# 5. PRACTICAL PHYSICS

## SYNOPSIS

**Experiments:**

**1.** Vernier callipers

Vernier constant = 1 MSD - 1VSD (or) Least count = $\dfrac{1MSD}{no\,of\ \ divsion\,on\ vernier\ scale}$

Reading = R = MSR + VSR x LC

**2.** Screw Gauge pitch $= \dfrac{dis\tan ce\ travelled\ on\ pitch\,scale}{number\,of\ rotation}$

Least count = $\dfrac{\text{pitch of screw}}{\text{no of divisions on circular scale}}$

Range = R = MSR + PSR x LC

**3.** Mass of a given body using a meter scale ; $M_0 \to$ un known mass

**4.** **Simple pendulum :** $T = 2\pi\sqrt{\dfrac{L}{g}}$ ; $g = \dfrac{4\pi^2 L}{T^2} = 4$ ; $\dfrac{L}{T^2}$ is calculataed from graph.

**5.** Searles apparatus $y = \dfrac{L}{\pi r^2}\left(\dfrac{Mg}{\Delta L}\right)$. Calculate $\dfrac{Mg}{\Delta L}$ from graph

**6.** Surface tension by capillary rise $T = \dfrac{r(h+\frac{r}{3})\rho g}{2\cos\theta}$

r-radius of capillary tube ; h - height to which liquid rises ; $\theta$ - angle of contact $\rho$ - densities of liquid.

**7.** Coefficient of a viscosity of a given viscous liquid by measuring terminal velocity of a given spherical body

$n = \dfrac{2}{a}(\rho - \sigma) g \left(\dfrac{r^2}{v_t}\right)$ poise

Calculate $\dfrac{r^2}{v_t}$ from graph. $\rho \to$ density of liquid ; $\sigma \to$ density of solid ball; $r \to$ radius of ball

$v_t \to$ terminal velocity

**8.** Speed of sound in air at room temperature using a resonance tube.

$V = 2f(l_2 - l_2)$ ; $f \to$ frequency of tuning fork ; $l_1 \to$ length of air column at first resonance

$l_2 \to$ length of air column at second resonance.

**9.** Variation of temperature of hot body with time, (Newton's law of cooling) $\log(\theta - \theta_0) = -Kt + c$

The graph between $\log(\theta - \theta_0)$ and 't' will be a straight line.

**10.** Specific heat of a given substance by method of mixtures.

$S = \dfrac{(M_2 - M_1 W_1)(\theta - \theta_0)(4.2)}{(M_3 - M_2)(\theta_S - \theta)}$ ; $M_1 \to$ Mass of empty calorimeter + stirrer

$M_2 \to$ mass of calorimeter + water + stirrer

$M_3 \to$ mass of calorimeter + water + stirrer + substance.

$\theta_0 \rightarrow$ initial temperature of water in calorimeter ; $\theta_s \rightarrow$ initial temperature of substance

$\theta \rightarrow$ final temperature of mixture.

Water eqvt. of = $W_1 = \frac{m_1 S_2}{s_1}$ calorimeter.

$S_1 \rightarrow$ specific heat of water ; $S_2 \rightarrow$ specific heat of material of calorimeter.

**11.** Resistance of given wire by meter bridge. $X = \frac{(100-l)R}{l}$ ; $l \rightarrow$ balancing length

$X = \frac{\rho L}{\pi r^2}$; $L \rightarrow$ length of wire ; $r \rightarrow$ radius of wire ; $\rho \rightarrow$ specific resistance of wire.

**12.** Resistance of a wire by using ohms law $R = \frac{V}{I}$. Calculate $\left(\frac{V}{I}\right)$ from graph

**13.** Resistance of a wire using post office box $X = \left(\frac{R_1}{R_2}\right)R$

$R_1 \& R_2$ are ratio arms. $R \rightarrow$ known resistance ; $X \rightarrow$ unknown resisnace.

First press battery $K_1$ & then galvanometer $K_2$, while taking reading.

**14.** Comparing emf's of two given cells using potentiometer. $\frac{E_1}{E_2} = \frac{l_1}{l_2}$ ; $l_1$ & $l_2$ are balancing lengths.

**15.** Internal resistance of a given primary cell using potentiometer $r = \left(\frac{l_1}{l_2} - 1\right)R$

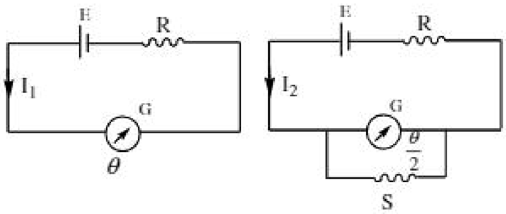
$l_1$ & $l_2$ are balancing lengths without shunt and with shunt respectively, and R is shunt resistance in parallel with the given cell.

**16.** Internal resistance and figure of a merit galvanometer with half deflection method.

$I_1 \frac{E}{R+G} = K\theta$

$I_2 = \frac{E}{R + \frac{GS}{G+S}} = \frac{K\theta}{2}$

$G = \frac{RS}{R-S}$




$K = \frac{1}{\theta}\left(\frac{E}{R+G}\right)$, $\theta \rightarrow$ full scale deflection.

