PHYSICS

RESONANCE ENGLISH

EXPERIMENTAL PHYSICS

Solved Example

1. Count total number of significant figures in the following measurements:

(a) 4.080cm (b) 0.079 cm (c) 950

(d) 10.00 cm (e) 4.07080 (f)7.090×10^5

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6. Count total number of $S.\ F$ in 6.020×10^{23}

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7. Count total number of $S.\ F$ in 1.60×10^{-12} .

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8. A cube has a side of length $1.2 \times 10^{-2} m.$ Its volume upto correct significant figures is

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9. In ohm's law exp, reading of voltmeter across the resistor is $12.5V$ and reading of currect I = 0.20 $< br.\ AmpEstimatetheresis\tan ce \in c$ or $rect$S.F` .

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10. Radius of a wire is 2.50 mm. The length of the wire is 50.0 cm. If mass of wire was measured as 25g, then find the density of wire in correct significant figures.

$[Given, \pi = 3.14, exact]$

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11. In resonance tube exp we find $l_1 = 25.0cm$ and $l_2 = 75.0cm$ The least count of the scale used to measure l is $0.1cm$ If there is no error in frequency What will be max permissible error in speed of sound (take $f_0 = 325Hz$) .

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12. If the measured value of resistance $R = 1.05\Omega$, wire diameter $d = 0.60mm$, and length $l = 75.3cm$, then find the maximum permissible error in resistivity , $\rho = \frac{R\left(\pi d^2/4\right)}{l}$.

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13. In ohm's law experiment potential drop across a resistance was measured as $v = 5.0$ volt and current was measured as $I = 2.0amp$ If least count of the volmeter and ammeter are $0.1V$ and $0.01A$ respectively then find the maximum permissible error in resistance .

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14. In Searle's experiment to find young's modulus, the diameter of wire is measured as $D = 0.05cm$, the length of wire is $L = 125cm$, and when a weight , $m = 20kg$ is the put , extension in wire was found to be $0.100cm$. Find the maximum permissible error in Young's modulus (Y).

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15. To find the value of g using simple pendulum. $T = 2.00 \pm 0.01\,\text{sec}$, $L = 1.00 \pm 0.01m$ was measured. Estimate maximum permissible error in g. (use $\pi^2 = 10$)

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16. In come observations value of g are coming as

$9.81, 9.80, 9.82, 9.79, 9.78, 9.84, 9.79, 9.78, 9.79$ and

$9.80 m / s^2$

Calculate absolute errors and percentage error in g.

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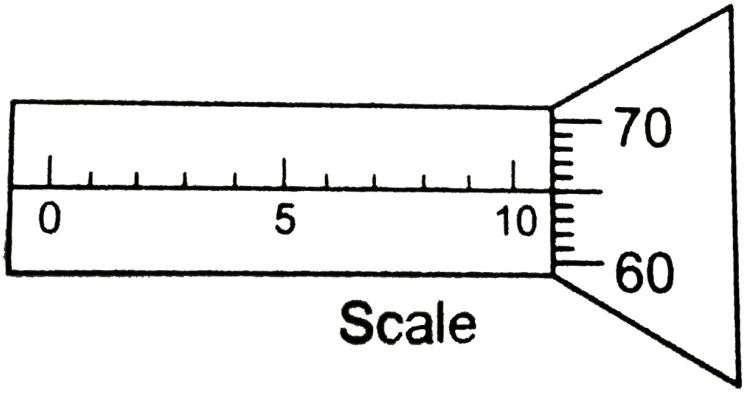
17. Read the screw gauge shown below in the figure.

Given that circular scale has 100 divisions and in one complete rotation the screw advances by $1 mm$.



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18. Read the screwgaug shown bellow Main scale has $\frac{1}{2}mm$ marks In complete rotation the screw advances by (1)/(2)mm` Circular scale has 50 division .

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19. Read the screwgaug shown bellow Main scale has $\frac{1}{2}mm$ marks In complete rotation the screw advances by (1)/(2)mm` Circular scale has 50 division .

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20. A wire of resistance $R = 100.0\Omega$ and length $l = 50.0cm$ is put between the jaws of screw gauge Its reading is shown in Pitch of the scregauge is $0.5mm$ and there are 50 division on circular scale Find its resistivity in correct significant and maximum permissible error in p (resistivity) .

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21. In a complete rotation, spindle of a screw gauge advances by $\frac{1}{2}mm$. There are 50 divisions on circular scale. The main scale has $\frac{1}{2}mm$ marks to (is graduated to $\frac{1}{2}mm$)

If a wire is put between the jaws, 3 main scale divisions are clearly visible, and $20th$ division of circular scale coincides with reference line. Find diameter of wire in correct significant figures.

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22. If the length of the cylinder is measured as $25mm$ and mass of the cylinder is measured as $50.0gm$ find the density of the cylinder $\left(gm/cm^3\right)$ in proper significant .

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23. Two measure diameter of a wire a screw-gauge is used The main scale division is of $1mm$ In a complete rotation the screw advances by $1mm$ and the circular scale has 100 divisions The reading of screw-gauge is as shown in If there is no error is no error in mass measurement but error in length measurement is $1\,\%$ then find max Possible error in density if diameter is 3.07 mm.

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24. Find the thickness of the wire The main scale division is of $1mm$ In a complete rotation the screw advances by $1mm$ and the circular scale has 100 devisions

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25. Find the thickess of the wire The main scale division is of $1mm$ In a complete rotation the screw advances by $1mm$ and the circular scale has 100 devisions Zero error of the screwgase is 0.007mm .


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26. Read the vermier 10 division of vermier scale are matching with 9 divisionsd of main scale

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27. Read the special type off vernier 20 division of vernier scale are matching with 19 divisions of main scale

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28. In the vernier caliperse 9 main scale divisions matches with 10 vernier scale divisions The thickness of the object using the defected vernier calliperse will be

Excess reading = 0.3mm

If we put an object between the jaws

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29. A vernier has 10 divisions and they are equal to 9 divisions of main scale in length. If the main scale is calibrated in mm, what is its least count?

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30. Main scale reading is $-1mm$ when there is no object between the jaws In the Vernier calipers 9 main scale divisions matches with 10 Vernier scale division The thickness of the object using the defected Vernier calipers will be

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31. The main scale of a vernier calipers reads $10mm$ in 10 divisions. Ten divisions of vernier scale coincide with nine divisions of the main scale. When the two jaws of the calipers touch each other, the fifth division of the vernier coincides with 9 main scale divisions and zero of the vernier is to the right of zero of main scale, when a cylinder is tighty

placed between the two jaws, the zero of the vernier scale lies slighty to the left of $3.2cm$ and the fourth vernier division coincides with a main scale division. Find diameter of the cylinder.

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32. If the length of the cylinder is measured as $25mm$ and mass of the cylinder is measured as $50.0gm$ find the density of the cylinder $\left(gm/cm^3\right)$ in proper significant .

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33. In a certain observation we get $l = 23.2cm, r = 1.32cm$ and time taken for 20 oscillations was 20.0 sec. Taking

$\pi^2 = 10$, find the value of g in proper significant figures.

