UNIT 1

PHYSICAL QUANTITIES AND MEASUREMENT

PROBLEMS

1.1: Express the following quantities using prefixes.

(a) 5000 g
(b) 2000 000 W
(c) 52×10^{-10} kg
(d) 225×10^{-8} s

Ans:

(a) 5000 g = 5×10^{3} g = 5kg
(b) 2000 000 W = 2×10^{6} W = 2 MW
(c) 52×10^{-10} kg = $5.2 \times 10^{1} \times 10^{-10} \times 10^{3}$ g = 5.2×10^{-6} g = 5.2 μ g
(d) 225×10^{-8} s = $2.25 \times 10^{2} \times 10^{-8}$ s = 2.25×10^{-6} s = 2.25 μ s

1.2: How do the prefixes micro, nano and pico relate to each other?

Ans: **Relation between micro and nano:**

$$1 \text{ nano} = 10^{-9}$$
$$= 10^{-3} \times 10^{-6}$$
$$\boxed{1 \text{ nano} = 10^{-3} \text{ micro}}$$

Relation between micro and pico

$$1 \text{ pico} = 10^{-12}$$
$$= 10^{-6} \times 10^{-6}$$
$$\boxed{1 \text{ pico} = 10^{-6} \text{ micro}}$$

Relation between nano and pico

$$1 \text{ pico} = 10^{-12}$$
$$= 10^{-3} \times 10^{-9}$$
$$\boxed{1 \text{ pico} = 10^{-3} \text{ nano}}$$

1.3: Your hairs grow at the rate of 1mm per day. Find their growth rate in mms^{-1}.
(LHR 2013, GUJ 2015)

Ans: Growth rate = 1 mm per day

$$= \frac{1 \text{ mm}}{1 \text{ day}}$$
$$= \frac{1 \times 10^{-3} \text{ m}}{8.64 \times 10^{4} \text{ s}}$$
$$= \frac{1}{8.64} \times 10^{-3} \times 10^{-4} \text{ ms}^{-1}$$
$$= 0.1157 \times 10^{-7} \text{ ms}^{-1}$$

$= 11.57 \times 10^{-2} \times 10^{-7}\ ms^{-1}$

$= 11.57 \times 10^{-9}\ ms^{-1} = 11.57\ nms^{-1}$

1.4: Rewrite the following in standard form.

(a) 1168 x 10^{-27}

(b) 32 x 10^{5}

(c) 725 x 10^{-5} kg

(d) 0.02 x 10^{-8}

Ans:

(a) $1168 \times 10^{-27} = 1.168 \text{ x } 10^{3} \text{ x } 10^{-27} = 1.168 \text{ x } 10^{-24}$

(b) $32 \times 10^{5} = 3.2 \text{ x } 10^{1} \text{ x } 10^{5} = 3.2 \text{ x } 10^{6}$

(c) $725 \times 10^{-5}\ kg = 7.25 \text{ x } 10^{2} \text{ x } 10^{-5} \text{ x } 10^{3}\ g = 7.25\ g$

(d) $0.02 \times 10^{-8} = 2.0 \text{ x } 10^{-2} \text{ x } 10^{-8} = 2.0 \text{ x } 10^{-10}$

1.5: Write the following quantities in standard form.

(a) 6400 km

(b) 380 000 km

(c) 300 000 000 ms^{-1}

(d) seconds in a day

Ans:

(a) $6400\ km = 6.4 \times 10^{3}\ km$

(b) $38000\ km = 3.8 \times 10^{5}\ km$

(c) $300\ 000\ 000\ ms^{-1} = 3.0 \text{ x } 10^{8}\ ms^{-1}$

(d) $1\ day = 24\ hours = 24 \text{ x } 3600\ s = 86400\ s = 8.64 \text{ x } 10^{4}\ s$

1.6: On closing the jaws of a vernier callipers, zero of the Vernier scale is on the right of it main scale such that 4^{th} division of its vernier scale coincides with one of the main scale division. Find its zero error and zero correction.

Ans: Number of division of Vernier scale = 4

Least count of Vernier calipers = 0.01 cm

Zero error = 4 x 0.01 cm = 0.04 cm

As zero of the Vernier scale is at the right side of the zero of the main scale so zero error will be positive.

So Zero correction = - 0.04 cm

1.7: A screw gauge has 50 divisions on its circular scale. The pitch of the screw gauge is 0.5 mm. What is its least count? (LHR 2013)

Ans: No. of divisions on circular scale = 50

Pitch = 0.5 mm

$$\text{As least count} = \frac{\text{pitch of screwguage}}{\text{Number of circular scale divisions}}$$

$$\text{Least Count} = \frac{0.5mm}{50} = 0.01\ mm = 0.001\ cm$$

1.8: Which of the following quantities have three significant figures? (LHR 2015, GRW 2015)

(a) 3.0066 m

(b) 0.00309 kg

(c) 5.05 x 10^{-27} kg

(d) 2001 s

Ans: b and c

1.9: What are the significant figures in the following measurements? (LHR 2015, GRW 2015)

(a) 1.009 m **(b) 0.00450 kg** **(c) 1.66 x 10^{-27} kg** **(d) 2001 s**

Ans:

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

1.10: A chocolate wrapper is 6.7 cm long and 5.4 cm wide. Calculate its area up to reasonable number of significant figures. (GRW 2013, LHR 2014)

Ans: Given data:

Length of chocolate wrapper = l = 6.7 cm
Width of chocolate wrapper = w = 5.4 cm

Required:

Area of chocolate wrapper = A =?

Solution:

As we know that

Area =length x width

By putting the values we have

Area = 6.7 cm x 5.4 cm
= 36.18 cm^2

Result:

As the least number of significant figures in observed measurements are 2

So Area = 36 cm^2