**17.** Focal length of a concave mirror by U - V method.

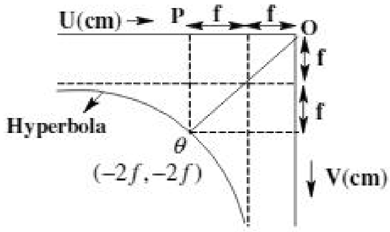
$f = \frac{-\theta p}{2} = \frac{-\theta R}{2}$

$OP = OR = \theta P = \theta R = 2f$

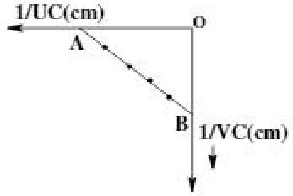
$f = \frac{UV}{U+V}$

$f = \frac{1}{OA} = \frac{1}{OB}$

(a)




(b)



**18.** Focal length of a concave mirror.

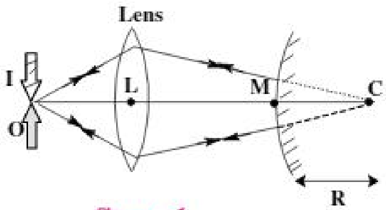


figure 1

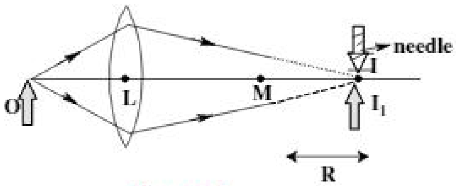


figure 2

A concave lens L is interposed between a convex mirror M and an object needle O. as shown in figure (1). The relative positions of O, M, and L are, So adjusted, their is no parallax between I and O, the position of M is noted.

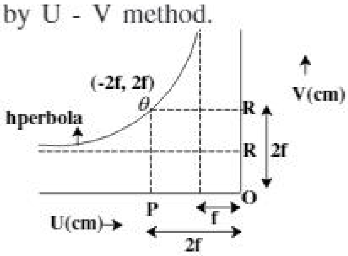
Now without disturbing the positions of the object O and is placed in the position of the image I of the object O, formed by Lens L along as in figure 2.

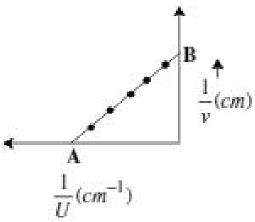
Now $f_{mirror} = \frac{R}{2} = \frac{MI_1}{2}$

**19.** Focal length of a convex lens by U - V method.

$f = \frac{\theta P}{2} = \frac{\theta R}{2}$

$f = \frac{1}{OA} = \frac{1}{OB}$

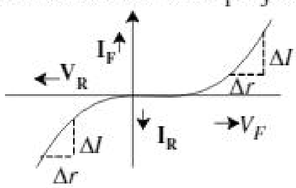



**20.** Forward and reverse bias characteristics curves of a pn-junction diode

$R_F = \frac{\Delta V}{\Delta I}$

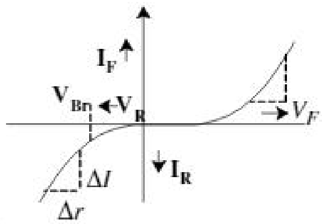
$R_R = \frac{\Delta V}{\Delta I}$




**21.** Forward bias and reverse bias of a zener diode.

$R_F = \frac{\Delta r}{\Delta I}$

$R_r = \frac{\Delta V}{\Delta I}$




**22.** Input and outpout characteristics of a transistor $R_i = \frac{\Delta V_{BE}}{\Delta I_s}$ at constant $V_{CE}$

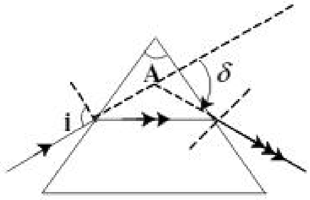
$R_0 = \frac{\Delta V_{CE}}{\Delta I_C}$ at constant $I_B$

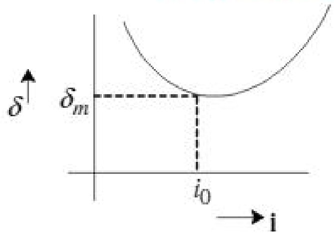
$A_i = B = \frac{\Delta I_C}{\Delta I_B}$ ; $A_r = \frac{V_0}{V_i} = \frac{\Delta V_{CE}}{\Delta V_S} = \frac{\Delta I_C R_0}{\Delta I_B r_i}$ ; $A_r = \frac{\beta R_0}{ri}$

Power gain : $A_P = A_i \times A_v = B \times \frac{BR_0}{r!} = \frac{\beta^2 R_0}{r_i}$

**23.** RI of a prism.

$$\mu = \frac{\sin\left(\frac{A+\delta_m}{2}\right)}{\sin\left(\frac{A}{2}\right)}$$




For various values of i, note down the values of $\delta$, plot graph, note down $\delta_m$.