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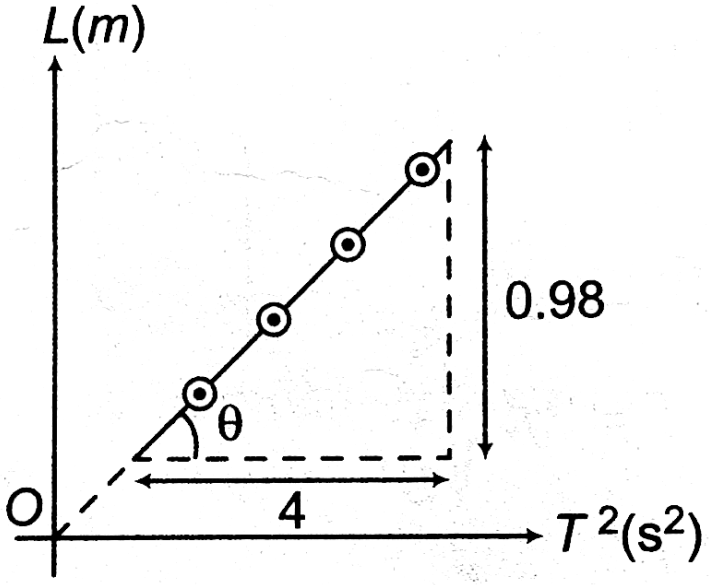
34. For different values of L, we get different values of T^2. The graph between L versus T^2 ia as shown in figure. Find the value of 'g' from the given graph.(Take $(\pi)^2 = 10$).



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35. In a certain obervation we got,$l = 23.2cm, r = 1.32cm$ and time taken for 10 oscillations was 10.0 s. Find, maximum percentage error in determinaton of 'g'.

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36. Time is measured using a stop watch of least count 0.1 second In 10 oscilation time taken is 20.0 second Find maximum permissible error in time period .

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37. A student performs an experiment for determination of $g = \frac{4\pi^2 l}{T^2} l \approx 1m$ and the commits an error of "Deltal' For T

he takes the time of n osciilations with the stop watch of least count Δt For which of the following data the measurement of g will be most accurate ?

(a) $\Delta L = 0.5 \Delta L = 0.1, n = 20$

(B) $\Delta L = 0.5 \Delta t = 0.1, n = 50$

(C) $\Delta L = 0.5, \Delta t = 0.02 n = 20$ (D) $\Delta L = 0.1 \Delta t = 0.05 n = 50$.

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38. The adjacent graph shows the extra extension (Δx) of a wire of length $1m$ suspended from the top of a roof at one end with an extera load Δw connected to the other end If the cross sectional area of the wire is $10^{-5} m^2$ calculate the Young's modulus of the meterial of the wire

(A) $2 \times 10^{11} N/m^2$ (B) $2 \times 10^{-11} N/m^2$ (c)

$3 \times 10^{913}) N/m^3$ (D) $2 \times 10^{16} N/m^2$

 .

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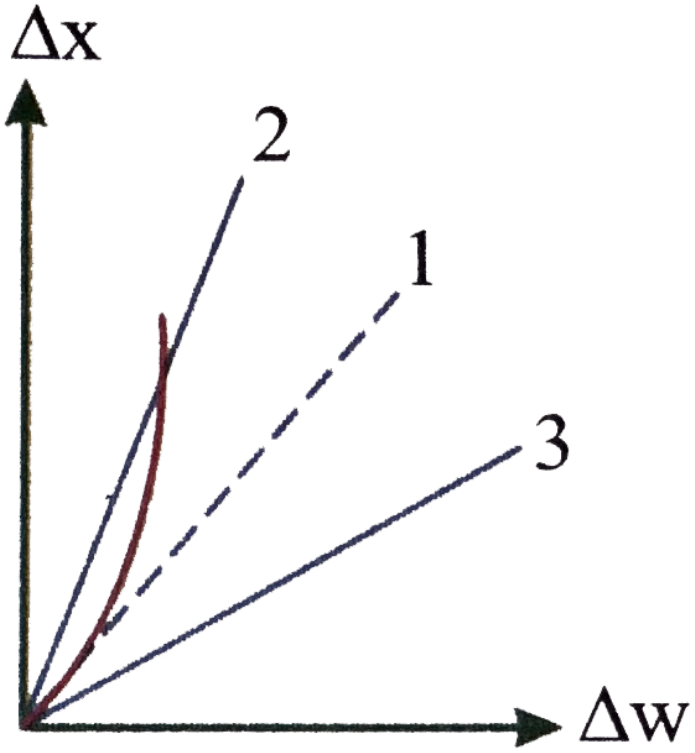
39. In the experiment, the curve between ΔX and ΔW is shown as dotted line (l). If we use an another wire of same material, but with double length and double radius. Which

of the curve is expected.



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40. Assertion: Bulk modulus of elasticity B represents incompressibility o the material.

Reason: $B = -\frac{\Delta p}{\Delta V / V}$, where symbols have their usual meaning.

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41. If we use very thin and long wire, then

A. Sensitivity (output/input=ΔX/ΔW) of experiment increases

B. Young's modulus will remain unchanged

C. Wire may break or yield during loading.

D. All of the above

Answer:

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42. In Searle's experiment to find young's modulus, the diameter of wire is measured as $D = 0.05cm$, the length of wire is $L = 125cm$, and when a weight , $m = 20kg$ is the put , extension in wire was found to be $0.100cm$. Find the maximum permissible error in Young's modulus (Y).

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43. The mass, specific heat capacity and the temperature of a solid are $1000g$, $\frac{1}{2}\frac{cal}{g^\circ C}$ and $80^\circ C$ respectively. The mass of the liquid and the calorimeter are $900g$ and $200g$. Initially,both are at room temperature $20^\circ C$ Both calorimeter and the solid are made of same material. In the

steady state, temperature of mixture is $40^{\circ} C$, then specific heat capacity of the unknown liquid.

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44. An electric heater of power 1000 W raises the temperature of 5 kg of a liquid from 25°C to 31°C in 2 minutes. Calculate : (i) the heat capacity, and (ii) the specific heat capacity of liquid.

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45. If the loss in graviational potential energy to falling the sphere by h height and heat loss to surrounding at constant rate H are also taken to account the energy equation will

modify to

(A)

$$m_1 s_1(\theta_1 - \theta) + \frac{m_1 gh}{J} = m_2 s_2(\theta - \theta_2) + m_3 s_3(\theta - \theta_2) - Ht$$

(B)

$$m_1 s_1(\theta_1 - \theta) - \frac{m_1 gh}{J} = m_2 s_2(\theta - \theta_2) + m_3 s_3(\theta - \theta_2) + Ht$$

(C)

$$m_1 s_1(\theta_1 - \theta) + \frac{m_1 gh}{J} = m_2 s_2(\theta - \theta_2) + m_3 s_3(\theta - \theta_2) + Ht$$

(D)

$$m_1 s_1(\theta_1 - \theta) - \frac{m_1 gh}{J} = m_2 s_2(\theta - \theta_2) + m_3 s_3(\theta - \theta_2) - Ht$$

.

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46. In the exp of finding sp heat capacity of an unknown sphere (S_2) mass of the sphere and caloreter aro $1000m$ and $200gm$ respectively and sp heat capacity of calorimeter

is equal to $\frac{1}{2} cal / gm^{\circ} C$ The mass of liquid 9water) used is $900 gm$ Initially both the water and the calorimeter were at room temp $20.0^{\circ} C$ while used is $900 gm$ Initially both the water and the calorimeter were at room temp $20.0^{\circ} C$ while the sphere was at temp $800^{\circ} C$ initially If the steady state temp was found to be $40.0^{\circ} C$ estimate sp heat capacity of the unknown sphere (S_2) $(use S_{water} = 1 cal / g^{\circ} C)$ Also fin the maximum permissible error in sp heat capacity of unknown sphere (S_2) mass end specific heats of sphere and calorimater are correctly known) .

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47. In electrical calorimeter experiment, voltage across the heater is $100.0 V$ and current is $10.0 A$. Heater is switched on for t $= 700.0 s$. Room temperature is $\theta_0 = 10.0^{\circ} C$ and final

temperature of calorimeter and unknown liquid is $\theta_f = 73.0^\circ C$. Mass of empty calorimeter is $m_1 = 1.0kg$ and combined mass of calorimeter and unknown liquid is $m_2 = 3.0kg$. Find the specificheat capacity of the unknown liquid in proper significant figures. Specific heat of calorimerter = $3.0 \times 10^3 j/kg.^\circ C$.

