DPP - Daily Practice Problems

Name : _____ Date : _____

Start Time : _____ End Time : _____

PHYSICS 02

SYLLABUS : Measurements (Errors)

Max. Marks : 120 **Time : 60 min.**

GENERAL INSTRUCTIONS

- The Daily Practice Problem Sheet contains 30 MCQ's. For each question only one option is correct. Darken the correct circle/ bubble in the Response Grid provided on each page.
- You have to evaluate your Response Grids yourself with the help of solution booklet.
- Each correct answer will get you 4 marks and 1 mark shall be deduced for each incorrect answer. No mark will be given/ deducted if no bubble is filled. Keep a timer in front of you and stop immediately at the end of 60 min.
- The sheet follows a particular syllabus. Do not attempt the sheet before you have completed your preparation for that syllabus. Refer syllabus sheet in the starting of the book for the syllabus of all the DPP sheets.
- After completing the sheet check your answers with the solution booklet and complete the Result Grid. Finally spend time to analyse your performance and revise the areas which emerge out as weak in your evaluation.

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

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

Q.2 If 97.52 is divided by 2.54, the correct result in terms of significant figures is

(a) 38.4 (b) 38.3937

(c) 38.394 (d) 38.39

Q.3 A physical quantity A is related to four observable a, b, c and d as follows, $A = \frac{a^2 b^3}{c\sqrt{d}}$ the percentage errors of measurement in a, b, c and d are 1%, 3%, 2% and 2% respectiely. What is the percentage error in the quantity A

(a) 12% (b) 7%

(c) 5% (d) 14%

Q.4 A physical quantity is given by $X = M^a L^b T^c$. The percentage error in measurement of M, L and T are α, β and γ respectively. Then maximum percentage error in the quantity X is

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

(c) $\frac{a}{\alpha} + \frac{b}{\beta} + \frac{c}{\gamma}$ (d) None of these

RESPONSE GRID	1. ⓐⓑⓒⓓ	2. ⓐⓑⓒⓓ	3. ⓐⓑⓒⓓ	4. ⓐⓑⓒⓓ

Q.5 If the length of rod A is 3.25 ± 0.01 cm and that of B is 4.19 ± 0.01 cm then the rod B is longer than rod A by
(a) 0.94 ± 0.00 cm (b) 0.94 ± 0.01 cm
(c) 0.94 ± 0.02 cm (d) 0.94 ± 0.005 cm

Q.6 If L = 2.331 cm, B = 2.1 cm, then L + B =
(a) 4.431 cm (b) 4.43 cm
(c) 4.4 cm (d) 4 cm

Q.7 The number of significant figures in all the given numbers 25.12, 2009, 4.156 and 1.217×10^{-4} is
(a) 1 (b) 2 (c) 3 (d) 4

Q.8 In an experiment, the following observation's were recorded: L = 2.820 m, M = 3.00 kg, l = 0.087 cm, Diameter D = 0.041 cm. Taking g = 9.81 m/s^2 using the formula, $Y = \frac{4MgL}{\pi D^2 l}$, the maximum percentage error in Y is
(a) 7.96% (b) 4.56% (c) 6.50% (d) 8.42%

Q.9 A physical parameter a can be determined by measuring the parameters b, c, d and e using the relation $a = \frac{b^{\alpha} c^{\beta}}{d^{\gamma} e^{\delta}}$.
If the maximum errors 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
(a) $(b_1 + c_1 + d_1 + e_1)$% (b) $(b_1 + c_1 - d_1 - e_1)$%
(c) $(\alpha b_1 + \beta c_1 - \gamma d_1 - \delta e_1)$% (d) $(\alpha b_1 + \beta c_1 + \gamma d_1 + \delta e_1)$%

Q.10 The period of oscillation of a simple pendulum is given by $T = 2\pi\sqrt{\frac{l}{g}}$ where l is about 100 cm and is known to have 1mm accuracy. The period is about 2s. The time of 100 oscillations is measured by a stopwatch of least count 0.1s. The percentage error in g is
(a) 0.1% (b) 1%
(c) 0.2% (d) 0.8%