**24.** RI of a glass slab using a travelling microscope. $\mu = \frac{r_3 - r_1}{r_2 - r_1}$

(**a**) on a sheet of white paper, mark a cross and place it below the objective of microscope.

(**b**) focus the eyepiece, such that cross wires, coincides with the marked cross on the paper. Not the reading of microscope is $r_1$.

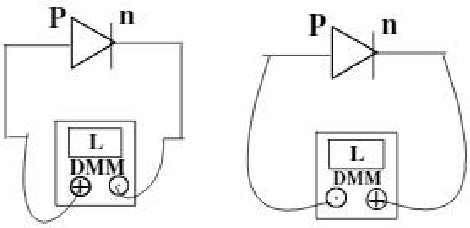
(**c**) Place the given glass slab on the cross mark appears to be raised, focus the microscope, such that corss mark on the paper, note down the reading as $r_2$.

(**d**) sprinkle some fine powder on the glass slab and more the microscope upward till the powder particles come in to focus, note down the reading as $r_3$. apparent depth = $r_3 - r_1$ real depth = $r_2 - r_1$.

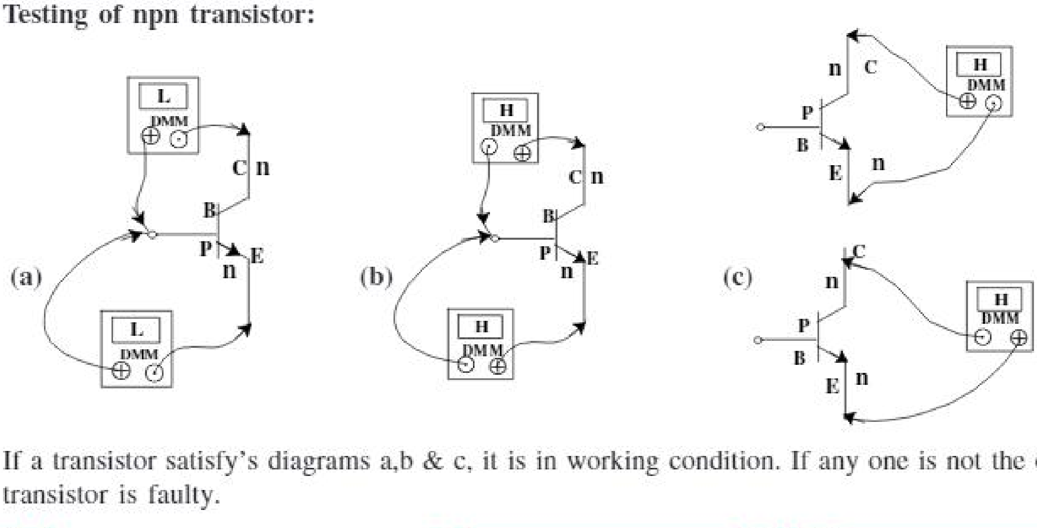
**Multi meter:** Diagram scan and paste it here. It display or shows 'L' it means low resistance and if it shows 'H', it mean hight resistance Here 'L' will be around $10\Omega$ to $800\Omega$ and H will be around several megha ohms ( $2m\Omega.t - 100m\Omega$ )

**DMM digital multimeter.**

**i) Testing of diode or Zener diode:**

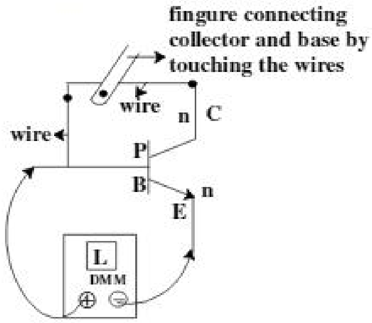



**ii) Testing of npn transistor:**




If a transistor satisfy's diagrams a,b & c, it is in working condition. If any one is not the obeyed, the transistor is faulty.

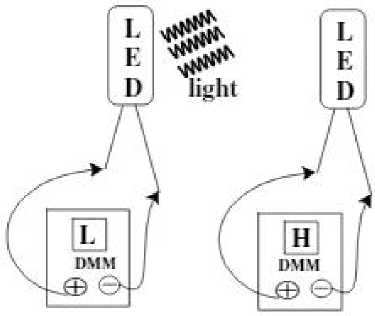
**(d) By pressing the wires connecting base and collector by finger and multimeter.**




**(a)** If meter reads low resistance, it is an npn transistors.

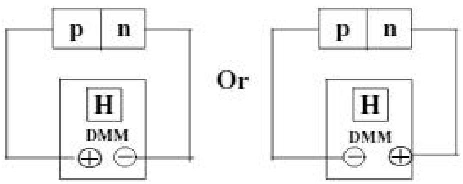
**(b)** if meter reads high resistance it is an pnp transistor.