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48. If mass and specific heat capacity of calormeter is negligible what would be maximum permissible error is S Use the data mentioned below

$m_1 \to 0, S_c \to 0, m_2 = 1.00kgV = 10.0VI = 10.0A$

$t = 1.00 \times 10^2 \sec\theta_0 = 15^9 \circ)C$ Corrected $\theta_t = 65^\circ C$

(A) 4%

(B) 5% (C) 8% (D) 12% .

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49. If the system were lossing heat according to Newton's cooling law the temperature of the mixture would change with time according to (while heater was on) .

A. 

B. 

C. 

D. 

Answer:

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50. Speed of soundd calculated is roughly

A. $340m/\sec$

B. $380m/\sec$

C. $430m/\sec$

D. None of these

Answer:

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51. Speed of soundd calculated is roughly

A. $324m/\sec$

B. $380m/\sec$

C. $430m / \sec$

D. None of these

Answer:

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52. What should be minimum length of tube so that third resonancee can also be heard .

A. $l_3 = 421$

B. $l_3 = 214$

C. $l_3 = 124$

D. None of these

Answer:

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53. Lorentz force can be calculated by using the formula (where symbol have their usual meaning)

A. $2.5cm$

B. $3.3cm$

C. $5.2cm$

D. None of these

Answer:

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54. For the third resonance, which option shows correct mode shaoe for displacement variation and pressure variation.

A. 

B. 

C. 

D. 

Answer:

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55. Force between two charges when placed in free space is 10N. If they are in a medium of relative permittivity 5, the

force between them will be

A. 2N

B. 50N

C. 0.5N

D. None of these

Answer:

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56. Taking the open end of tube as $y = 0$ position of pressure nodes will be .

A. $y = -1cmy = 49cm$

B. $y = 0cmy = 50cm$

C. $y = 1cm y = 51cm$

D. None of these

Answer:

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57. If a tuning fork of frequency $(340 \pm 1\ \%)$ is used in the resonance tube method and the first and second resonance lengths are $20.0cm$ and $74.0cm$ respectively. Find the maximum possible percentage error in speed of sound.

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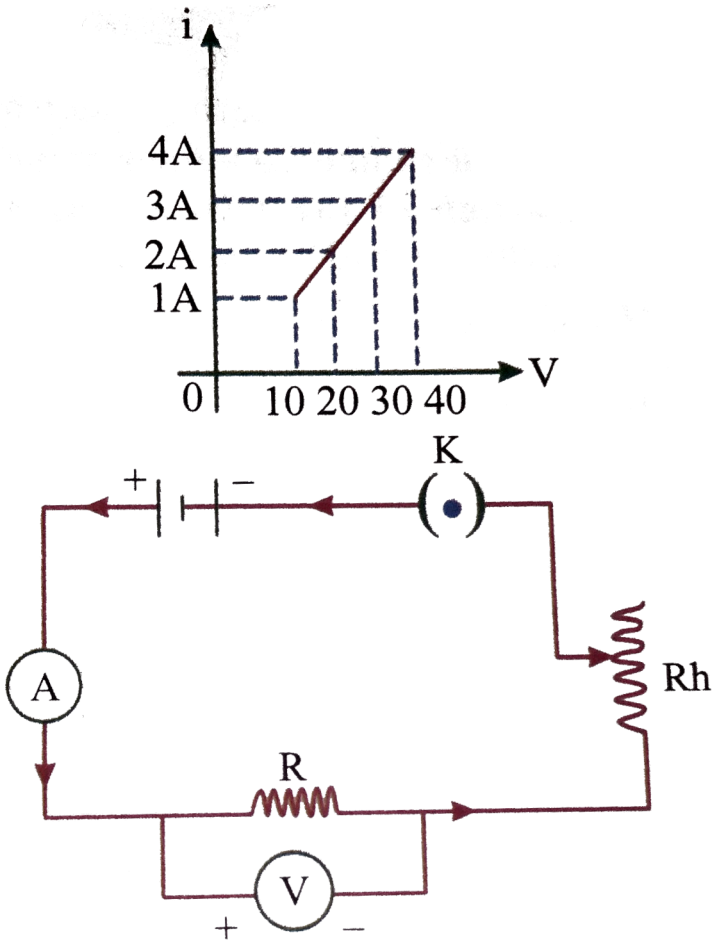
58. If emf of battery is $100V$, then what was the resistance of Rheostat adjusted at reading ($i = 2A, V = 20V$)



A. 10Ω

B. 20Ω

C. 30Ω

D. 40Ω

Answer:

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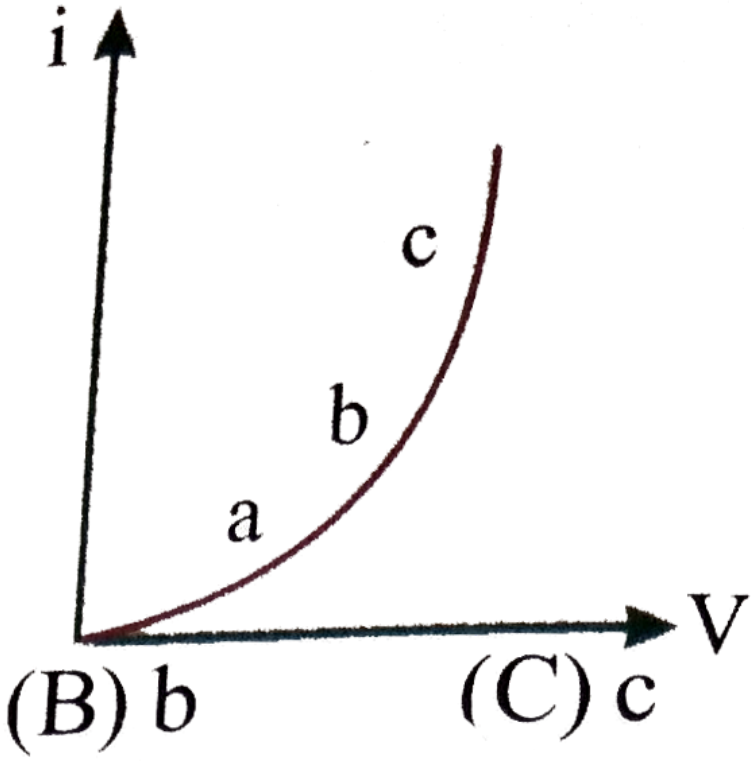
59. Iv/sV curve for a non Ohmic resistance is shown. The dynamic resistance is maximum at point



A. a

B. b

C. c

D. same for all

Answer:

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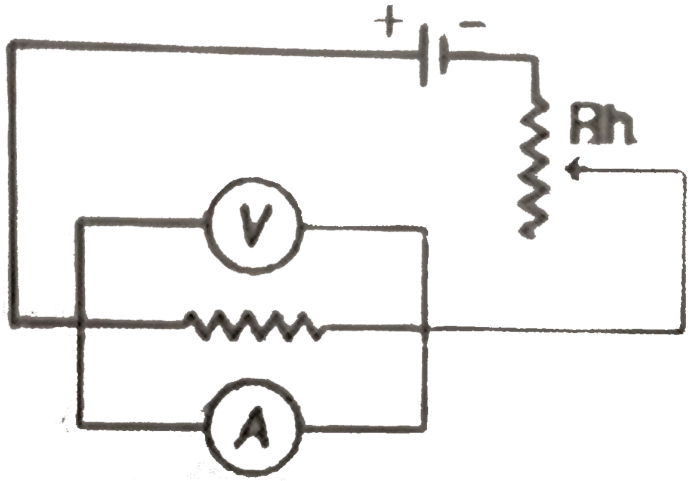
60. If by mistake, ammeter is connected in parallel to the resistance then $i - V$ curve expected is (Here $i =$ reading of ammeter, $V =$ reading of voltmeter)



A.