Q.11 The mean time period of second's pendulum is 2.00s and mean absolute error in the time period is 0.05s. To express maximum estimate of error, the time period should be written as
(a) (2.00 ± 0.01)s (b) (2.00 + 0.025) s
(c) (2.00 ± 0.05) s (d) (2.00 ± 0.10) s

Q.12 Error in the measurement of radius of a sphere is 1%. The error in the calculated value of its volume is
(a) 1% (b) 3%
(c) 5% (d) 7%

Q.13 The relative density of material of a body is found by weighing it first in air and then in water. If the weight in air is (5.00 ± 0.05) newton and weight in water is (4.00 ± 0.05) newton. Then the relative density along with the maximum permissible percentage error is
(a) 5.0 ± 11% (b) 5.0 ± 1%
(c) 5.0 ± 6% (d) 1.25 ± 5%

Q.14 The resistance $R = \frac{V}{i}$ where V = 100 ± 5 volts and i = 10 ± 0.2 amperes. What is the total error in R ?
(a) 5% (b) 7% (c) 5.2% (d) $\frac{5}{2}$%

Q.15 The length of a cylinder is measured with a meter rod having least count 0.1 cm. Its diameter is measured with vernier calipers having least count 0.01 cm. Given that length is 5.0 cm. and radius is 2.0 cm. The percentage error in the calculated value of the volume will be
(a) 1% (b) 2%
(c) 3% (d) 4%

Q.16 According to Joule's law of heating, heat produced $H = I^2Rt$, where I is current, R is resistance and t is time . If the errors in the measurements of I,R. and t are 3%, 4% and 6% respectively then error in the measurement of H is
(a) ± 17% (b) ± 16%
(c) ± 19% (d) ± 25%

RESPONSE GRID					
	5. ⓐⓑⓒⓓ	**6.** ⓐⓑⓒⓓ	**7.** ⓐⓑⓒⓓ	**8.** ⓐⓑⓒⓓ	**9.** ⓐⓑⓒⓓ
	10. ⓐⓑⓒⓓ	**11.** ⓐⓑⓒⓓ	**12.** ⓐⓑⓒⓓ	**13.** ⓐⓑⓒⓓ	**14.** ⓐⓑⓒⓓ
	15. ⓐⓑⓒⓓ	**16.** ⓐⓑⓒⓓ			

Space for Rough Work

Q.17 A physical quantity P is given by $P = \frac{A^3 B^{\frac{1}{2}}}{C^{-4} D^{\frac{3}{2}}}$. The quantity which brings in the maximum percentage error in P is
(a) A (b) B
(c) C (d) D

Q.18 If there is a positive error of 50% in the measurement of velocity of a body, then the error in the measurement of kinetic energy is
(a) 25% (b) 50%
(c) 100% (d) 125%

Q.19 The random error in the arithmetic mean of 100 observations is x; then random error in the arithmetic mean of 400 observations would be
(a) $4x$ (b) $\frac{1}{4}x$ (c) $2x$ (d) $\frac{1}{2}x$

Q.20 The percentage errors in the measurement of mass and speed are 2% and 3% respectively. How much will be the maximum error in the estimation of the kinetic energy obtained by measuring mass and speed?
(a) 11% (b) 8%
(c) 5% (d) 1%

Q.21 The unit of percentage error is
(a) Same as that of physical quantity
(b) Different from that of physical quantity
(c) Percentage error is unitless
(d) Errors have got their own units which are different from that of physical quantity measured

DIRECTIONS (Q.22-Q.24) : In the following questions, more than one of the answers given are correct. Select the correct answers and mark it according to the following codes:

Codes :
(a) 1, 2 and 3 are correct **(b)** 1 and 2 are correct
(c) 2 and 4 are correct **(d)** 1 and 3 are correct

Q.22 In the context of accuracy of measurement and significant figures in expressing results of experiment, which of the following is/are correct?
1. Out of the two measurements 50.14 cm and 0.00025 ampere, the first one has greater accuracy
2. Out of the two measurements 50.14 cm and 0.00025 ampere, the second has greater accuracy.
3. If one travels 478 km by rail and 397 m by road, the total distance travelled is 875 km.
4. If one travels 697 m by rail and 478 km by road, the total distance is 478 km.