**iii) Testing of LED :**




longer lead is p - type and shorter lead is n-type

**iv) Faulty diode or zener diode or LED:**



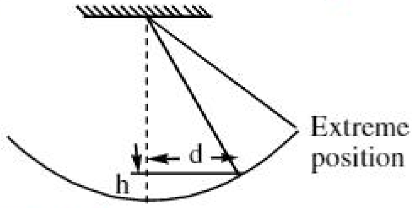

v) When capacitor is connected across a multimeter, it should reading display high resistance, when capacitor is in good condition. If it displays low resistance, then the capacitor is damaged.

## LECTURE SHEET

### LEVEL-I (MAIN)

*Straight Objective Type Questions*

1. A simple pendulum of length l oscillates about the mean position as shown in the figure. If the total energy of the pendulum is E, the velocity of the pendulum bob of mass m at point P is:



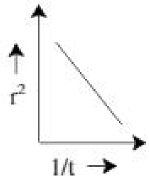

1) $\sqrt{\frac{2E}{m}-\frac{gl}{h^2}}$  2) $\sqrt{\frac{2E}{m}-\frac{gd^2}{l}}$

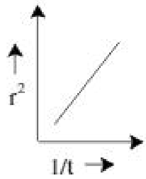
3) $\sqrt{\frac{E}{m}-\frac{2gl}{h^2}}$  4) $\sqrt{\frac{E}{m}-\frac{2gd^2}{l}}$

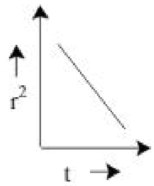
2. The coefficient of viscosity of a liquid of density $\sigma = 1.0$ CGS units as determined by measuring the terminal velocity of a spherical solid ball of density $\rho = 1.5$CGS units inside the liquid. If the ball of radius 1.00cm attain terminal velocity 1cm/s, then the viscosity (in CGS units) of the liquid as calculated from the observations of the experimental is: [Take g = 10m/s$^2$]

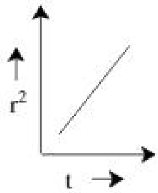
1) $\frac{1000}{9}$ 2) $\frac{100}{9}$ 3) $\frac{10}{9}$ 4) $\frac{1}{9}$

3. In the above experiment, spherical balls of different radii r but of same material are choosen and dropped freely inside a vertical tube. If the time t is recorded for each ball to fall a fixed distance s after attaining a constant terminal speed then the correct graph from the observation is:

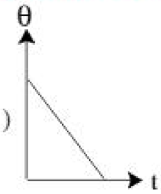
1) 

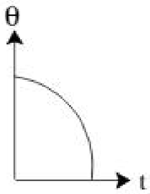
2) 

3) 

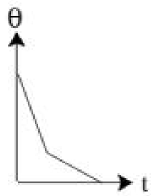
4) 


4. The temperature of water in calorimeter is $\theta$ and the temperature of surrounding is $\theta_c (< \theta)$. Observations are recorded for temperature difference $(\theta - \theta_0)$ and time t. The cooling curve is best represented in graph.

1) 

2) 

3) 

4) 


5. A tuning fork of frequency 500Hz when sounded on the mouth of resonance tube the lengths of air column for first and second resonance are recorded as 10cm and 40cm respectively. The room temperature is 20°C. The velocity of sound at the room temperature obtained from the explanation is

1) 300 m/s 2) 332 m/s
3) 290 m/s 4) 310 m/s

6. A piece of copper of mass 1kg heated upto temperature 80°C and then dropped in a glass beaker filled with 500cc of water at 20°C. After some time the final temperature of water is recorded to be 35°C. The specific heat capacity of copper is: (take specific heat capacity of water = 4200J/kg°C and neglect the thermal capacity of beaker)

1) 420J/kg°C 2) 700J/kg°C
3) 1180J/kg°C 4) 1260J/kg°C

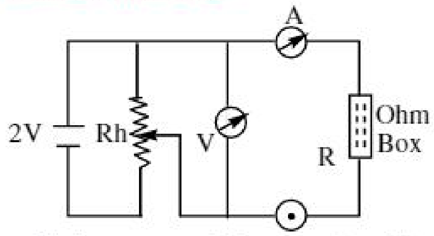
7. A student peforms meter bridge experiment to determine specific resistance of a conducting wire of length 10cm and diameter 1mm. When a standard $6\Omega$ resistance is connected on left gap and the given conducting wire is connected on the right gap, the balance pointis obtained for 60cm length of the meter bridge wire. The specific resistance in $\Omega$–m for the material of the given wire is:

1) $3.14 \times 10^{-2}$ 2) $6.28 \times 10^{-2}$
3) $3.14 \times 10^{-5}$ 4) $6.28 \times 10^{-5}$

8. Acopper strip is introduced in the left gap and a resistance $R = 0.4\Omega$ is placed in the right gap of a meter bridge experiment. The balance points before and after interchanging the copper strip and the resistnace R are 30cm and 60cm respectively. The resistance per unit length of the bridge wire is

1) $4\Omega.m^{-1}$ 2) $3\Omega.m^{-1}$ 3) $\frac{3}{4}\Omega.m^{-1}$ 4) $\frac{4}{3}\Omega.m^{-1}$

