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Solved Exercise First year physics Chapter #01:-

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MCQS:-

1-1) The betterment of mankind.

1-2) Meter Rule Reason:- $1mm = 0.1cm = \frac{0.1}{100} m = (0.001m)$ → L.C of meter rule.

1-3) 1.39 cm solution:- M.S = 1.3cm, V.S = 9 x 0.01cm = 0.09cm

M.S + V.S = 1.3cm + 0.09cm = 1.39cm

1-4) 3.17 mm solution:- M.S = 3mm, C.S = 17 x 0.01mm = 0.17mm

M.S + C.S = 3 + 0.17 = 3.17mm.

1-5) All of the above

1-6) four Reason:- 2500.0 kg (significant: 2500 and 0; 0 is significant)

1-7) 19 kg Reason:- addition → Answer → same as least no. of decimal places

12 + 2.02 + 5.1

no decimal place

1-8) 0.153 Reason:- Subtraction → Answer → minimum no. of decimal places

1.126 - 0.97268

3 decimal places

1-9) 4.6 Reason:- multiplication → Answer → minimum No. of significant figures

1-10) 7.5 Reason:- Division → Answer → significant figures

1-11) 4.9×10^2 m Reason:- 488 m ⇒ 4.88×10^2 m ⇨ 4.9×10^2 m

1-12) $[L]^{-1}$ Reason:- $\frac{\text{Force}}{\text{Energy}} = \frac{[MLT^{-2}]}{[ML^2T^{-2}]} = \frac{[L]}{[L^2]} = [L^{-1}]$

1-13) Moment of inertia & Moment of force.

1-14) 3.26 cm Solution:- Zero error = Division coinciding × L.C = 4 × 0.01 cm = +0.04 cm

M.S Reading = (3.30 cm)* 3.30 cm
V.S Reading = 0 × 0.01 cm = 0 cm
Total = 3.30 cm = 3.26 cm
Zero Correction = 3.30 − 0.04 cm

1-15) precision of a measurement.

1-16) 80.6 cm Reason:- 0.2 cm → even Reading.

Short Questions:-

1-1) Base units	Derived units
The units used to express base quantities are called base units.	The units used to express derived quantities are called derived units.
Example:-	Example:-
Length → meter	Area → (meter)^2 → m^2
Mass → Kilogram	Volume → cubic meter (cm^3)
Time → second	Speed → meter per second (ms^{-1})

1-2) (i) Multiplying or dividing:-

Keep a number of significant figures NOT more than the factor containing least number of significant

figures.

For Example:-

$$\frac{(5.348 \times 10^{-2}) \times (3.64 \times 10^{4})}{1.336} = 1.457689882 \times 10^{3}$$

As, the factor 3.64×10^{4} has least number of significant figures i.e. 3, the answer should also be written with three significant figures. The answer then will be 1.46×10^{3}.

(ii) Adding or subtracting :-

The number of decimal places retained in the answer should be equal to the smallest number of decimal places in any of the quantities being added or subtracted.

For Example:-

$$72.1 + 3.42 + 0.003 = 75.523.$$

As the number 72.1 has only one decimal place, our answer should also have one decimal place. So the answer will be 75.5.

1.3) Relation between main scale & vernier scale :-

10 divisions of vernier scale = 9 divisions of main scale

1 division on vernier scale = $\frac{9}{10}$ divisions of main scale

1 division on V.S = 0.9 division on M.S

least count of vernier callipers :-

The difference between one main scale division & one vernier scale division is 0.1mm. This is the least count.

1·4) Write in Scientific Notation :-

(a) $143·7 \rightarrow 143,7 \rightarrow 1·437 \times 10^2$

(b) $206·4 \times 10^2 \rightarrow 206,4 \times 10^2 \rightarrow 2·064 \times 10^2 \times 10^2 = 2·064 \times 10^4$

1·5) Use Correct prefixes :-

(a) 580×10^2 g

$= 580,\times 10^2$ g

$= 58·0 \times 10^1 \times 10^2$ g

$= 58·0 \times 10^3$ g

$\therefore K = 10^3$

$\boxed{= 58·0$ Kg$}$

(b) $0·45 \times 10^{-5}$ s

$= 0,45 \times 10^{-5}$ s

$= 4·5 \times 10^{-1} \times 10^{-5}$ s

$= 4·5 \times 10^{-6}$ s

$\boxed{= 4·5\ \mu s}$ $\quad \therefore 10^{-6} =$ micro (μ)

1·6) Dimensions of K·E :-

$K·E = \frac{1}{2} mv^2$

$= [M][LT^{-1}]^2$

$= [M][L^2T^{-2}]$

$= [ML^2T^{-2}]$

1·7) Find No. of significant figures :-

(i) 37 km → 2 significant figures

(ii) 0·002953 m → 4 significant fig.