B.

C.

D.

Answer:

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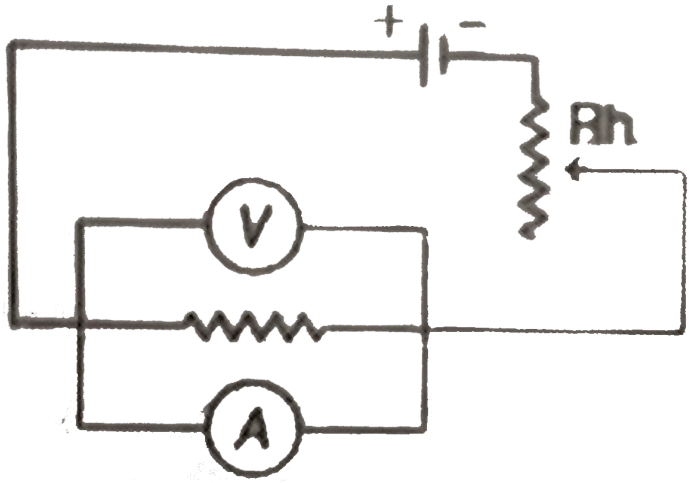
61. If by mistake, ammeter is connected in parallel to the resistance then $i - V$ curve expected is (Here $i =$ reading of ammeter, $V =$ reading of voltmeter)



A. 

B. 

C. 

D. 

Answer:

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62. In the experiment of Ohm's law, when potential difference of 10.0 V is applied, current measured is 1.00 A. If length of wire is found to be 10.0cm and diameter of wire 2.50 mm, then find maximum permissible percentage error in resistivity.

A. 1.8%

B. 10.2%

C. 3.8%

D. 5.75%

Answer:

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63. If % error in length diameter current and voltage are same than which of the following affects %error in measurenet of resistivity the most .

A. length measurement

B. voltagemeasurement

C. current measurement

D. diameter measurement

Answer:

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64. From some insturments, current measured is $i = 10.0Amp$. Potential difference measured is $V = 100.0V$, length of wire is $31.4cm$, and diameter of wire is $2.00mm$ (all of correct significant figures). The resistivity of wire (in correct significant figure) will be (use $\pi = 314$)

A. $1.00 \times 10^{-4}\Omega - m$

B. $1.00 \times 10^{-4}\Omega - m$

C. $1.00 \times 10^{-4}\Omega - m$

D. $1.00 \times 10^{-4}\Omega - m$

Answer:

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65. In the previous question, find the maximum permissible error in resistivity and resistance.

A. $2.14\ \%\ 15\ \%$

B. $1.5\ \%\ 2.45\ \%$

C. $2.4\ \%\ 1.1\ \%$

D. None of these

A. $2.14\ \%\ 15\ \%$

B. $1.5\ \%\ 2.45\ \%$

C. $2.4\ \%\ 1.1\ \%$

D. None of these

Answer:

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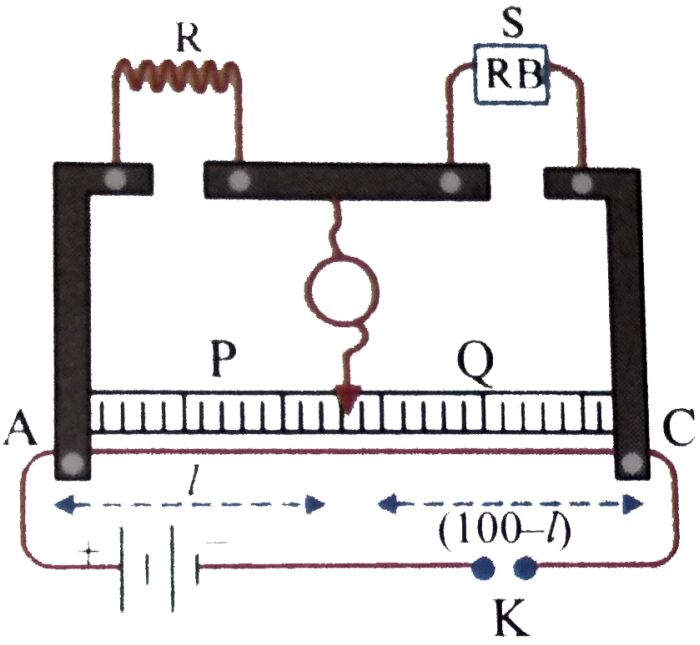
66. If resistance S in $RB = 300\Omega$, then the balanced length is found to be $25.0cm$ from end A. The diameter of unknown wire is $1mm$ and length of the unknown wire is $3.14cm$. The

specific resistivity of the wire should be



A. $2.5 \times 10^{-4} \Omega - m$

B. $3.5 \times 10^{-4} \Omega - m$

C. $4.5 \times 10^{-4} \Omega - m$

D. None of these

Answer:

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67. In the previousd question .

A. $30cm$

B. $40cm$

C. $50cm$

D. None of these

Answer:

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68. In a meter bridge, null point is at $l = 33.\ cm.$ When the resistance S is shunged by 12Ω resistance the null point is

found to be shifted by a distance of $18.2cm$. The value of unknown resistance R should be

A. 13.5Ω

B. 68.8Ω

C. 3.42Ω

D. None of these

Answer:

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69. If we use 100Ω and 200Ω in place of R and X we get null point deflection.$l = 33cm$. If we interchange the resistors, the null point length is found to be $67cm$. Find end corrections α and β.

A. $\alpha = 1cm\beta = 1cm$

B. $\alpha = 2cm, \beta = 1cm$

C. $\alpha = 1cm\beta = 2cm$

D. None of these

Answer:

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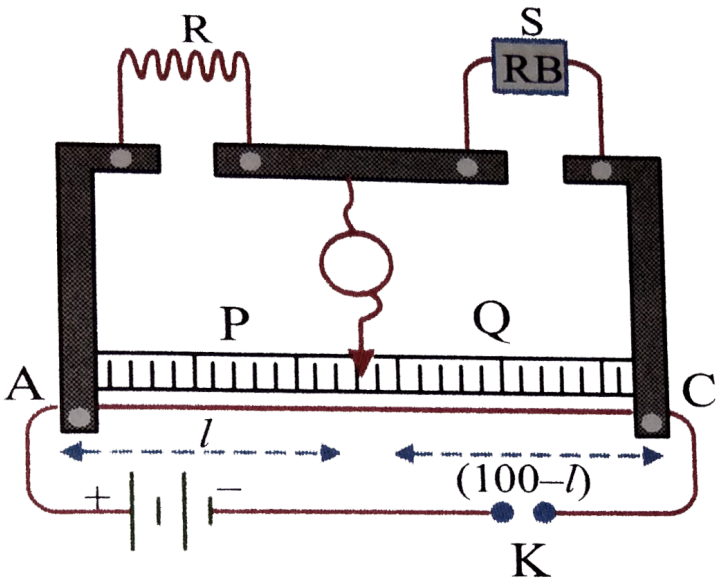
70. Consider the meter bridge circuit without neglecting and corrections (α, β)



Now start taking obsevation. At the position of R, unknown resistance is used, and at position of S, 300Ω resistance is used. If the balanced length was found to be $l = 26cm$, then estimate the unknown resistance.

A. 108Ω

B. 105.4Ω

C. 100Ω

D. 110Ω

Answer:

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71. If the unknown Resistancee calculated without using the end correction is R_1 and with using end corrections is R_2 then (assume same end corection) .