9. In the following experiment the rheostat is at a fixed resistance and the resistance R in the ohm box is increased in steps while switching on the key:

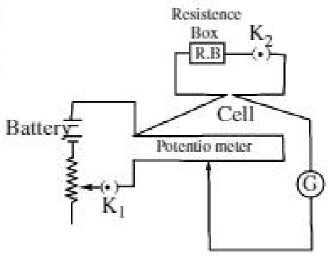



1) The voltmeter (V) reading will increase and the ammeter (A) reading will decrease
2) The reading of V will decrease and the reading of A will increase
3) The reading in both the meters will decrease
4) The reading in both the meters will increase

10. In order to determine the internal resistance of a primary cell by means of potentiometer the emf of the battery connected across the ends of the potentiometer wire should be

1) equal to the emf of the primary cell
2) smaller than the emf of the primary cell
3) Greater than the emf of the primary cell
4) All the above three options maybe possible

11. The adjoining figure shows the connection of potetniometer experiment to determine internal resistance of a leclanche cell. When the cell is an open circuit the balancing length of the potentiometer wire is 3.4m and on closing the key $K_2$ the balancing length becomes 17.m. If the resistnace R through which current is dream is $10\Omega$ then the internal resistance of the cell is:

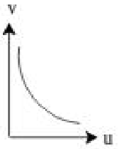


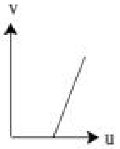

1) $0.1\Omega$ 2) $1\Omega$
3) $10\Omega$ 4) $1.1\Omega$

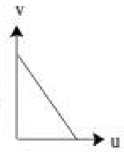
12. In an experiment for the determination of focal length of the convex mirror a convex lens of focal length 20cm is placed on the optical bench and an object pin is placed at a distance 30cm from the lens. When a convex mirror is introduced in between the lens and the real and inverted image of the object, the final image of object O is formed at O itsefl. If the distance between the lens and the mirror is 10cm, then the focal length of the mirror is

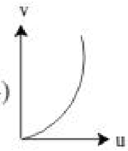
1) 10cm 2) 20cm
3) 25cm 4) 50cm

13. In an experiment for finding the focal length of a thin convex lens using two - pin method the position of the image '$\upsilon$' is recorded for various positrons 'u' of the object. Which of the following best represents object distance u versus image distance $\upsilon -$graph.

1) 


2) 

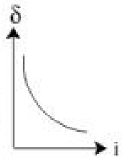

3) 

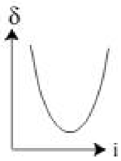

4) 


14. In determining the angle of minimum deviation for a given prism, a graph is plotted between the angle of incidence (i) and the angle of deviation ($\delta$). Which of the following graphs will correctly represents (i$-\delta$) curve

1) 


2) 


3) 


4) 


15. In a light emitting diode (LED)

1) negative leg is shorter than the positive
2) negative leg is longest than the positive
3) negative leg is equal to the positive leg
4) negative leg is zero and positive leg is infinite.

16. A student performed the experiment to measure the speed of sound in air using resonance air - column method. Two resonance in the air - column were obtained by lowering the the water level. The resonance with the shorter air column is the first resonance and that with the longer air column is the second resonance. Then :

1) the intensity of the sound heard at the first resonance was more than that at the second resonance.
2) the pongs of the tunning fork were kept in a horizontal plane above the resonance tube
3) the amplitude of vibration of the ends of the prongs is typically around 1cm
4) the length of the air column at the first resonance was somewhat shorter than 1/4th of the wave-length of the sound in air

17. A student performed the experiment of determination of focal length of a convex mirror by u -v method length of the mirror used is 24cm. The maximum using an optical beneth of length 1.5m . The focal error in the location of the image can be 0.2cm. The 5 sets of (u,v) values recorded by the student (in cm) are (42, 56), (48, 48), (60, 40), (66, 33), (78, 39). The data set(s) that cannot come from experiment and is (are) incorrectly recorded, is (are):

1) (42, 56) 2) (48, 48) 3) (66, 33) 4) (78, 39)

## *Numerical Value Type Questions*

18. In an experiment for determining the mass of given body using a meter scale suspended horizontally with a thread and a standard weight of 1kg, the power (mass) arm is adjustable and the weight is fixed. If the unknown mass is kept at a distance 65cm from the thread loop, then the given mass (in kg) is:

19. For the experimental determination of Young's modulus of elasticity Y of the material of a given wire by using Searle's apparatus, the spherometer reading while load increasing and decreasing are tabulated below:

| S NO | Load hanger (kg) | Spherometer screw reading | |
|---|---|---|---|
| | | Load increasing (cm) | Load decreasing (cm) |
| 1 | 0 | 2.350 | 2.360 |
| 2 | 1 | 3.482 | 3.486 |
| 3 | 2 | 4.590 | 4.600 |
| 4 | 3 | 5.700 | 5.708 |
| 5 | 4 | 6.840 | 6.850 |

