

Moment of inertia plays the same role in rotatory motion as mass plays in linear motion.

3. *What is meant by inertia of a body ?*

The inability of a body to change by itself its position of rest or of uniform motion is called inertia.

4. *Is the moment of inertia constant for a given body ?*

No. It depends upon the position of the axis about which the body rotates.

5. *Upon what factors does the M.I. of a body depend ?*

The M.I. of a body depends upon (i) the mass of the body (ii) the position of the axis of rotation (iii) the distribution of mass in the body about the axis of rotation.

6. *What is meant by radius of gyration ?*

The radius of gyration of a body about a given axis of rotation is that perpendicular distance from the axis, the square of which when multiplied by the total mass of the body gives the M.I. of the body about that axis. Thus $I = \Sigma mr^2 = Mk^2$. Here k is called the radius of gyration of the body.

7. *What is a torsional oscillation?*

If a body suspended by means of a wire is given a slight rotation in the horizontal plane and then released, the wire twists the suspension fibre first in one direction and then in reverse direction executing torsional oscillations.

8. *How is the period related to moment of inertia ?*

Radius of gyration = $\sqrt{\frac{M.I}{\text{Total area}}}$

By the relation $T=2\pi\sqrt{I/C}$ where I is moment of inertia and C is the couple per unit twist.

9. Why I/T^2 is constant for given length of wire ?

For a given length of the wire as I changes T also changes thereby making I/T^2 a constant

10. What is rigidity modulus ?

It is the ratio of shearing stress to shearing strain. within the elastic limit.

11. The diameter of the wire is to be measured accurately in this experimet ? Why ?

Since the radius occurs with fourth power in the formula, the diameter of the wire is measured very accurately.

2. INTERFERENCE AT A WEDGE

1. What is meant by interference of light ?

When two light waves superimpose then the resultant amplitude in the region of superposition is different than the amplitude of individual waves.

This modification of amplitude obtained by superposition of two waves is known as interference.

2. What are the conditions necessary for observing the interference fringes ?

The conditions are : (1) The two light sources must originate from a single source (ii) The two sources of light must be coherent (iii) The amplitudes of the interferring waves should be equal or nearly equal (iv) The two sources must lie close to each other.

3. Why do we get alternate dark and bright fringes ?

Because the resultant may be of maximum or minimum intensity depending upon the phase difference between the two waves. Where the intensity is minimum there will appear dark rings and there will be bright rings where the intensity is maximum.

4. What are coherent sources ?

Two sources which vibrate in the same phase or has a constant phase difference between them are called coherent sources.

How can you obtain coherent sources ?

The coherent sources can be obtained by ing a pencil of rays into two either by ction or by refraction.

What is an air wedge ?

If the thickness of the air film enclosed between the glass plates increases outwards from the line of contact of the plates it is called an air wedge.

7. *Is the fringe at the point of contact of the glass plates dark or bright ?*

At the point of contact the two interferring rays are opposite in phase and produce zero intensity. Hence the fringe will be dark.

8. *Why are the fringes straight ?*

Because in the case of a wedge shaped film 't' remains constant only in a direction parallel to the thin edge of the wedge.

9. *Why the fringes are formed ?*

The fringes are formed as a result of interference between the light waves reflected from the upper and from the lower surfaces of the airfilm enclosed between the two plates.

10. *What is a monochromatic light?*

A light which has a single wavelength is called monochromatic.

11. *What is fringe width ?*

It is the distance between any two successive dark or bright fringes.

12. *If the thickness of the piece of paper is increased will the width of fringes increase or decrease ?*

The width of the fringe will decrease.

13. *What will happen when a liquid is introduced in between the two plates ?*

The fringe width decreases.

14. *Mention an application of interference fringes.*

Interference fringes are used in industry for testing optical flatness of glass plate.

3. NEWTON'S RINGS

1. *What are Newton's rings ?*

When a beam of light is made to fall normally on the combination of plano-convex lens and plane glass plate, concentric circular rings are observed. These rings are known as Newton's rings.

2. *Where the rings are formed actually ?*

The rings are formed in the air film between the glass plate and the lens. They are called localised fringes.