Q.23 A thin copper wire of length l metre increases in length by 2% when heated through 10°C. Which is not the percentage increase in area when a square copper sheet of length l metre is heated through 10°C
(1) 12% (2) 8% (3) 16% (4) 4%

Q.24 A body travels uniformly a distance of (13.8 ± 0.2) m in a time (4.0 ± 0.3) s.
1. Its velocity with error limit is $(3.5 \pm 0.31)\ ms^{-1}$
2. Its velocity with error limit is $(3.5 \pm 0.11)\ ms^{-1}$
3. Percentage error in velocity is $\pm 4\%$
4. Percentage error in velocity is $\pm 9\%$

DIRECTION (Q.25-Q.27) : Read the passage given below and answer the questions that follows :

The internal radius of a 1m long resonance tube is measured as 3 cm. A tuning fork of frequency 2000 Hz is used. The first resonating length is measured as 4.6 cm and the second resonating length is measured as 14.0 cm.

Q.25 Calculate the maximum percentage error in measurement of e.
(a) 3.33% (b) 2.23% (c) 4.33% (d) 5.33%

Q.26 Calculate the speed of sound at the room temperature.
(a) 275 m/s (b) 376 m/s
(c) 356 m/s (d) 330 m/s

RESPONSE GRID					
	17. ⓐⓑⓒⓓ	18. ⓐⓑⓒⓓ	19. ⓐⓑⓒⓓ	20. ⓐⓑⓒⓓ	21. ⓐⓑⓒⓓ
	22. ⓐⓑⓒⓓ	23. ⓐⓑⓒⓓ	24. ⓐⓑⓒⓓ	25. ⓐⓑⓒⓓ	26. ⓐⓑⓒⓓ

Space for Rough Work

Q.27 Calculate the end correction.

(a) 0.2 cm (b) 0.3 cm

(c) 0.1 cm (d) 0.4 cm

DIRECTIONS (Q. 28-Q.30) : Each of these questions contains two statements: Statement-1 (Assertion) and Statement-2 (Reason). Each of these questions has four alternative choices, only one of which is the correct answer. You have to select the correct choice.

(a) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.

(b) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1.

(c) Statement-1 is False, Statement-2 is True.

(d) Statement-1 is True, Statement-2 is False.

Q.28 **Statement-1:** Number of significant figures in 0.005 is one and that in 0.500 is three.

Statement-2 : This is because zero is not significant.

Q.29 **Statement-1:** Out of three measurements $l = 0.7$ m; $l = 0.70$ m and $l = 0.700$ m, the last one is most accurate.

Statement-2: In every measurement, only the last significant digit is not accurately known.

Q.30 **Statement-1:** Parallex method cannot be used for measuring distances of stars more than 100 light years away.

Statement-2: Because parallex angle reduces so much that it cannot be measured accurately.

RESPONSE GRID	27. ⓐⓑⓒⓓ	28. ⓐⓑⓒⓓ	29. ⓐⓑⓒⓓ	30. ⓐⓑⓒⓓ

DAILY PRACTICE PROBLEM SHEET 2 - PHYSICS			
Total Questions	30	Total Marks	120
Attempted		Correct	
Incorrect		Net Score	
Cut-off Score	28	Qualifying Score	46
Success Gap = Net Score – Qualifying Score			
Net Score = (Correct × 4) – (Incorrect × 1)			

Space for Rough Work

DAILY PRACTICE PROBLEMS

PHYSICS SOLUTIONS

02

1. (d) Density $\rho = \frac{M}{V} = \frac{M}{\pi r^2 L}$

$$\Rightarrow \frac{\Delta\rho}{\rho} = \frac{\Delta M}{M} + 2\frac{\Delta r}{r} + \frac{\Delta L}{L}$$

$$= \frac{0.003}{0.3} + 2\times\frac{0.005}{0.5} + \frac{0.06}{6}$$

$$= 0.01 + 0.02 + 0.01 = 0.04$$

$\therefore$ Percentage error $= \frac{\Delta\rho}{\rho}\times 100 = 0.04\times 100 = 4\%$

2. (a) In division (or multiplication), the number of significant digits in the answer is equal to the number of significant digits which is the minimum in the given numbers.

