Exercise - II

Q.1 How many significant figures are given in the following quantities ?

(A) 343 g	(B) 2.20
(C) 1.103 N	(D) 0.4142 s
(E) 0.0145 m	(F) 1.0080 V
(G) 9.1 × 10 ⁴ km	(H) 1.124 × 10 ^{−3} \

Q.2 Perform the following operations :

(A) 703 + 7 + 0.66	(B) 2.21 × 0.3
(C) 12.4 × 84	(D) 14.28/0.714

Q.3 Solve with due regard to significant digits

(i) $\sqrt{6.5-6.32}$	(ii) 2.91×0.3842
	(II)0.080

Q.4 The main scale of a vernier calipers reads in millimeter and its vernier is divided into 10 divisions which coincide with 9 divisions of the main scale. When the two jaws of the instrument touch each other the seventh divison of the vernier scale coincide with a scale division and the zero of the vernier lies to the right of the zero of main scale. Furthermore, when a cylinder is tightly placed along its length between the two jaws, the zero of the vernier scale lies slightly to the left of 3.2 cm; and the fourth vernier division conicdes with a scale division. Calculate the measured length of the cylinder.

Q.5 The VC shown in the diagram has zero error in it (a you can see).

It is given that 9 msd = 10 vsd.

(i) What is the magnitude of the zero error ? (1 msd = 1 mm) (ii) The observed reading of the length of a rod measured by this VC comes out to be 5.4 mm. If the vernier had been error free then reading of main scale would be _____ and the division of vernier scale coinciding would be _____.



Q.6 Consider a home made vernier scale as shown in the figure.In this diagram, we are interested in measuring the length of the line PQ. If both the inclines are identical and their angles are equal to θ then what is the least count of the instrument.



Problems

Q.7 The pitch of a screw gauge is 0.5 mm and there are 50 divisions on the circular scale. In measuring the thickness of a metal plate, there are five divisions on the pitch scale (or main scale) and thirty fourth division coincides with the reference line. Calculate the thickness of the metal plate.

Q.8 The pitch of a screw gauge is 1 mm and there are 50 divisions on its cap. When nothing is put in between the studs, 44^{th} division of the circular scale coincides with the reference line zero of the main scale is not visible. When a glass plate is placed between the studs, the main scale reads three divisions and the circular scale reads 26 divisions. Calculate the thickness of the plate.

Q.9 In a given optical bench, a needle of length 10 cm is used in between (object & lens) and lens and image to estimate bench error. The object needle, image needle & lens holder have their reading as shown.

 $x_0 = 1.1 \text{ cm}, \quad x_1 = 21.0 \text{ cm}, x_1 = 10.9 \text{ cm}$

Estimate the bench errors which are present in image needle holder and object needle holder. Also find the focal length of the convex lens when.

 $x_0 = 0.6 \text{ cm}, x_1 = 22.5 \text{ cm}, x_L = 11.4 \text{ cm}$

Q.10 Make the appropriate connections in the meter bridge set up shown. Resistance box is connected between_____. Unknown resistance is connected between_____. Battery is connected between _____.



Q.11 A body travels uniformly a distance of (13.8 ± 0.2) m in time (4.0 ± 0.3) sec. Calculate its velocity.

Q.12 Consider S = x cos (θ) for x = (2.0 ± 0.2) cm, θ = 53 ± 2°. Find S.

Q.13 Two resistance R₁ and R₂ are connected in (i) series and (ii) parallel. What is the equivalent resistance with limit of possible percentage error in each case of R₁ = 5.0 ± 0.2 Ω and R₂ = $10.0 \pm 0.1 \Omega$.

Q.14 5.74 gm of a substance occupies a volume of 1.2 cm^3 . Calculate its density with due regard for significant figures.

Q.15 The time period of oscillation of a simple pendulum is

given by T = $2\pi\sqrt{l/g}$ The length of the pendulum is measured as l = 10 ± 0.1cm and the time periods as T = 0.5 ± 0.02 s. Determine percentage error in the value of g.

Q.16 A physical quantity P is related to four observables A,

B, C and D as P = $4\pi^2 A^3 B^2 (\sqrt{C} D)$ The percentage error of the measurment in A, B, C and D are 1%, 3% and 2%, 4% respectively. Determien the percentage error & absolute error in the quantity P. Value of P is calculated 3.763.



Q.17 A glass prism of angle A = 60° (exact) gives minimum angle of deviation θ = 30° with the max. error of 1° when a beam of parallel light is passed through the prism during an experiment. Find the maximum permissible percentage error in the measurment of refractive index μ of the material of the prism.

Q.18 In a vemier calipers the main scale and the vernier scale are made up different materials. When the room temperature increases by $\Delta T^{\circ}C$, it is found the reading of the instrument remains the same. Earliner it was observed that the front edge of the wooden rod placed for measurment crossed the Nth main scale division and N + 2 msd coincided with the 2nd vsd. Initially, 10 vsd coincided with 9 msd. If coefficient of linear expansion of the main scale is α_1 and that of the vermier scale is α_2 then what is the value of α_1/α_2 ? (Ignore the expansion of the rod on heating)

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(A) 1.8 / (N)	(B) 1.8 / (N + 2)
(C) 1.8 / (N – 2)	(D) None

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