3. *Can you give an example of non-localised fringes ?*

Yes. The fringe obtained in the Fresnel's biprism experiment are non-localised as they are formed in the space anywhere between the biprism and the eyepiece.

4. *Why are the fringes circular ?*

The fringes are circular because the air film is symmetrical about the point of contact of the lens and the glass plate.

5. *Why the glass plate is kept at 45° with vertical ?*

Because the glass plate inclined at 45°

makes the rays normally incident on the combination of lens and plate.

6. *Will there be any change in ring if light is incident obliquely ?*

Yes. The diameter of the rings will increase.

7. *What will happen if we use white light instead of monochromatic light ?*

We will get some coloured rings with a white light source.

8. *What will happen if a liquid is introduced between the lens and the plate ?*

The rings will contract because its diameter will decrease.

9. *What is meant by radius of curvature ?*

Radius of curvature is the radius of the sphere of which the lens forms a part.

10. *On what factors do the diameter of the ring depend ?*

It depends on : (i) The refractive index of the medium enclosed between the lens and the glass plate. (ii) The radius of curvature of the plano-convex lens (iii) The wavelength of the

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rce used.

In the Newton's ring system, the rings get loser as we move away from the centre. Why is it so ?

The diameter of dark rings are proportional to the square root of the natural numbers whereas that of the bright rings to the square root of the odd natural numbers. Hence the diameter of the rings does not increase in the same proportion as the number of rings increases.

12. Why is the central spot dark in the ring system ? How will it look when viewed by transmitted light ?

At the point of contact the path difference between the two interferring beams is equal to $\lambda/2$. Since this is the condition of minimum intensity the central spot will appear dark. When viewed by transmitted light the central spot will appear bright.

13. Name some of the applications of Newton's rings.

Newton's rings are used to determine (i) the wavelength of monochromatic light. (ii) the radius of a spherical surface. (iii) the refractive index of a liquid.

14. How do you measure the radius of curvature of the lens ?

By using a spherometer.

15. Is the back lash error taken into consideration here ?

Yes. It is avoided by moving the screw in one direction only before taking each reading.

4. DIFFRACTION GRATING

1. What do you mean by diffraction of light?

When light passes by the edge of an opaque obstacle it bends slightly into the geometrical shadow. This property of light waves of bending round corners is called diffraction of light.

2. What is the difference between interference and diffraction ?

(i) Interference is the result of interaction of light coming from two different wave fronts originating from the same source whereas the diffraction pattern is the result of the interaction

of light coming from different parts of the same wavefront.

(ii) The width of the fringes in interference is always equal whereas in diffraction pattern they are never equal.

3. *How many kinds of diffraction do you know. What are they ?*

Two. They are Fresnel's diffraction and Fraunhofer diffraction.

4. *What are the preliminary adjustments which are to be made before using a spectrometer?*

(i) The eye piece of the telescope is adjusted so that the cross wires are clearly seen (ii) The telescope is adjusted to receive parallel rays by focussing it on a distant object. (iii) The prism table is levelled using a spirit level. (iv) The illuminated slit of the collimator is viewed through the telescope and the collimator is adjusted till the image of the slit is clearly seen.

5. *What is the type of eyepiece used in the telescope ?*

Ramsden's eyepiece. The telescope with a

Hugens's eye piece does not permit any measurement since the cross wires cannot be conveniently used with this eyepiece whereas with Ramsden's eyepiece a cross wire can be used for the measurements.

6. *What is a diffraction grating ?*

A diffraction grating is an optical plane glass plate on which a large number of equidistant parallel lines are ruled by a fine diamond point. The space between any two successive rulings act as slits of equal width.

7. *Is it such a grating that you are using here?*

No, those grating are very expensive. So we use copies of the gratings made by celluloid casting. These copies are called grating replicas.

8. *What is meant by grating constant ?*

The distance between any two successive slits is called the grating constant.

9. *What is meant by angle of minimum deviation ?*

The angle of deviation D depends on the angle of incidence i. For a particular value of i

e angle of deviation is minimum. This minimum ngle is called the angle of minimum deviation.

10. What is an order of a spectrum?

In a grating multiple spectra is obtained. Each spectrum corresponds to an order of the spectrum.