A. $R_1 > R_2$ when balanced point is in first half

B. $R_1 > R_2$ when balanced point is in first half

C. $R_1 > R_2$ when balanced point is in first half

D. $R_1 > R_2$ when balanced point is in first half

Answer:

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72. If the length of wire is `(100.0 cm) and radius of wire as measured from screw gauge is (1.00mm) then the specific resistance of wire material is .

A. $13.35 \times 10^{-6} \Omega m$

B. $13.4 \times 10^{-5} \Omega - m$

C. $13.352 \times 10^{-6} \Omega - m$

D. $16.5 \times 10^{-6} \Omega m$

Answer:

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73. Assertion To locate null defiection the battery key (K_1) is pressed first and then the galvanom eter key (K_2)

Reason if first K_2 is pressed and then as soon as K_1 is pressed current suddenly try to increase so due to self induction a large stopping emf is generated in galvanometer which may damage the glavanometer .

A. A. if both Asseration and Reason are true and the Reason is a correct explation of Asseration

B. B. if both Asseration and Reason are true and the Reason is a correct explation of Asseration

C. C. if Asseration is ture but Reason is false

D. D. If both Assertion and Reason are false

Answer: A

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74. What is the maximum resistance which can be made using five resistors each of $1/5\Omega$?

A. $1111k\Omega, 0.1\Omega$

B. $1111k\Omega, 0.01\Omega$

C. $1111k\Omega, 0.001\Omega$

D. None of these

Answer:

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75. In a certain experiment if $\frac{Q}{P} = \frac{1}{10}$ in R if 192Ω if used we are getting deflection toward right at 193Ω again toward rightr but at 194Ω deflection is toward left the unknown resistance should lie between .

A. 19.2 to 19.3Ω

B. 19.3 to 19.4Ω

C. 19 to 20.3Ω

D. 19.4 to 19.5Ω

Answer: B

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76. What is the change in experiment if battery is connected between B and D and galvanometer is connected across A and C ?

A. We cannot get balanced point

B. Experiment will be less accurate

C. Experiment can e done in similar manner

D. Experiment can be done in similar manner but now K_2 should be pressed first then K_1 .

Answer: D

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77. To find index error for u when a knitting needle of length $20.0cm$ is adjusted between pole and object needle the separation between the indices of object needle and mirror was pbserved to be $20.2cm$ Index correction for u is .

A. $-0.2cm$

B. $0.2cm$

C. $-0.1cm$

D. $0.1cm$

Answer:

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78. To find index error v when the same knitting needle is adjusted between the pole and the image needle the separation between the indices of image needle and mirror was found to be $19.9cm$ Index error for v is .

A. $0.1cm$

B. $-0.1cm$

C. $0.2cm$

D. $-0.2cm$

Answer: B

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79. In some observation the observed object distance (Separation between indicos of object needle and mirror) is $30.2cm$ and the observed imager distane is $19.9cm$ Using index correction from previous two questions estimate the focal length of the concave mirror .

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80. In $u - v$ method to find focal length of a concave mirror, if object distance is found to be $10.0cm$ and image distance was also found to be $10.0cm$, then find maximum permissible error in f.

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Exercise

1. A student is recuired to measure emf of a cell the should use .

A. Potentiometer

B. Voltmeter

C. ammeter

D. either (1) or (2)

Answer: A

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2. A potentiometer is an ideal device of measuring potential difference because

A. it uses a sensitive galvanometer

B. it does not disturb the potential difference it measures

C. it is an elaborate arrangement

D. it has a long wire hence heat developed quickly radiated

Answer: B

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3. Which of the following statements is correct during measurement of emf of cell by potentiometer ? .

A. No current flows through potentiometer wire upto position of null point

B. At null point in any potentiometer experiment no current flows through whole of potentiometer wire .

C. No current is drawn from cell when null point is obtained

D. No current is drawn from battery when null point is obtained

Answer: C

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4. The sensitivity of a potentiometer can be increased by

A. increasing the series resistance in the primary circuit

B. decreasing the length of the potentiometer wire

C. using a thin and high resistivity wire as a potentiometer wire

D. increasing the length of the wire

Answer: D

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5. By Plotting $\frac{1}{v}$ verus $\frac{1}{u}$ focal length of a convex mirror can be found .

A. No as it forms a virtual image

B. Yes only if scale is large

C. Yes only if scale is small

D. Yes only if aperture is small

Answer: A

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6. The focal length of which of the following can not be obtained directly .

A. convex mirror and convex lens

B. convex mirror & concave lens

C. convex lens and concave mirror

D. concave lensd and concave mirror

Answer: B

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7. Which of the following statement is false ?

A. The bench correction is always equal to the negative of bench error

B. larger the distance between the two objects larger the magnitude of parallax

C. parallax disappear if the positions of two objects coincide

D. parallax can occur between any two objects

Answer: B

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8. The focal length of a convex mirror is obtained by using a convex lens The following observations are recorded during theexperiment .

$$\begin{aligned} \text{objectopsition} &= 5cm \\ \text{lens} &= 35.4cm \\ \text{Image} &= 93.8cm \\ \text{Mirror} &= 63.3cm \\ \text{Bencherror} &= -0.1cm \end{aligned}$$

then the focal length of mirror will be .

A. 7.5

B. $8.4cm$

C. $15.3cm$

D. None of these

Answer: C

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9. For sperical mirros graph plotted between $-\frac{1}{V}$ and $-\frac{1}{u}is$.

A. stright line with slope 1

B. straight line with slope -1

C. Parabola

D. none

Answer: B

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10. Find significant in the following observations .

(i) $0.007gm$

(ii) $2.64 \times 10^{24}kg$

(iii) $0.2370gm/cm^3$

(iv) $6.320J/K$

(v) $6.032N/m^2$

(vi) $0.0006032K^{-1}$.

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11. Round off the following numbers upto three significant figures

A. $0.03927kg$

B. 4.085×10^8 sec

C. $5.2354m$

D. $4.735 \times 10^{-6} kg$

Answer:

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12. If a tuning fork of frequency (f_0) 340 Hz and tolerance $\pm 1\%$ is used in the resonance column method for determining the speed of sound. If the first and the second resonance are measured at $l_1 = 24.0cm$ and $l_2 = 74.70cm$, then the permissible error in speed of sound is

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Exercise 1 Part

1. Using screw gauge the observation of the diameter of a wire are $1.324, 1.326, 1.334, 1.336 \text{units}$ respectively. Find the average diameter the mean error the relative error and % error .

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Part Ii

1. The length of a rectangular plate is measured by a meter scale and is found to be $10.0 cm$. Its width is measured by verier callipers as $1.00 cm$. The least count of the meter scale

and vernier callipers are $0.1cm$ and $0.01cm$ respectively. Maximum permissible error in area measurement is

A. $\pm 0.2cm^2$

B. $\pm 0.1cm^2$

C. $\pm 0.3cm^2$

D. zero

Answer:

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2. In the previous question, minimum possible error in area measurement can be.

