JEE Main Practice Test-21
Errors & Experiments

Topic : ERRORS & EXPERIMENTS Time: 75Min Marking +4 –1

Section - A : MCQs with Single Option Correct

1. A screw gauge gives the following reading when used to measure the diameter of a wire.
Main scale reading : 0 mm
Circular scale reading : 52 divisions
Given that 1 mm on main scale corresponds to 100 divisions of the circular scale. The diameter of wire from the above data is :
(A) 0.052 cm (B) 0.026 cm (C) 0.005 cm (D) 0.52 cm

2. A spectrometer gives the following reading when used to measure the angle of a prism.
Main scale reading : 58.5 degree
Vernier scale reading : 09 divisions
Given that 1 division on main scale corresponds to 0.5 degree. Total divisions on the Vernier scale is 30 and match with 29 divisions of the main scale. The angle of the prism from the above data is :
(A) 58.59 degree (B) 58.77 degree (C) 58.65 degree (D) 59 degree

3. A student measured the diameter of a wire using a screw gauge with the least count 0.001 cm and listed the measurements. The measured value should be recorded as :
(A) 5.3200 cm (B) 5.3 cm (C) 5.32 cm (D) 5.320 cm

4. N divisions on the main scale of a vernier calliper coincide with $(N + 1)$ divisions of the vernier scale. If each division of main scale is a units, then the least count of the instrument is :
(A) a (B) $\frac{a}{N}$ (C) $\frac{N}{N+1} \times a$ (D) $\frac{a}{N+1}$

5. A student measured the length of a rod and wrote it as 3.50 cm. Which instrument did he use to measure it ?
(A) A meter scale
(B) A vernier calliper where the 10 divisions in vernier scale matches with 9 division in main scale and main scale has 10 divisions in 1 cm
(C) A screw gauge having 100 divisions in the circular scale and pitch as 1 mm
(D) A screw gauge having 50 divisions in the circular scale and pitch as 1 mm

6. An experiment is performed to obtain the value of acceleration due to gravity g by using a simple pendulum of length L. In this experiment time for 100 oscillations is measured by using a watch of 1 second least count and the value is 90.0 seconds. The length L is measured by using a meter scale of least count 1 mm and the value is 20.0 cm. The error in the determination of g would be :
(A) 1.7% (B) 2.7% (C) 4.4% (D) 2.27%

7. In the experiment of calibration of voltmeter, a standard cell of e.m.f. 1.1 volt is balanced against 440 cm of potential wire. The potential difference across the ends of resistance is found to balance against 220 cm of the wire. The corresponding reading of voltmeter is 0.5 volt. The error in the reading of voltmeter will be :
(A) – 0.15 volt (B) 0.15 volt (C) 0.5 volt (D) – 0.05 volt

8. Match List-I (Event) with List-II (Order of the time interval for happening of the event) and select the correct option from the options given below the lists :

List-I	List-II
(1) Rotation period of earth	(i) 10^5s
(2) Revolution period of earth	(ii) 10^7s
(3) Period of light wave	(iii) 10^{-15}s
(4) Period of sound wave	(iv) 10^{-3}s

(A) (1)-(i), (2)-(ii), (3)-(iii), (4)-(iv)
(B) (1)-(ii), (2)-(i), (3)-(iv), (4)-(iii)
(C) (1)-(i), (2)-(ii), (3)-(iv), (4)-(iii)
(D) (1)-(ii), (2)-(i), (3)-(iii), (4)-(iv)

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

(A) 1% (B) 5% (C) 2% (D) 3%

10. Diameter of a steel ball is measured using a Vernier callipers which has divisions of 0.1 cm on its main scale (MS) and 10 divisions of its vernier scale (VS) match 9 divisions on the main scale. Three such measurements for a ball are given as :

S.No.	MS(cm)	VS divisions
1.	0.5	8
2.	0.5	4
3.	0.5	6

If the zero error is – 0.03 cm, then mean corrected diameter is :

(A) 0.52 cm (B) 0.59 cm (C) 0.56 cm (D) 0.53 cm

11. A student measures the time period of 100 oscillations of a simple pendulum four times. The data set is 90 s, 91 s, 95 s, and 92 s. If the minimum division in the measuring clock is 1 s, then the reported mean time should be :

(A) 92 ± 1.8 s (B) 92 ± 3 s (C) 92 ± 1.5 s (D) 92 ± 5.0 s

12. The following observations were taken for determining surface tension T of water by capillary method : Diameter of capillary, $D = 1.25 \times 10^{-2}$ m
rise of water, $h = 1.45 \times 10^{-2}$ m
Using $g = 9.80$ m/s^2 and the simplified relation

$T = \frac{rhg}{2} \times 10^3$ N/m, the possible error in surface tension is closest to :

(A) 2.4% (B) 10% (C) 0.15% (D) 1.5%

13. The percentage errors in quantities P, Q, R and S are 0.5%, 1%, 3% and 1.5% respectively in the measurement of a physical quantity $A = \frac{P^3Q^2}{\sqrt{RS}}$.