11. On what factors does the maximum number of order of spectrum depend?

For a given wavelength the maximum number of order of spectra depends upon the grating element (a+b). Since the maximum angle of diffraction can be 90°

$$n_{max} = (a+b) \sin 90°/\lambda = (a+b)/\lambda$$

12. How many orders of spectrum do you get here?

We get only ~~two~~ orders of spectra

Because $n = \frac{2.54 \times 10^{-2}}{15,000 \times 5893 \times 10^{-10}} = 2$

13. How does a grating spectra differ from a prism spectrum?

(i) A prism gives only one spectrum; but a grating gives a number of spectra on either side of the central maxima. (ii) The prism spectrum is much more intense than the grating spectrum. (iii) In a prism spectrum, the deviation is least for violet and greatest for the red. (iv) The prism spectrum depends upon the material of the prism whereas the grating spectrum is independent of the material of the grating.

14. Why is the order of colours in the two spectra reverse?

In grating the angle of diffraction is proportional to the wavelength of light. Therefore the violet ray which has a least wavelength is diffracted least and the red is diffracted more. The reverse happens in the case of prism spectrum because the angle of deviation is the greatest for violet and smallest for the red.

15. What will happen if the number of rulings per inch (N) is increased or decreased?

If N is increased, we get few order number of bands seperated by large angle and if N is decreased we will get several order numbers

seperated by small angle.

16. Are the intensities of light same in all the orders of the spectrum?

No. As the order of the spectrum increases the intensity decreases.

17. Is there any other method to find the wavelength of a radiation. Name it?

Yes. Normal incidence method.

5. YOUNG'S MODULUS BY UNIFORM BENDING

1. What is meant by least count?

The smallest value of a physical quantity which can be measured accurately with an instrument is called the least count.

2. What do you mean by elasticity?

The property of a body by virtue of which it tends to regain its original shape or size after removing the applied forces is known as elasticity.

3. Distinguish between elastic and plastic bodies.

Bodies which can completely recover their

original size and shape after removal of deforming forces are said to be perfectly elastic. On the other hand, bodies which completely retains its altered size and shape are said to perfectly plastic.

4. Which of rubber, steel is more elastic and why?

In case of rubber deformation can be easily produced. But in the case of steel greater force is necessary to produce a small deformation. Hence steel is more elastic than rubber in the language of physics.

5. What is meant by elastic limit?

There is maximum value for the deforming force beyond which the body ceases to be elastic. This maximum value of the deforming force is called the elastic limit of the body.

6. What is modulus of elasticity?

Within elastic limit, the ratio of stress to strain for a given material is constant and this constant is known as modulus of elasticity.

7. What is stress? What is its unit?

The restoring force per unit area of the body

is called stress. Its unit is Newton/meter^2.

8. *What is strain ?*

The ratio of the change in any dimension of a body to the original dimension is called strain.

9. *How many types of strain do you know ? Name them ?*

(i) Longitudinal strain (ii) Volume strain (iii) Shearing strain

10. *What is meant by longitudinal strain ?*

When a change of length takes place the strain is known as longitudinal strain. It is measured by a change in length per unit length.

11. *What is meant by volume strain?*

The change in volume per unit volume is called volume strain.

12. *What is meant by shearing strain?*

The change in an angle of a body is called shearing strain.

13. *The readings of the travelling microscope are taken when the load increases and then decreases. The mean value of the readings is then taken. Why ?*

When the load is increased the beam undergoes some structural changes inside. The beam does not recover from these changes immediately but takes some time to come to its original condition. Therefore we take readings for load decreasing also so that the beam gets enough time to come to its original condition. But the original condition may not be exactly reproduced even now. So the mean value of the two readings is taken.

14. *State Hooke's Law.*

Hooke's law states that, within elastic limit the stress is directly proportional to the strain.

15. *What are the other elastic constants ? Name them. How are they connected to each other ?*

Rigidity modulus (n) & Bulk modulus (k).

By the relation, $Y = \frac{9nk}{3k+n}$

16. *What is Poisson's ratio ?*

It is the ratio between lateral strain and the

longitudinal strain.

17. What is the theoretical limits between which the value of Poisson's ratio lie ?

Its value should lie between -1 to +0.5.