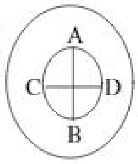
The mean extension for 2kg load is

20. Equal volumes of water and alcohol are taken in two similar colorimeter at temperature 50°C. Water filled calorimeter takes 100s to cool from 50°C to 40°C and alcohol filled tapes 70s and col from 50°C to 40°C. If the thermal capacity of each calorimeter is numerically equal to the volume to either liquid, then the specific heat capacity of alcohol is: (take relative density of alcohol 0.8 and specific heat capacity of water is 1 both in CGS units) (in cal/gm°C)

21. A galvanometer of $50\Omega$ resistance when connected across the terminals of a battery of emf 2V along with the resistance $200\Omega$ the deflection produced in the galvanometer is 10 divisions. If the total number of divisions on the galvanometer scale on either side of central zero is 30, then the maximum current (in mA) that can pass through the galvanometer is

22. In experiment for measuring surface tension by capillary rise method, readings for positions A, B, C and D for internal diameter of capillary tube are given as under. Mean internal radius of capillary is (in mm)

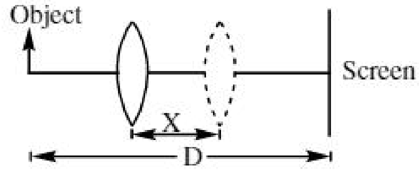
A(cm) = 1,009
B(cm) = 1,006
C(cm)= 1,009
D(cm)= 1,004




23. In measurement of mass of a given object by the principle of moments, the meter scale is hung from its mid -point. A known weight of mass 2kg is hung at one end of meter scale and unknown weight of mass m kg is hung at 20cm from the centre on other side. The value of m is (in kg)

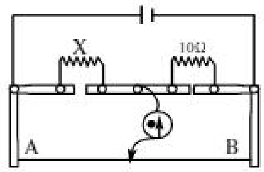
24. In U - V method, the object disteance is 30.0cm and image distance is 60.0cm from pole of concave mirror. The percentage error in measurement of focal length of mirror is $\frac{n}{18}\%$. Find the value of n

25. Displacement method is applicable to determine the focal length of convex lens. In this method, the applicable formula is $f = \frac{D^2 - X^2}{4D}$. Here D = distance between object plane and screen on which image is formed f = focal length of lens,




X = distance between two position of lens. To determine focal length of lens, the measure value of D and x are 90.0cm and 30.0cm, respectively. If percentage error in measurement of focal length is $n \times 10^{-1}\%$. Find the value of n.

26. A meter bridge is set up as shown in figure, to determine an unknown resistance X using a standard $10\Omega$ resistor. The galvanometer shows null point when tapping key is at 52cm mark. The end corrections are 1cm and 2cm respectively, for the ends A and B. The determined value of X is (in $\Omega$)




27. While measuring surface tension of water using capillary rise method, height of the lower meniscus from free surface of water is 3cm while inner radius of capillary tubne is found to be 0.5cm. Then compute surface tension of water (in N/m) using this data. [Take contact angle between glass and water as 0° and g = $9.81 ms^{-2}$]

## LEVEL-II (ADVANCED)

### *Straight Objective Type Questions*

1. If m and M are the masses of two bodies that are tied at two ends of a meter scale that is balanced on a sharp edge of a heavy board wedge. If M = 20g, its distance from centere =30cm and distance of mass m from centre is 25cm when metre scale is balanced, then m is

a) 23g b) 24g c) 25g d) 26g

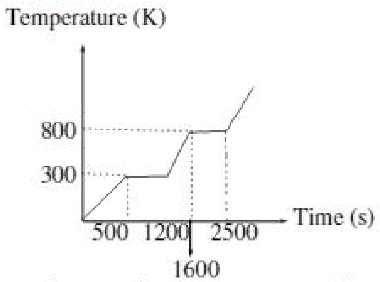
2. In the experiment of measuring speed of sound by resonance tube, it is observed that for tunning fork of frequency v = 480Hz, length of air column cm, $l_1 = 30cm, l_2 = 70cm$, then $\upsilon_1$ is equal to

a) $338 ms^{-1}$ b) $379 ms^{-1}$ c) $384 ms^{-1}$ d) $332 ms^{-1}$

3. If velocity of sound at room temperature is $35078 cm^{-1}$, then velocity of sound at 0°C

a) $33200 cms^{-1}$ b) $33286 cms^{-1}$ c) $33296 cms^{-1}$ d) $33256 cms^{-1}$

4. A heating curve has been plotted for a solid object as shown in the figure. If the mass of the object is 200g, then latent heat of vaporisation for the material of the objects, is [power supplied to the object is constant and equal to 1kW]




a) $4.5 \times 10^6 J - kg^{-1}$ b) $4.5 \times 10^6 cal\,kg^{-1}$ c) $4.5 \times 10^8 J - kg^{-1}$ d) $4.5 \times 10^4 cal - kg^{-1}$