The maximum percentage error in the value of A will be :

(A) 8.5% (B) 6.0% (C) 7.5% (D) 6.5%

14. In a screw gauge, 5 complete rotations of the screw cause it to move a linear distance of 0.25 cm. There are 100 circular scale divisions. The thickness of a wire measured by this screw gauge gives a reading of 4 main scale divisions and 30 circular scale divisions. Assuming negligible zero error, the thickness of the wire is :
(A) 0.0430 cm (B) 0.3150 cm (C) 0.4300 cm (D) 0.2150 cm

15. The relative uncertainty in the period of a satellite orbiting around the earth is 10^{-2}. If the relative uncertainty in the radius of the orbit is negligible, the relative uncertainty in the mass of the earth is :
(A) 3×10^{-2} (B) 10^{-2} (C) 2×10^{-2} (D) 6×10^{-2}

16. The density of a material in the shape of a cube is determined by measuring three sides of the cube and its mass. If the relative errors in measuring the mass and length are respectively 1.5% and 1%, the maximum error in determining the density is :
(A) 2.5% (B) 3.5% (C) 4.5% (D) 6%

17. The pitch and the number of divisions, on the circular scale, for a given screw gauge are 0.5 mm and 100 respectively. When the screw gauge is fully tightened without any object, the zero of its circular scale lies 3 divisions below the reference line.
The readings of the main scale and the circular scale, for a thin sheet, are 5.5 mm and 48 respectively, the thickness of this sheet is:
(A) 5.755 m (B) 5.725 mm (C) 5.740 m (D) 5.950 mm

18. The diameter and height of a cylinder are measured by a meter scale to be 12.6 ± 0.1 cm and 34.2 ± 0.1 cm, respectively. What will be the value of its volume in appropriate significant figures ?
(A) $4260 \pm 80\ cm^3$ (B) $4300 \pm 80\ cm^3$ (C) $4264.4 \pm 81.0\ cm^3$ (D) $4264 \pm 81\ cm^3$

19. Consider the following data:
10 main scale division = 1 cm, 10 vernier division = 9 main scale divisions. Zero of vernier scale is to the right of the zero marking of the main scale with 6 vernier divisions coinciding with main scale divisions. The measured reading for length measurement is 4.3 cm on main scale with 2 vernier divisions coinciding with main scale graduations. Estimate the actual length :
(A) 426 cm (B) 4.26 cm (C) 4.38 cm (D) 4.5 cm

20. The value of one division of a vernier scale in a device is (0.4)° and 20 divisions of main scale are equal to 25 divisions of vernier. Then leastcount of device is :
(A) (0.5)° (B) (0.4)° (C) (0.2)° (D) (0.1)°

Section- B: INTEGER Answer Type Questions

21. Resistance of a given wire is obtained by measuring the current flowing in it and the voltage difference applied across it. If the percentage errors in the measurement of the current and the voltage difference are 3% each, then calculate the error in the value of resistance of the wire.

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

23. A screw gauge with a pitch of 0.5 mm and a circular scale with 50 divisions is used to measure the thickness of a thin sheet of Aluminium. Before starting the measurement, it is found that when the two jaws of the screw gauge are brought in contact, the 45^{th} division coincides with the main scale line and the zero of the main scale is barely visible. What is the thickness of the sheet (in cm) if the main scale reading is 0.5 mm and the 25^{th} division coincides with the main scale

line ?

24. A physical quantity P is described by the relation $P = a^{1/2} b^2 c^3 d^{-4}$.
If the relative errors in the measurement of a, b, c, and d respectively, are 2%, 1%, 3% and 5%, then claculate the relative error in P.

25. The relative error in the determination of the surface area of a sphere is α. Then the relative error in the determination of its volume is $\frac{n}{2}\alpha$, find n ?

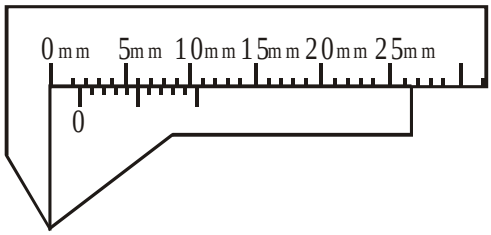
26. A copper wire is stretched to make it 0.5% longer. Calculate the percentage change in its electrical resistance if its volume remains unchanged.

27. The least count of the main scale of a screw gauge is 1 mm. Calculate the minimum number of divisions on its circular scale required to measure 5 μm diameter of wire.

28. A spherometer has 20 threads per centimeter. Its circular scale has 100 divisions. Find the least count of spherometer in μm.

29. A wire has a mass (0.3 ± 0.003) g, radius $(0.5 + 0.005)$ mm and length (6 ± 0.06) cm. Calculate the maximum percentage error in measurement of density.

30. In the given vernier calliper both jaws touch each other. The least count of the instrument is 0.1 mm. The side callipers has zero error n/10 mm. Find n.



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ANSWER KEY

Section - A : MCQs with Single Option Correct

1. (A)	**2.** (C)	**3.** (D)	**4.** (D)
5. (B)	**6.** (B)	**7.** (D)	**8.** (A)
9. (D)	**10.** (B)	**11.** (C)	**12.** (D)
13. (D)	**14.** (D)	**15.** (C)	**16.** (C)
17. (B)	**18.** (A)	**19. (B)**	**20. (D)**

Section- B: INTEGER Answer Type Questions

21. [6]	**22.** [200]	**23.** [80]	**24.** [32]
25. [3]	**26.** [1]	**27.** [200]	**28.** [5]
29. [4]	**30.** [5]		

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