18. What is meant by uniform bending ?

When an uniform load acts on the beam, the envelope of the bent beam will form an arc of a circle and the bending is called uniform bending.

19. What is meant by non-uniform bending ?

When we load the beam only at a point of the beam the envelope of the bent would not form an arc of a circle and the bending is called non-uniform bending. The cantilever bending is a non-uniform bending.

20. How will the value of Young's modulus change with a change in the length, breadth or thickness of the beam ?

The value of Young's modulus remains the same as long as the material of the beam remains the same. This is because the Young's modulus is a constant for the material.

21. What should be measured very accurately in this experiment ?

Since l and d occur in the third power they should be measured very accurately.

22. What is the practical application of the knowledge of elasticity ?

It enables us to calculate the stress which a body of a given size can bear. Again on knowing the Young's modulus of a material and the magnitude of stress to be applied to the body one can calculate the size which the body must possess in order to withstand that stress. It thus helps in designing of the body.

23. What is the effect of temperature on elastic moduli ?

In general the value of elastic moduli decrease with the rise of temperature.

6. SONOMETER

1. What is a sonometer ?

A sonometer is a long, hollow wooden box having two fixed bridges and a moyable bridge. A wire has its one end tied to a hook fixed on the box and the other end passes over a smooth

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frictionless pulley and carries a load.

2. *What is an alternating current ?*

A current which flows first in one direction and then in the reverse direction is called alternating current.

3. *Why is the instrument called a sonometer?*

Because it is used to measure the constants relating to sound.

4. *Mention some of the applications of a sonometer.*

A sonometer can be used (i) To verify the laws of transverse vibration of a string. (ii) To determine the frequency of a tuning fork. (iii) To determine the density of the material of the wire. (iv) To determine the frequency of ac mains.

5. *What is meant by frequency of ac ?*

The number of times the current changes its direction per second is known as frequency of ac.

6. *What is the frequency of the ac in your lab?*

50 cycles per second.

7. *How do you distinguish between longitudinal and transverse waves?*

In longitudinal wave motion the particles of the medium vibrate in the direction of propagation of the wave whereas in transverse wave motion the particles of the medium vibrate in a direction at right angles to the direction of propagation of the wave.

8. *Does direct current also have frequency?*

No. Since the direct current does not change its direction of motion it does not have any frequency.

9. *Why does the wire vibrates when the current is passed through it ?*

When a wire carrying current is placed in a magnetic field it experiences a mechanical force according to Fleming's left hand rule. The current flows along the wire whereas the magnetic field is perpendicular to it. During the first half cycle when the current flows in one direction, the wire goes either up or down while in the next half cycle the wire goes in the reverse direction due to the change in the direction of the current. Thus the wire executes forced vibrations up and down when the current is passed through it.

10. What are the laws of vibrations of strings? OR On what factors does the frequency of vibration of a sonometer wire depends ?

The frequency of transverse vibrations of a stretched string is (i) Inversely proportional to the length of the string when the tension and mass per unit length are constant. (ii) Directly proportional to the square root of the tension when the length and the mass per unit length are constant and (iii) Inversely proportional to the square root of the mass per unit length when length and tension are constant.

11. What types of vibrations are produced in a sonometer wire ?

Transverse stationary vibrations are produced in a sonometer wire.

12. What is Fleming's left hand rule ?

This rule helps us to predict the direction of motion of a conductor in a magnetic field. According to this rule, if we stretch the thumb, the fore finger and middle finger of our left hand mutually at right angles to one another such that the fore finger points in the direction of magnetic

field, middle finger in the direction of current then thumb points in the direction of motion of the conductor.

13. Is it a case of forced vibrations?

Yes. Here the current forces the wire to vibrate with its own frequency with the help of magnetic field.

14. What are stationary waves ?

When two identical progressive waves travel through a medium along the same line in opposite direction they superimpose to produce new type of waves which appear stationary in space. These waves are called stationary waves.

15. What is a transformer and what is its use?

A transformer is a device which is used to either increase or decrease the voltage of a given alternating current. If the transformer increases the voltage it is called a step-up transformer and if it decreases the voltage it is called step-down transformer.