5. While measuring viscosity of caster oil using terminal velocity concept the following observation table has been taken by a student. Which one is the first correct reading which he should consider for the computation of terminal velocity

| S.No. | Distance | Time |
|---|---|---|
| 1 | 20cm | 1s |
| 2 | 20cm | 14s |
| 3. | 20cm | 1.8s |
| 4 | 20cm | 1.81s |
| 5 | 20cm | 1.82s |

a) 1 b) 2 c) 3 d) 4

6. To identify whether the transistor is working or not, using multimeter, which statement serves the purpose?

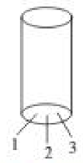
a) The common lead of multimeter is connected to base and other lead to first emitter and then to collector, only 1st connection shows the continuity

b) The common lead multimeter is connected to base and other lead to first emitter and then to collector, both the connection shows the continuity

c) The common lead of multimeter is connected to base and other lead to first emitter and then to collector, none of the connections show the continuity

d) All of the above

7. Consider the transistor shown in figure, its terminals are marked as 1, 2 and 3. Using multimeter one try to identify the base of transistor, he proceed in the way as follows. Experiment I: He touches the common lead of the multimeter to 2, then on touching other lead of multimeter to 1 he hasn't got any beep (indication of conduction) but when connected to 3 got the beep.



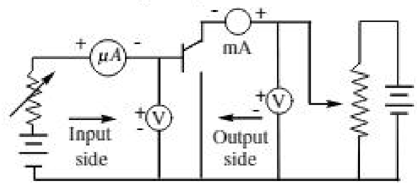

Experiment II: He connected the common lead of multimeter to 1 and other lead to 2 and 3 one by one then in this case he got beep for both connections. From this we conclude that

a) 1 is base b) 2 is base c) 3 is base d) none of these

8. In previous question, the tansistor is

a) npn b) pnp c) ppn d) nnp

9. The circuit diagram below shows n-p-n transistor in CE configuration. For this configuration, mark the correct statement(s).



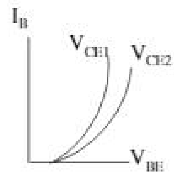

a) The potential divider on input side is used to keep $V_{CE}$ constant drawing input characteristics.

b) The potential divider on output side is used to keep $V_{CE}$ constant while drawing output characteristics

c) The potential divider on input side is used to keep base current constant while drawing output characteristics.

d) Both (a) and (c) are correct

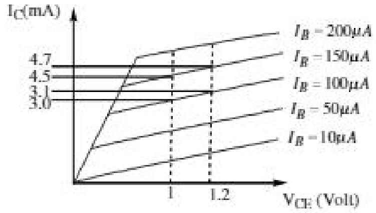
10. Input characteristics are shown for CE configuration of n-p-n transistor for different output voltage. Here.




a) $V_{CE_1} > V_{CE_2}$ b) $V_{CE_1}$

c) $V_{CE_1} < V_{CE_2}$ d) none of these

11. Out put characteristics of n - p - n transistor in CE configuration is shown. From teh characteristics curve determine the current gain at $V_{CE} = 1V$.



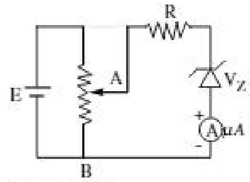

a) 30

b) 32

c) 28

d) 40

12. A zener diode is operating in its normal region i.e., the breakdown region for which the circuit diagram is as shown in figure. Here, take $V_Z = 7V$ and $R = 10k\Omega$. For potential difference equal to 8V across AB, what is the current through microammeter?



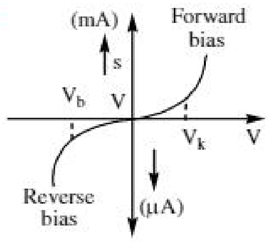

a) $1000\mu A$ b) 1 mA c) $10\mu A$ d) $100\mu A$

13. A wide jar is filled with water, in which a steel ball of radius 0.25cm has been dropped to measure the viscosity of water by using terminal velocity concept.

a) This method is appropriate b) This method is not appropriate

c) If we take a jar of length 2m it will work d) None of the above

14. The V - I character for a p - n junction diode is plotted as shown in the figure. From the plot, we can conclude that
[$V_b \rightarrow$ breakdown voltage $V_k \rightarrow$ knee voltage]



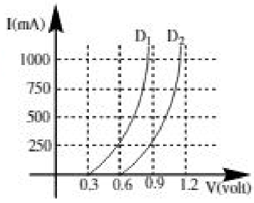

a) the forward bias reistance of diode is very high almost infinity for small values of V and after a certainvalue it become very low

b) the reverse bias resistance of diode is very high in the beginning upto breakdown voltage is not achieved

c) both forward and reverse bias resistance are same for all voltage

d) both (a) and (b) are correct

15. The forward bias characteristics of two diodes $D_1$ and $D_2$ are shown, the knee voltage for $D_1$ and $D_2$ are respectively (approx)




a) 0.6V, 0.7V b) 0.3V , 0.6V

c) 0.9V , 1.2V d) 0.6V, 0.9V

16. In an experiment to determine the speed of sound using a resonance column

a) prongs of the tunning fork are kept in a vertical plane

b) prongs of the tuning fork are kept in a horizontal plane

c) In one of the two resonance observed, the length of the resonating air column is close to the wavelength of sound in air

d) in one of the resonance observed the length of the resonating air column is close to half of the wavelength of sound in air.