A. $\pm 0.02cm^2$

B. $\pm 0.01 cm^2$

C. $\pm 0.03 cm^2$

D. Zero

Answer:

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3. For a cabical block, error in measurement of sides is $\pm 1\%$ and error in ,easurement of mass is $\pm 2\%$ then maximum posible error in dencity is

A. 1%

B. 5%

C. 3%

D. 7%

Answer:

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4. To estimate g (from $g = 4\pi^2 \frac{L}{T^2}$), error in measurement of L is $\pm 2\%$ and error in measurement of $Tis \pm 3\%$ The error in estimated g will be

A. $\pm 8\%$

B. $\pm 6\%$

C. $\pm 3\%$

D. $\pm 5\%$

Answer:

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5. The least count of a stop watch is 0.2 s, The time of 20 oscillations of a pendulum is measured to be 25s. The percentage error in the time period is

A. $16\ \%$

B. $0.8\ \%$

C. $1.8\ \%$

D. $8\ \%$

Answer:

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6. The dimensions of a rectangular block measured with a vernier callipers having least count of $0.1mm$ is $5mm \times 10mm \times 5mm$. The maximum percentage error in measurement of volume of the blcok is

A. $5\ \%$

B. $10\ \%$

C. $15\ \%$

D. $20\ \%$

Answer:

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7. An experiment measure quantities x,y,z and then t is in calculate from the data as $t = \frac{xy^2}{z^3}$ if perecentage error in x,y,z and are respectively $1\%, 3\%, 2\%$ then percentage error in t is

A. 10%

B. 4%

C. 7%

D. 13%

Answer:

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8. The external and internal diameters of a hollow cylinder are measured to be (4.23 ± 0.01) cm and (3.89 ± 0.01)cm. The thickness of the wall of the cylinder is

A. $0.34 \pm 0.02cm$

B. $0.17 \pm 0.02cm$

C. $0.17 + -0.01cm$

D. $0.34 \pm 0.01cm$

Answer:

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9. The mass of a ball is 1.76kg. The mass of 25 such balls is

A. $0.44 \times 10^3 kg$

B. $44.0kg$

C. $44kg$

D. $44.00kg$

Answer:

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10. Two resistor $R_1 = (24 \pm 0.5)\Omega$ and $R_2 = (8 \pm 0.3)\Omega$ are joined in series, The equivalent resistence is

A. $32 \pm 0.32\Omega$

B. $32 \pm 0.8\Omega$

C. $32 \pm 0.2\Omega$

D. $32 \pm 0.5\Omega$

Answer:

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11. The pitch of a screw gauge is $0.55mm$ and there are 100 divisions on its circular scale. The instrument reads $+2$ divisions when nothing is put in between its jaws. In measuring the diameter of a wire, there are 8 divisions on the main scale and 83^{rd} division coincides with the reference. Then the diameter of the wire is

A. $4.05mm$

B. $4.405mm$

C. $3.05mm$

D. $1.25mm$

Answer:

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12. The pitch of a screw gauge having 50 division on its circular scale is $1mm$. When the two jaws of the screw gauge are in contact with each other, the zero of the circular scale lies 6 division below the lineof graduation. When a wire is placed between the jaws, 3 linear scale divisioins are clearly visible while 31^{th} division on the circular scale coincide with the reference line. The diameter of the wire is:

A. $3.62mm$

B. $3.50mm$

C. $3.5mm$

D. $3.74mm$

Answer:

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13. The smallest division on the main scale of a vernier callipers is $1mm$, and 10 vernier divisions coincide with 9 mainn scalel divisions. While measuring the diameter of a spehre the zero mark of the vernier scale lies between 2.0 and 2.1 cm and the fifth division of hte vernier main scale coincide with a main scale division. Then diameter of the sphere is

A. $20.5mm$

B. $21.5mm$

C. $21.50mm$

D. $20.50mm$

Answer:

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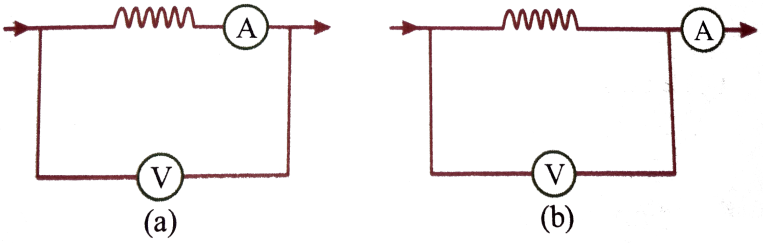
Partiii

1. In the, Ohm's law experiment to find resistance of unknown resistor R, following two arrangement (a) and (b) are possible.



The resistance measured is given by

$$R_{measured} = \frac{V}{i}$$

V= voltage reading of voltmeter, $i =$ current Reading of ammeter.

But unfortunately the ammeters and voltmeter used are not ideal, but having resistance R_A and R_V respectively.

For arrangement (b), the measured resistance is

A. $R + R_v$

B. $R + R_A$

C. $\frac{RR_v}{R + R_v}$

D. $\frac{RR_v}{R + R_v} + R_A$

Answer:

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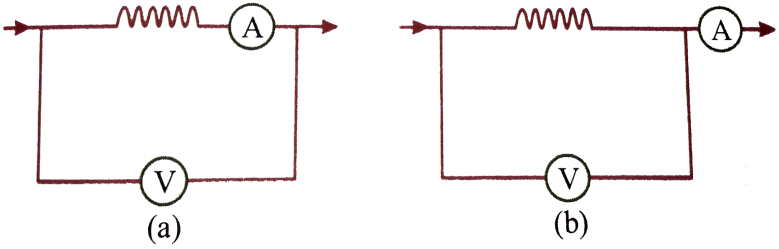
2. In the, Ohm's law experiment to find resistance of unknown resistor R, following two arrangement (a) and (b) are possible.



The resistance measured is given by

$$R_{measured} = \frac{V}{i}$$

V= voltage reading of voltmeter, $i =$ current Reading of ammeter.

But unfortunately the ammeters and voltmeter used are not

ideal, but having resistance R_A and R_V respectively.

For arrangement (a), the measured resistance is

A. $R + R_v$

B. $R + R_A$

C. $\frac{RR_v}{R + R_v}$

D. $\frac{RR_v}{R + R_v} + R_A$

Answer:

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3. In the Ohm'slaw experiment to find resistance of unknown resistor R following arrangements (a) and (b) are possible The resistance measured is given by

$R_{measured} = \frac{V}{i}$

V = voltage reading of voltmeter I = current Reading of ammeter But unfortunately the ammeters and voltmeter used are not ideal but having resistance R_A and R_v respect tively

Yor are given two unknown resistors X and Y These resistances are to be determind using an ammeter of $R_A = 0.5\Omega$ and a voltmeter of $R_v = 20k\Omega$ It is known that X is in range of a few ohms and Y is in the range of several kilo ohm's Which circuit is perferable to measure X and Y

Resistor	$Circuit$
x	(a)
y	(b)

A. $x \to (a), y \to (b)$

B. $x \to (b), y \to (a)$

C. $x \to (a), y \to (a)$

D. $x \rightarrow (b), y \rightarrow (b)$

Answer:

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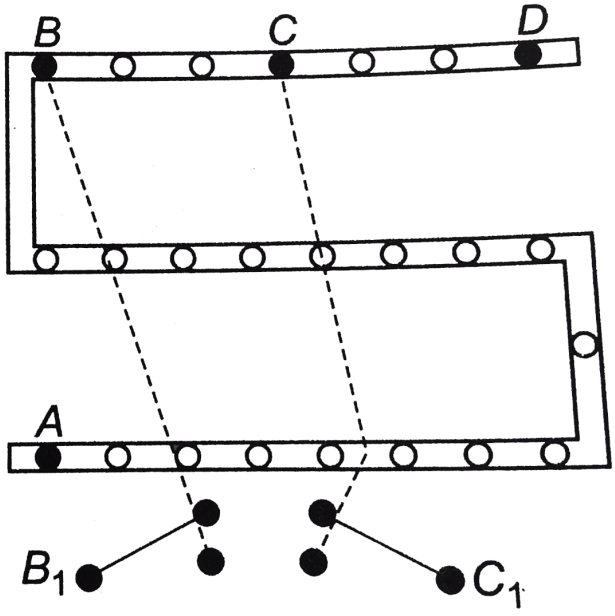
Exercise 2 Part 1

1. For the post office arrangement to determine the value of unknown resistance, the unknown resistance should be

connected between.