16. What is resonance ? In this experiment is the resonance sharp or flat ?

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When the natural frequency of the wire is qual to the frequency of the alternating current it s called resonance.

The resonance is sharp because a slight displacement of bridges causes a considerable fall in amplitude of vibration.

17. What is the function of the sonometer board?

The sonometer is made in the form of a hollow box so that it contains air inside. When the wire vibrates the energy of vibration is communicated to the board and from there to the enclosed air. Now the air also begins to vibrate together with the wire and the intensity of sound increases. The hole drilled on the sides of the board enable the inside air to come into contact with the outside air so that the transfer of energy is made possible.

18. Why are bridges provided on the board?

The bridges limit the length of vibrating segment.

19. Why do you use a transformer here?

The transformer is used to step down the ac

voltage from 220 volts to a small value of about 6 to 12 volts so that the wire may not get any electrical shock.

20. What is actually changing when the distance between the bridges is changed?

The natural frequency of the sonometer wire.

21. What happens to the length of the vibrating segment if thickness of the wire is increased?

The length of the vibrating segment decreases.

19. Of what material is the wire made of and why?

The wire is made of brass or copper. It can be of any metal except iron, nickel or cobalt which are magnetic. A non-magnetic material is always taken so that it may be attracted by the magnet.

7. DENSITY OF GLASS

1. How do you define the density of a substance?

The density of a substance is defined as its mass per unit volume.

2. *What is the dimension of density?*

Dimension of density = $[M^1L^{-3}T^0]$

3. *What is the difference between density and relative density?*

The density of a substance is different in different system of units whereas the relative density is the same in all systems since it is a pure number and dimensionless.

4. *Define specific gravity of a substance*

Specific gravity or relative density of a substance is the ratio of the weight of a certain volume of the substance to the weight of an equal volume of water at 4 °C.

5. *What is the density of water at 4°C in S.I. units?*

1000 kg/m³

6. *How does density vary with temperature?*

In general, the density decreases with the increase in temperature.

7. *How does the density of water vary with temperature?*

The density of water increases from 0°C to 4°C and thereafter decreases. Thus the density of water is maximum at 4°C.

8. *What changes will be there in density when the length of the tube or diameter of the tube is varied?*

The density remains unchanged for if there is any change in length or diameter the volume changes and hence mass of the material also changes.

9. *How do you distinguish between mass and weight? How will you measure them?*

Mass of a body is the quantity of matter contained in the body whereas weight of the body is the force with which it is attracted towards the centre of the earth and is equal to mass multiplied by acceleration due to gravity. Moreover the mass of a body does not change when the body is moved from one place to another whereas the weight of a body will differ from place to place depending upon the value of the acceleration due to gravity.

The mass of a body is measured by a physical balance whereas the weight of a body to measured by a spring balance.

10. If you are given a glass rod instead of a glass tube how will you determine the density of the glass rod?

Then Density = $M / \pi R^2 L$

8. CANTILEVER

1. Define Young's modulus.

The ratio of the longitudinal stress to the longitudinal strain within elastic limit is called the Young's modulus.

2. What is a cantilever?

A cantilever is a beam which is fixed at one end and loaded at the other end.

3. What is a beam?

A beam is a rod or a bar of uniform cross section whose length is much greater as compared to its other dimensions.

4. What happens when a beam is bent?

When a beam is bent, its filaments on the

convex side are elongated while the filaments on the concave side are shortened.

5. What is neutral surface?

When a beam is bent, the filaments or fibres on the convex side of the beam are extended while those on the concave side are compressed. In between the two surfaces there exists a surface which will neither be compressed nor extended. This surface is known as neutral surface.

6. What do you mean by neutral axis?

The neutral surface is perpendicular to the plane of bending. The line along which the neutral surface intersects the plane of bending is called neutral axis.

7. What is elastic after effect?

Different substances take different intervals of time to regain their original shape when deforming forces are removed. This delay in recovering the original condition after the deforming force has been withdrawn is known as elastic after effect. For example after the withdrawal of deforming forces, quartz resumes its original condition almost immediately but glass

will take several hours to resume its normal condition.

8. For a given load if the length of the cantilever is doubled, how will the depression change ?

Depression, $s = 4mgl^3/bd^3Y$

Hence, depression will be proportionately greater, 8 times the original depression.