3. (d) Percentage error in A

$$= \left(2\times 1 + 3\times 3 + 1\times 2 + \frac{1}{2}\times 2\right)\% = 14\%$$

4. (a) Percentage error in $X = a\alpha + b\beta + c\gamma$

5. (c) Errors in A and B will be added.

6. (c) Given, L = 2.331 cm
= 2.33 (correct upto two decimal places)
and B = 2.1 cm = 2.10 cm
$\therefore$ L + B = 2.33 + 2.10 = 4.43 cm. = 4.4 cm
Since minimum significant figure is 2.

7. (d) The number of significant figures in all of the given number is 4.

8. (c) $Y = \frac{4MgL}{\pi D^2 l}$ so maximum permissible error in Y

$$= \frac{\Delta Y}{Y}\times 100 = \left(\frac{\Delta M}{M} + \frac{\Delta g}{g} + \frac{\Delta L}{L} + \frac{2\Delta D}{D} + \frac{\Delta l}{l}\right)\times 100$$

$$= \left(\frac{1}{300} + \frac{1}{981} + \frac{1}{2820} + 2\times\frac{1}{41} + \frac{1}{87}\right)\times 100$$

$$= 0.065\times 100 = 6.5\%$$

9. (d) $a = \frac{b^\alpha c^\beta}{d^\gamma e^\delta}$

So, maximum error in a is given by

$$\left(\frac{\Delta a}{a}\times 100\right)_{max} = \alpha.\frac{\Delta b}{b}\times 100 + \beta.\frac{\Delta c}{c}\times 100$$

$$+\gamma.\frac{\Delta d}{d}\times 100 + \delta.\frac{\Delta e}{e}\times 100$$

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

10. (c) $T = 2\pi\sqrt{\frac{l}{g}}$

$$\Rightarrow T^2 = 4\pi^2\frac{l}{g} \Rightarrow g = \frac{4\pi^2 l}{T^2}$$

Here % error in $l = \frac{1mm}{100cm}\times 100 = \frac{0.1}{100}\times 100 = 0.1\%$

and % error in $T = \frac{0.1}{2\times 100}\times 100 = 0.05\%$

$\therefore$ % error in g
= % error in l + 2(% error in T)
$= 0.1 + 2\times 0.05 = 0.2\%$

11. (c) Mean time period T = 2.00 sec
& Mean absolute error $\Delta T = 0.05$ sec.
To express maximum estimate of error, the time period should be written as (2.00 ± 0.05) sec

12. (b) $V = \frac{4}{3}\pi r^3$

$\therefore$ % error in volume = 3 × % error in radius
$= 3\times 1 = 3\%$

13. (a) Weight in air $= (5.00 \pm 0.05)$N
Weight in water $= (4.00 \pm 0.05)N$
Loss of weight in water $= (1.00 \pm 0.1)N$

Now relative density $= \frac{\text{weight in air}}{\text{weight loss in water}}$

i.e. R.D $= \frac{5.00 \pm 0.05}{1.00 \pm 0.1}$

Now relative density with max permissible error

$$= \frac{5.00}{1.00} \pm \left(\frac{0.05}{5.00} \pm \frac{0.1}{1.00}\right)\times 100 = 5.0 \pm (1+10)\%$$

$$= 5.0 \pm 11\%$$

14. (b) $\therefore \left(\frac{\Delta R}{R}\times 100\right)_{max} = \frac{\Delta V}{V}\times 100 + \frac{\Delta l}{l}\times 100$

$$= \frac{5}{100}\times 100 + \frac{0.2}{10}\times 100 = (5+2)\% = 7\%$$

15. (c) Volume of cylinder $V = \pi r^2\ell$
Percentage error in volume =

$$\frac{\Delta V}{V}\times 100 = \frac{2\Delta r}{r}\times 100 + \frac{\Delta l}{l}\times 100$$

$$= \left(2\times\frac{0.01}{2.0}\times 100 + \frac{0.1}{5.0}\times 100\right) = (1+2)\% = 3\%$$

$$\frac{\Delta V}{V}\times 100 = \frac{2\Delta r}{r}\times 100 + \frac{\Delta l}{l}\times 100$$

$$= \left(2\times\frac{0.01}{2.0}\times 100 + \frac{0.1}{5.0}\times 100\right) = (1+2)\% = 3\%$$