A. B and C

B. C and D

C. A and D

D. B_1 and C_1

Answer:

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Exercise 2 Part

1. A wire has a mass $(0.3 \pm 0.003)g$, radius $(0.5 \pm 0.005)mm$ and length $(6 \pm 0.06)cm$. The maximum percentage error in the measurement of its density is

A. 1

B. 2

C. 3

D. 4

Answer:

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2. The pitch of a screw gauge is 1mm and there are 100 divisions on circular scale. While measuring the diameter of a wire, the linear scale reads 1 mm and 47th division on circular scale coincides with reference line. The length of the wire is 5.6 cm. Find the curved surface area of the wire in cm^2 to correct number of significant figures.

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3. In searle's experiment, which is used to find Young's modulus of elasticity, the diameter of experimental wire is D= 0.05cm(measursd by a scale of least count 0.001 cm) and length is L =110cm(measured by a scale of least count 0.1 cm). A weight of 50 N causes an extension of l= 0.125 cm(measured by a micrometer of least count 0.001 cm). Find

maximum possible error in the values of Young's modulus. Screw gauge and meter scale are free from error.

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4. The side of a cube is measured by Vernier callipers (10 divisons of the vernier scale , where 1 divison of main scale is 1 mm). The main scale reads $10mm$ and first division of vernier scale coincides with the main scale . The mass of the cube is $2.736g$. Find the density of the cube in appropriate significant figures.

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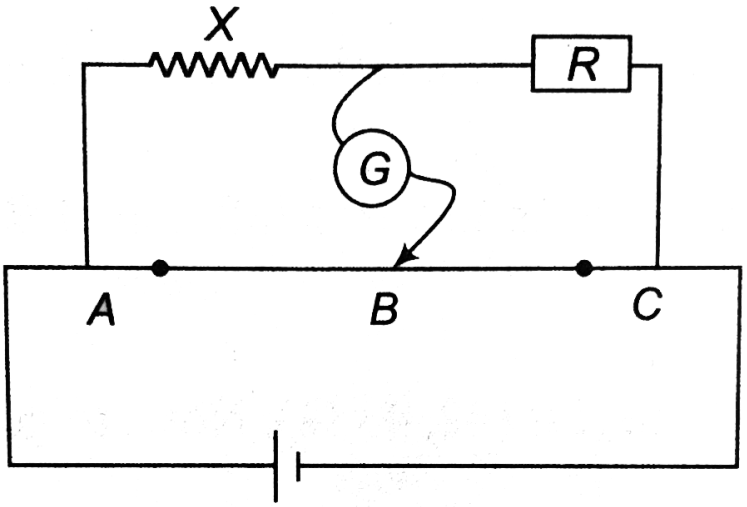
5. R_1, R_2, R_3 are different values R. A, B and C are the null points obtained corresponding to R_1, R_2 and R_3 respectively. For which resistor, the value of R will be the most accurate and why?



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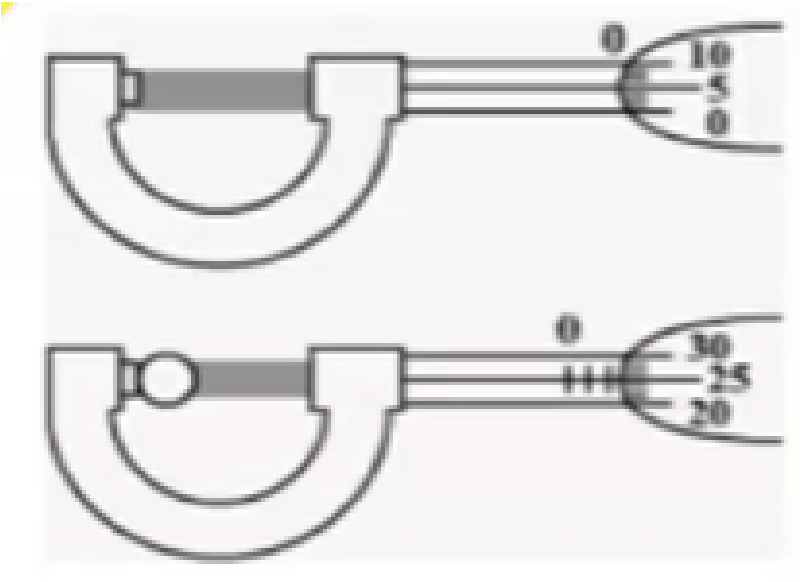
6. The number of circular divisions on the shown screw gauge is 50 it moves 0.5mm on main scale for moone

complete rotation Main scale reading is 2 The diameter of the balls is



A. a.$2.25mm$

B. b.$2.20mm$

C. c.$1.20mm$

D. d.$1.25mm$

Answer:

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7. A student performs an experiment for determination of $g\left(=\frac{4\pi^2 l}{T^2}\right)$, $\approx 1m$, and he commits an error of Δl. For T he takes the time of n oscillations with the stop watch of least count Δ and he commits is human error of $0.1\,\text{sec}$. For which of the following data, the measurement of g will be most accurate?

A. $\Delta L = 0.5, \Delta T = 0.1, n = 20$

B. $\Delta L = 0.5, \Delta T = 0.1, n = 50$

C. $\Delta L = 0.5 \Delta T = 0.01, n = 20$

D. $\Delta L = 0.1 \Delta T = 0.05, n = 50$

Answer:

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8. A student performs an experiment to determine the Young's modulus of a wire , exactly $2m$ long , by Searle's method . In a particular reading , the student measures the extension in the length of the wire to be $0.8mm$ with an uncertainty of $0.05mm$ at a load of exactly $1.0kg$. The student also measures the diameter of the wire to be $0.4mm$ with an uncertainity of $0.01mm$. Take $g = 9.8ms^{-2}$ (exact) . The Young's modulus obtained from the reading is

A. $(2.0 \pm 0.3) \times 10^{11} N/m^2$

B. $(2.0 \pm 0.2) \times 10^{11} N/m^2$

C. $(2.0 \pm 0.1) \times 10^{11} N/m^2$

D. $(2.0 \pm 0.05) \times 10^{11} N/m^2$

Answer:

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9. Student $I, II,$ and III perform an experiment for measuring the acceleration due to gravity (g) usinf a simple pendulum. They use lengths of the pendulum and // or record time for different number of oscillations . The observations are shown in the following table . Least count for length $= 0.1cm$

Student	Length of Pendulam (cm)	Number of n Oscillation (n)	Time Period (s)
I	64.0	8	16.0
II	64.0	4	16.0
III	20.0	4	9.0

Least count for time $= 0.1s.$

If E_I, E_{II} , and E_{III} are the percentage errors in g , i.,e., $\left(\frac{\Delta g}{g} \times 100\right)$ for students I,II , and III, respectively , then

A. $E_t = 0$

B. E_I is minimum

C. $(E_I = E_{II}$

D. E_{II} is maximum

Answer:

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10. A Vernier callipers has $1mm$ marks on the main scale . It has 20 equal divisions on the vernier scale , which match with 16 main scale divisions . For this vernier callipers, the least count is

A. $0.02mm$

B. $0.05mm$

C. $0.1mm$

D. $0.2mm$

Answer:

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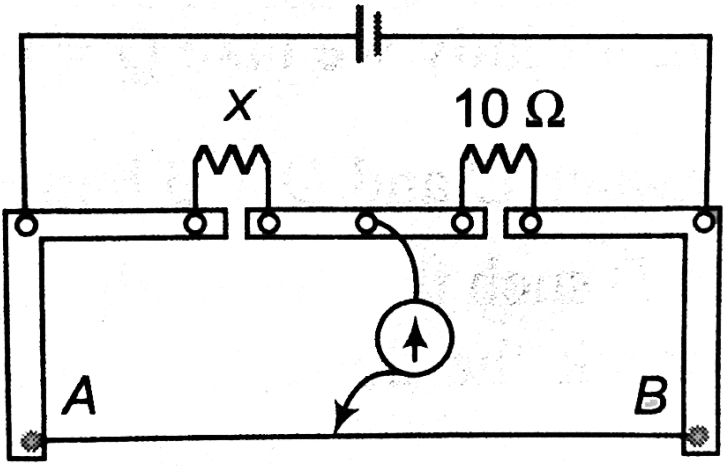
11. A meter bridge is set- up as shown in figure, to determine an unknown resistance X using a standard 10Ω resistor. The galvanometer shows null point when tapping - key is at $52cm$ mark. The end -corrections are $1cm$ and $2cm$ respectively for the ends A and B. The determined values of X is .



