Section A

1. A physical parameter a can be determined by measuring the parameters b, c, d and e using the relation $a = b^\alpha c^\beta / d^\gamma e^\delta$. If the maximum error in the measurement of b, c, d and e are $b_1\%$, $c_1\%$, $d_1\%$ and $e_1\%$, then the maximum error in the value of a, determined by the experiment is–

   (1) $(b_1 + c_1 + d_1 + e_1)\%$

   (2) $(b_1 + c_1 - d_1 - e_1)\%$

   (3) $(\alpha b_1 + \beta c_1 - \gamma d_1 - \delta e_1)\%$

   (4) $(\alpha b_1 + \beta c_1 + \gamma d_1 + \delta e_1)\%$

2. The heat generated in a circuit is dependent upon the resistance, current and time for which the current is flown. If the error in measuring the above are as 1%, 2% and 1% the maximum error in measuring heat will be

   (1) 2%   (2) 3%

   (3) 6%   (4) 1%

3. The percentage errors in the measurement of mass and speed are 2% and 3% respectively. How much will be the maximum error in the estimate of kinetic energy obtained by measuring mass and speed ?

   (1) 11 %   (2) 8 %

   (3) 5 %   (4) 1 %

4. One centimetre on the main scale of vernier callipers is divided into ten equal parts. If 10 divisions of vernier scale coincide with 8 small divisions of the main scale, the least count of the callipers is

   (1) 0.01 cm   (2) 0.02 cm

   (3) 0.05 cm   (4) 0.005 cm

5. While measuring acceleration due to gravity by a simple pendulum a student makes a positive error of 1% in the length of the pendulum and a negative error of 3% in the value of the time period. His percentage error in the measurement of the value of g will be -

   (1) 2 %   (2) 4 %

   (3) 7 %   (4) 10 %

6. The density of a cube is measured by measuring its mass and the length of its side. If the maximum errors in the measurement of mass and length are 4% and 3% respectively, the maximum error in the measurement of the density is -

   (1) 9%   (2) 13%

   (3) 12%   (4) 7%

7. A student measured the diameter of a wire using a screw gauge with least count 0.001 cm and listed the measurements. The correct measurement is –

   (1) 5.3 cm   (2) 5.32 cm

   (3) 5.320 cm   (4) 5.3200 cm

8. The error in the measurement of radius of a sphere is 0.1% . The error in the measurement of volume is -

   (1) 0.1%   (2) 0.3%

   (3) 0.5%   (4) 0.8%

9. The pressure on a square plate is measured by measuring the force on the plate and the length of the sides of the plate. If the maximum error in the measurement of force and length are respectively 4% and 2%, the maximum error in the measurement of pressure is –

(1) 1% (2) 2%

(3) 6% (4) 8%

10. When a copper sphere is heated, maximum percentage change will be observed in–
(1) radius (2) area
(3) volume (4) none of these

11. A wire has a mass (0.3 ± 0.003) g, radius (0.5 ± 0.005) mm and length (6 ± 0.06) cm. The maximum percentage error in the measurement of its density is–
(1) 1 (2) 2
(3) 3 (4) 4

12. If the error in the measurement of radius of a sphere is 2 % then the error in the determination of volume of the sphere will be :-
(1) 8% (2) 2 %
(3) 4 % (4) 6%

Section B

1. A quantity is represented by $X = M^a L^b T^c$. The percentage error in measurement of M, L and T are α%, β % and γ % respectively. The percentage error in X would be

(1) $(\alpha a + \beta b + \gamma c)$ %

(2) $(\alpha a - \beta b + \gamma c)$ %

(3) $(\alpha a - \beta b - \gamma c)$ %

(4) None of these

2. An experiment measures quantities a, b and c, and X is calculated from $X = ab^2/c^3$. If the percentage error in a, b and c are ± 1%, ± 3% and ± 2% respectively, the percentage error in X will be –

(1) ± 13% (2) ± 7%

(3) ± 4% (4) ± 1%

3. Zero error of an instrument introduces
(1) Systematic errors (2) Random errors
(3) Both (4) None

4. What is the fractional error in g calculated from

$T = 2\pi\sqrt{\ell/g}$? Given that fractional errors in T and

ℓ are $\pm x$ and $\pm y$ respectively.

(1) x + y (2) x – y

(3) 2x + y (4) 2x – y

5. If error in measuring diameter of a circle is 4%, the error in the radius of the circle would be
(1) 2% (2) 8%
(3) 4% (4) 1%

6. A thin copper wire of length ℓ metre increases in length by 2% when heated through 10 C. What is the percentage increase in area when a square copper sheet of length ℓ metre is heated through 10 C ?

(1) 4% (2) 8%

(3) 16% (4) None of the above.

7. The period of oscillation of a simple pendulum in the experiment is recorded as 2.63s, 2.56s, 2.42s, 2.71s and 2.80s respectively. The average absolute error is

(1) 0.1s (2) 0.11s

(3) 0.01s (4) 1.0s

8. The resistance is $R = \dfrac{V}{I}$ where $V = 100 \pm 5$ Volts

and $I = 10 \pm 0.2$ amperes. What is the total error in R ?

(1) 5 % (2) 7 %

(3) 5.2 % (4) $\left(\dfrac{5}{2}\right)$ %

9. The length, breadth and thickness of a strip are (10.0 ± 0.1) cm, (1.00 ± 0.01)cm and (0.100 ± 0.001)cm respectively. The most probable error in its volume will be

(1) ± 0.03 cm^3 (2) ± 0.111 cm^3

(3) ± 0.012 cm^3 (4) None of these

10. If error in measuring diameter of a circle is 4 %, the error in circumference of the circle would be :-

(1) 2 %   (2) 8 %

(3) 4 %   (4) 1 %

11. The external and internal radius 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 :-

(1) (0.34 ± 0.02) cm

(2) (0.17 ± 0.02) cm

(3) (0.17 ± 0.01) cm

(4) (0.34 ± 0.01) cm

12. Percentage error in measuring the radius and mass of a solid sphere are 2% & 1% respectively. Then error in measurement of moment of inertia with respect to its diameter is :-

(1) 3 %   (2) 6 %

(3) 5 %   (4) 4 %

13. In a vernier calliper, N divisions of vernier scale coincide with $(N-1)$ divisions of main scale (in which 1 division represents 1mm). The least count of the instrument in cm. should be

(1) N   (2) N – 1

(3) $\dfrac{1}{10N}$ (4) $\dfrac{1}{N-1}$

14. The length of a cylinder is measured with a metre rod having least count 0.1 cm. Its diameter is measured with vernier callipers having least count 0.01 cm. Given the length is 5.0 cm. and radius is 2.00 cm. The percentage error in the calculated value of volume will be –

(1) 2%   (2) 1%

(3) 3%   (4) 4%

15. A vernier callipers has 20 divisions on the vernier scale which coincide with 19 divisions on the main scale. The least count of the instrument is 0.1 mm. The main scale divisions are of

(1) 0.5 mm

(2) 1 mm

(3) 2 mm

(4) 1/4 mm

ANSWER KEYS

Section A

Que.	1	2	3	4	5	6	7	8	9	10	11	12			
Ans.	4	3	2	2	3	2	3	2	4	3	4	4			

Section B

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	1	1	1	3	3	1	2	2	1	3	1	3	3	3	3

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