9. How will the value of Y change with a change in the length, breadth or thickness of the beam ?

The value of Y will remain the same as long as the material of the beam remains the same. Because Young's modulus is a constant for a material.

10. Is there anything that changes in length, breadth or thickness of the beam?

Yes, the depression will change according to the formula, $s = 4mgl^3/bd^3Y$. For instance, if the length is halved, the depression will become 1/8 of its value.

11. What is the use of Young's modulus is practical life?

The knowledge of Young's modulus is applied in finding how much load a particular beam may carry safely. The principle is used in laying griders and beams etc., in big buildings and bridges.

9. VOLUME RESONATER

1. What do you mean by frequency of a vibrating body ?

The number of vibrations executed by a body in one second is called its frequency.

2. What do you understand by the frequency of a tuning fork ?

When a tuning fork is excited, its prong begins to vibrate, the number of vibrations executed by a prong per second is called the frequency of the fork.

3. What are the factors on which the frequency of a tuning fork depend?

The frequency of a fork depends upon the length and thickness of the prongs and upon the velocity of sound in its material.

The frequency varies (i) directly as the

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thickness of the prong (ii) inversely as the square of the length of the prong and (iii) directly as the velocity of propagation of the longitudinal wave through the material of the fork.

4. *Suppose you are given two forks of the same set. Without seeing the marked frequency, how will you ascertain which fork has higher frequency?*

The tuning fork with the shorter and thicker prongs has higher freqency than the one with longer and thinner prongs.

5. *How will you distinguish between two tuning forks of nearly the same frequency?*

The two forks are sounded together and the number of beats per second are counted. Then the prong of one of the forks is slightly loaded with wax and they are again sounded. If the number of beats per second decrease, the fork loaded has higher frequency and if the beats per second increase the loaded fork is of lower frequency.

6. *What is resonance?*

When the natural frequency of a body coincides with that of applied frequency, the

amplitude of vibration of the former becomes maximum. This phenomenon is called resonance.

7. *What is a resonator?*

A resonator is a device in which an air column or a volume of air in it can resonate in response to any source of sound such as a tuning fork.

8. *How will the frequency of the tuning fork be affected when one of the prongs is (i) loaded with a little wax (ii) filed off a little.*

The frequency of a fork (i) decreases by loading any one of the prong with wax and (ii) increases by filing off a little metal from a prong.

9. *What type of sound waves are produced when a tuning fork is excited?*

Transverse stationary waves are produced in a vibrating tuning fork.

10. *At resonance, what vibrates with the frequency of the fork?*

The volume of air above the water in the bottle vibrates with the frequency of the fork.

11. *What is the difference in the vibrations of*

the free ends and the stem of a tuning fork ?

The free ends of the fork executes transverse vibrations whereas the stem performs longitudinal vibrations.

12. Why are tuning forks designed to have standard frequencies like 256, 288, 512 etc. ?

The tuning forks are designed to have frequencies like 256, 288, 512 etc., because these constitute the note of the major diatonic scale (a musical scale) and can be conveniently determined.

13. Of what material are the tuning forks generally made and why ?

The tuning forks are generally made of steel since its elasticity is high and density low.

14. What is the effect of temperature on the frequency of a tuning fork ?

With increase of temperature the length of the prongs increases and elasticity decreases and so the frequency of the tuning fork becomes less.

15. What should be done in order to avoid any change in frequency due to change of

temperature ?

In order that the frequency may not change with temperature its elasticity must not vary with temperature. For these reasons, the tuning forks are to be made from elinvar (*el*asticity *invar*iable) an alloy of nickel and steel.

16. What is neck correction ? How is the neck correction found for an accurate determination of the frequency of a tuning fork ?

The volume of air in the resonator is found from the base of the neck upto which the water is filled. The volume, however includes that contained by the neck also which we do not take into account. Thus the volume of the neck should be added to the volume of air. This is neck-correction.

To find neck correction a graph is drawn by plotting volume V along the Y-axis and $1/n^2$ along the X-axis. The resulting graph will be a straight line which does not pass through the origin. This indicates that n^2V is not a perfect constant. The straight line is produced to cut the volume axis at