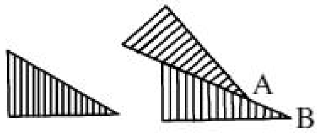
17. A vernier callipers is constructed by using two identical triangular wedges each of angle of inclination $\alpha = 60^\circ$. Assume that one division is equivalent to 1mm. While measuring length AB, the reading of lower wedge is 8th mark and 7th mark of upper wedge coincide with a particular mark of lower wedge. Mark the correct option (s)

a) Least count is 1mm

b) Least count is 0.1mm

c) Length AB is 15mm

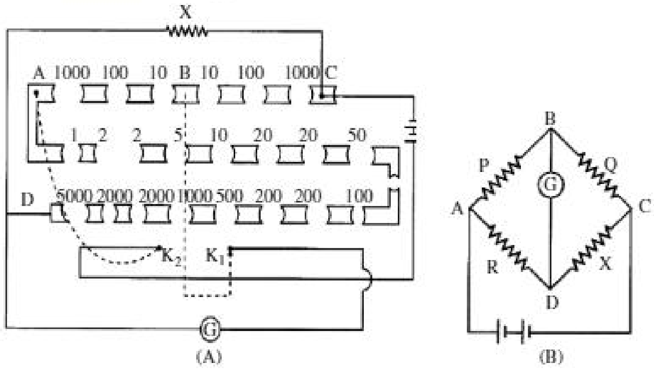
d) Length AB is 1.5 mm




## *Linked Comprehension Type Questions*

***Passage :***

***Post office box is useful to measure the value of unknown resistance correctly upto 2nd decimal place. It is based on Wheatstone bridge.***




***Systematic diagrams of post office box are shown in the above figures. Each of the arms AB and BC contains three resistance of $10\Omega$, $100\Omega$ and $1000\Omega$. These arms are generally known as ratio arms. With the help of these resistance, we can introduce resistance P in arm AB and resistance Q in arm BC. The resistance arm AD is a complete resistance box containing resistance from $1\Omega$ to $5000\Omega$. In this arm, we can introduced resistance R by taking out plugs of suitable values. The unknown resistance X is connected in fourth arm CD. These four arms actually form Wheatstone briige shown in figure. For balanced conditions, no deflection is formed in galvanometer.***

***At balanced condition*** $PX = QR,\ X = \dfrac{QR}{P}$

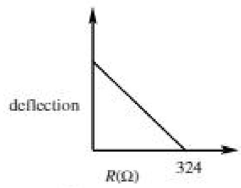
18. What is the minimum and maximum possible reistance, which can be deterined by using post office box?

a) $0.01\Omega, 1111\times10^3\Omega$ b) $0.1\Omega, 5000\times10^3\Omega$ c) $0.01\Omega, 500\times10^3\Omega$ d) $0.01\Omega, 1111\Omega$

19. In an experiment with a post office box, the ratio arms 1000 : 10. The value of third resistance is $999\Omega$, The the values of unknown resistance is

a) $99.9\Omega$ b) $999\Omega$ c) $9.99\Omega$ d) $1000\Omega$

20. In post office box, the galvanometer deflection versus resistance R (pulled out of resistance box) for arm ratio 100 : 1 is given as shown in (due to unstable values of R, galvanometer shows deflection). The consecutive value of R (as shown in figure) is




a) $324\Omega$ b) $3.24\Omega$ c) $32.4\Omega$ d) $0.309\Omega$

21. In previous questions, if we add some detergent to water, then

a) liquid level in capillary tube is less than 3cm b) liquid level in capillary tube is greater than 3cm

c) liquid level in capillary tube is equal to 3cm d) anything may happen

22. While measuring surface tension of water using capillary rise method the necessary precaution to be taken is/are

a) capillary tube should be clean while water should have some grease

b) both capillary tube and water should be clean

c) no need to take care of temperature of water d) None of these

## KEY SHEET (LECTURE SHEET)

**LEVEL-I**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1) **2** | 2) **1** | 3) **2** | 4) **3** | 5) **1** | 6) **2** | 7) **3** | 8) **4** |
| 9) **1** | 10) **3** | 11) **3** | 12) **4** | 13) **1** | 14) **4** | 15) **2** | 16) **1,4** |
| 17) **3,4** | 18) **0.54** | 19) **0.24** | 20) **0.50** | 21) **0.24** | 22) **0.2** | 23) **5** | 24) **5** |
| 25) **20** | 26) **10.60** | | 27) **0.77** | | | | |

**LEVEL-II**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1) **b** | 2) **c** | 3) **c** | 4) **a** | 5) **c** | 6) **d** | 7) **b** | 8) **b** |
| 9) **c** | 10) **a** | 11) **a** | 12) **b** | 13) **b** | 14) **d** | 15) **a** | 16) **a** |
| 17) **ac** | 18) **a** | 19) **c** | 20) **b** | 21) **a** | 22) **b** | | |