(a) 10.2Ω

(b) 10.6Ω

(c) 10.8Ω

(d) 11.1Ω.

A. $10.2ohm$

B. $10.6ohm$

C. $10.8ohm$

D. $11.1ohm$

Answer:

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12. The density of a solid ball is to be determined in an experiment. The diameter of the ball is measured with a screw gauge, whose pitch is 0.5 mm and there are 50 divisions on the circular scale. The reading on the main scale is 2.5 mm and that on the circular scale is 20 divisions. If the measured mass of the ball has a relative error of 2%, the relative percentage error in the density is

A. 0.9%

B. 2.4%

C. 3.1%

D. $4.2\,\%$

Answer:

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13. In the experiment of Young's modulus $\left(Y = \frac{4MLg}{\pi/d^2}\right)$ by using Searle's method , a wire of length $L = 2m$ and $diameterd = 0.5mm$ is used . For a load $M = 2.5kg$, an extension $l = 0.25mm$ in the length of the wire is observed. Quantities d and l are measured using a srew gauge and a micrometer , respectively. They have the same pitch of $0.5mm$. The number of divisions on their circular scale is 100. The contributions to the maximum probable error of the Y measurement

A. due to the erros in the measurment of d and l are the same

B. due to the error in themeasurments of d is twice that due to the error in the measurment of

C. due to the error in themeasurments of d is twice that due to the error in the measurment of

D. due to the error in themeasurments of d is twice that due to the error in the measurment of

Answer:

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14. The diameter of a cylinder is measured using a vernier callipers with no zero error . It is found that the zero of the vernier scale lies between $5.10 \text{ and } 5.15cm$ of the main scale . The $24th$ division of the vernier scale exactly coincides with one of the main scale divisions . The diameter of the cylinder is

A. $5.12cm$

B. $5.124cm$

C. $5.1236cm$

D. $5.148cm$

Answer:

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15. During Searle's experiment, zero of the Vernier sacle lies between $3.20 \times 10^{-2},$ and $3.25 \times 10^{-2} m$ of the main scale. The 20^{th} division of the Vernier scale exactly coincides with one of the main scale divisions. When an additional load of $2kg$ is applied to the wire, the zero of the vernier scale still lies between $3.20 \times 10^{-2},$ and $3.25 \times 10^{-2} m$ of the main scale but now the 45^{th} division of Vernier scale coincide with one of the main scale divisions. the length of the thin metallic wire is $2m$ and its cross-sectional ares is $8 \times 10^{-7} m^2$. the least count of the Vernier scale is $1.0 \times 10^{-5} m$. the maximum percentage error in the Young's modulus of the wire is

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16. Consider a Vernier callipers in which each $1cm$ on the main scale is divided into 8 equal divisions and a screw gauge with 100 divisions in its circular scale. In the Vernier callipers, 5 divisions of the Vernier scale coincide with 4 divisions on the scale and in the screw gauge, one complete rotation of the circular scale moves it by two divisions on the linear scale. Then :

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17. The energy of a system as a function of time t is given as $E(t) = A^2 \exp(-at), where \alpha = 0.2s^{-1}$. The measurement of A has an error of 1.25% . If the error in the measurement of time is 1.50% , the percentage error in the value of $E(t) at t = 5s$ is

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Part Ii

1. Two full turns of the circular scale of a screw gauge cover a distance of 1 mm on its main scale. The total number of division on the circular scale is 50. Further, it is found that the screw gauge has a zero error of -0.03 mm while measuring the diameter of a thin wire, a student notes the main scale reading of 3 mm and the number of circular scale division in line with the main scale as 35. The diameter of the wire is

A. $3.32mm$

B. $3.73mm$

C. $3.67mm$

D. 3.38mm`

Answer:

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2. An experiment is performed to find the refractive index of glass using a travelling microscope. In this experiment distance are measured by

A. a vernier scale provided on the microscope

B. a standard laboratory scale

C. a metal scale provided on the microscope

D. a screw gauge provided on the microscope

Answer:

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3. In an experiment the angles are required to be measured using an instrument 29 divisions of the main scale exactly coincide with the 30 divisions of the vernier scale. If the smallest division of the main scale is half-a-degree $(=0.5^{\circ})$, then the least count of the instrument is

A. half minute

B. one dergree

C. half degree

D. one minutue

Answer:

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4. In a optics experiment, with the positive of the object fixed, a student varies the positive of a convex lens and for each positive, the screen is adjusted to get a clear image of the object. A graph between the object distance u and the image distance v, from the lens, is plotted using the same scale for the two axes. A straight line passing through the origin and making an angle of 45° with the x-axis meets the experimental curve at P. The coordinates of P will be

A. $\left(\frac{f}{2}, \frac{f}{2}\right)$

B. (f, f)

C. $(4f, 4f)$

D. $(2f, 2f)$

Answer:

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5. The respective number of significant figures for the numbers $23.023, 0.0003$ and 2.1×10^{-3} are

A. $5, 1, 2$

B. $5, 1, 5$

C. $5, 5, 2$

D. $4, 4, 2$

Answer:

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6. A screw gauge gives the following reading when used to mesure the diametre of a wire.

Main scale reading : 0mm

Circular scale reading : 52 divisions

Given that 1mm on main scale corresponds to 100 divisions of the circular scale. the diameter of wire from the above data is :

A. $0.52cm$

B. $0.052cm$

C. $0.026cm$

D. $0.0005cm$

Answer:

Watch Video Solution

7. If 400Ω of resistance is made by adding four 100Ω resistance of tolerance 5%, then the tolerance of the combination is:

A. $5\ \%$

B. $10\ \%$

C. $15\ \%$

D. $20\ \%$

Answer:

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8. The currect voltage relation of diode is given by $I = \left(e^{1000V/T} - 1\right)mA$, where the applied voltage V is in volt and the temperature T is in degree Kelvin. If a student makes an error measuring $\pm 0.01V$ while measuring the current of $5mA$ at $300K$, what will be error in the value of current in mA?

A. $0.2mA$

B. $0.02mA$

C. $0.5mA$

D. $0.05mA$

Answer:

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9. A student measured the length of a rod and wrote it as $3.50cm$. Which instruments dis he use to measure it ?

A. A meter scale

B. Avernier scale matches with 9 division in main scale and main scale has 10 divisions in 1cm

C. A screw gausge having 100 divisions the circular scale and pitch as 1mm

D. A screw gausge having 50divisions the circular scale and pitch as 1mm

Answer:

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10. The period of oscillation of a simple pendulum is $T = 2\pi\sqrt{\frac{L}{g}}$. Measured value of L is 20.0 cm known to 1 mm accuracy and time for 100 oscillations of the pendulum is found to be 90 s using wrist watch of 1 s resolution. The accuracy in the determination of g is :

A. 2%

B. 3%

C. 1%

D. 5%

Answer:

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