16. (b) $H = I^2Rt$

$$\frac{\Delta H}{H}\times 100 = \left(\frac{2\Delta I}{I} + \frac{\Delta R}{R} + \frac{\Delta t}{t}\right)\times 100$$

$= (2\times 3 + 4 + 6)\% = 16\%$

17. (c) Quantity C has maximum power. So it brings maximum error in *P*.

18. (d) Kinetic energy $E = \frac{1}{2}mv^2$

$$\therefore \frac{\Delta E}{E}\times 100 = \frac{v'^2 - v^2}{v^2}\times 100 = [(1.5)^2 - 1]\times 100$$

$$\therefore \frac{\Delta E}{E}\times 100 = 125\%$$

19. (b) Required random error $= \frac{x}{4}$

20. (b) $\therefore E = \frac{1}{2}mv^2$

$\therefore$ % Error in K.E.
= % error in mass + 2 × % error in velocity
$= 2 + 2\times 3 = 8\%$

21. (c)

22. (d) Since for 50.14 cm, significant number = 4 and for 0.00025, significant numbers = 2

23. (a) Since percentage increase in length = 2%
Hence, percentage increase in area of square sheet
$= 2\times 2\% = 4\%$

24. (d) Here, $s = (13.8 \pm 0.2)$ m
$t = (4.0 \pm 0.3)$ s

velocity, $v = \frac{s}{t} = \frac{13.8}{4.0} = 3.45\ ms^{-1} = 3.5\ ms^{-1}$
(rounding off to two significant figures)

$$\frac{\Delta v}{v} = \pm\left(\frac{\Delta s}{s} + \frac{\Delta t}{t}\right) = \pm\left(\frac{0.2}{13.8} + \frac{0.3}{4.0}\right) = \pm\frac{(0.8 + 4.14)}{13.8\times 4.0}$$

$$\Rightarrow \frac{\Delta v}{v} = \pm\frac{4.94}{13.8\times 4.0} = \pm 0.0895$$

$\Delta v = \pm 0.0895 \times v = \pm 0.0895 \times 3.45 = \pm 0.3087 = \pm 0.31$
(rounding off to two significant fig.)
Hence, $v = (3.5 \pm 0.31)\ ms^{-1}$

% age error in velocity $= \frac{\Delta v}{v}\times 100 = \pm 0.0895\times 100 = \pm 8.95$

$\% = \pm 9\%$

25. (a) Maximum percentage error in measurement of e, as given by Reyleigh's formula.
(Given error is measurement of radius is 0.1 cm)
$\Delta e = 0.6\,\Delta R = 0.6\times 0.1 = 0.06$ cm.

Percentage error is $\frac{\Delta e}{e}\times 100 = \frac{0.06}{0.6\times 3}\times 100 = 3.33\%$

26. (b) Speed of sound at the room temperature.
$\ell_1 = 4.6$ cm, $\ell_2 = 14.0$ cm.,
$\lambda = 2(\ell_2 - \ell_1) = 2(14.0 - 4.6) = 18.8$ cm.

$$v = f\lambda = 2000\times\frac{18.8}{100} = 376\ m/s$$

27. (c) End correction obtained in the experiment.

$$e = \frac{\ell_2 - 3\ell_1}{2} = \frac{14.0 - 3\times 4.6}{2} = 0.1\ cm.$$

28. (d) Since zeros placed to the left of the number are never significant, but zeros placed to right of the number are significant.

29. (b) The last number is most accurate because it has greatest significant figure (3).

30. (a) As the distance of star increases, the parallex angle decreases, and great degree of accuracy is required for its measurement. Keeping in view the practical limitation in measuring the parallex angle, the maximum distance of a star we can measure is limited to 100 light year.