(iii) 7·50034 cm → 6 significant fig.

(iv) 200·0 m → 4 significant fig.

1·8) Write dimensions of :-

(i) planck's Constant :-

$E = h\nu$ → Frequency

Energy → planck's Constant.

$h = \frac{E}{\nu} = \frac{[ML^2T^{-2}]}{[T^{-1}]}$

$= [ML^2T^{-2}][T] \rightarrow \boxed{= [ML^2T^{-1}]}$ → Same as angular momentum

(ii) Angular velocity :-

$\omega = \frac{\Delta\theta}{\Delta t} = \frac{\text{(Dimensionless)}}{[T]}$

$\omega = [T^{-1}]$ → same as frequency

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Constructed Response Questions

1·1) We use both Kilogram and mole to measure the amount of a substance because both serve different but complementary purpose and are convenient to use:-

Kilogram :- The Kilogram measures amount of matter in a body.

Mole :- Mole measures amount of atoms/molecules & particles in a body.

1·2) 0·424m is the correct answer.

Reason :-

As least count is 1mm.

$1mm = 0·1cm = \frac{0·1}{100} m = 0·001 m$

The least count in meters is 0·001 m which shows that three decimal places are allowed, so, 0·424m has three decimal places, hence it is correct.

1·3) We use kilogram as SI unit of mass, because its magnitude is more manageable & easy to write for daily life objects but gram is a smaller unit. Moreover, the metric system was defined using kilogram historically, so it has become a convention.

1·4) If $P = Q + R$ and both Q & R have same dimensions $[MLT]$ then P will also have dimensions $[MLT]$.

$P = Q + R$	Units of P :-
$P = [MLT] + [MLT]$	If dimensions of P are $[MLT]$ then
$P = 2[MLT]$	unit of P will be kgms.
$P = [MLT]$	

If Q & R have different dimensions :-

Only quantities with similar dimensions can be added or subtracted. So, if Q & R had different dimensions, we could not find dimensions of P.

1·5) :- (a) Clock with hour, minute and second hand :-

The least count will be 1 second, since the second hand can measure one second.

(b) Clock with only minute & hour hand :-

The least count will be 1 minute, because minute hand can measure minutes only.

1·6) Place the pencil flat against the meter rule & measure its diameter. Take multiple readings and average them to reduce error. For more accuracy, place several identical pencils side by side, measure the total width, and divide by number of pencils. This improves precision and gives results close to vernier callipers.

1·7) If we use screw gauge, the reading will be more accurate as compared to vernier callipers because, screw gauge is more precise than a vernier callipers.

1·8) Zero error = +0·02cm

Main scale reading = 2·6cm

Vernier scale reading = 8 x 0·01cm = 0·08cm

Reading = M·S + V·S = 2·6cm + 0·08cm → = (2·68cm)

Zero Correction = 2·68cm − 0·02cm = [2·66cm] → Final Reading.

1·9) Zero error = 2 x 0·01mm = [+0·02mm]

→ positive zero error because zero of C·S is below datum line.

Main scale reading = 6·5mm

C·S reading = 27 x 0·01mm

= 0·27mm

Reading = M·S + C·S = 6·5mm + 0·27mm = 6·77m

Zero Correction = 6·77mm − 0·02mm = [6·75mm] → Final reading

1·10) A dimensionless quantity is a quantity which has no dimensions.

For Example :-

$$\text{Refractive Index} = \frac{\text{Speed of light in vacuum}}{\text{Speed of light in a medium}} = \frac{[LT^{-1}]}{[LT^{-1}]} = [M^0L^0T^0]$$

$$\text{plane Angle} = \frac{\text{Arc length}}{\text{Radius}} = \frac{[L]}{[L]} = [M^0L^0T^0]$$

Common Misconception :-

Every dimensionless quantity is also unitless ✗

Some dimensionless quantities have units. ✓

plane Angle → Dimensionless → But has a unit Radian.

1·11) M.S Reading = 1·5mm

C.S reading = 26 × 0·01 mm = 0·26mm

Total thickness = 1·5mm + 0·26 mm → = 1·76mm

⇒ As the sheet was folded three times, total layers of sheet become $2^3 = 8$ sheets.

Thickness of one sheet = $\frac{1·76}{8}$ = **0·22mm** → Final Reading.

1·12) (a) 0·020555 → 0·0206 → $2·06 \times 10^{-2}$

(b) 4656·5 → 4656 → 4660 → $4·66 \times 10^{3}$

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