PROBLEMS

1.1 Express the following quantities using prefixes.

(a) 5000 g **(b) 2000000 W**

(c) 52x1Tt0kg **(d) 225x10^{-8s}**

{(a)5kg (b) 2 MW (c) 5.2 µg (d) 2.25µs }

Solution:

(a) 5000 g

= 5 x 1000g

= 5 x 1kg (Since 1000g = 1kg)

= 5kg

(b) 2000,000 w

=2 x 1000000

= 2 x 10^6W (10^6 = 1 Mega)

= 2 MW

(c) 52 x 10^{-10} kg

= 5.2 x l0 x 10^{-10} kg

= 5.2 x 10^{-9} kg

= 5.2 x 10^{-9} x 1000g (Since 1 kg = 1000 g)

= 5.2 x 10^{-9} x 10^3 g

= 5.2 x 10^{-9} x 10^{-6} g

= 5.2 µg (10^{-6} = 1micro(µ))

(d) 225 x 10^{-8} s

= 225 x 10^{2} x 10^{-8} s

= 2.25 x 10^{-6} s

= 2.25 µs (10^{-6} = 1micro(µ))

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

Solution:

As we know

micro = µ = 10^{-6}

nano = n = 10^{-9}

pico = p = 10^{-12}

The relation between micro, nano and pico can be written as.

micro = 10^{-6}

nano = 10^{-6} x 10^{-3} = 10^{-6} micro

pico = 10^{-6} x 10^{-6} = 10^{-6} micro

1.3 Your hair grows at the rate of 1 mm per day. Find their growth rate in nm s^{-1}. (11.57 nm s^{-1})

Solution:

Growth rate Of hair in nm s^{-1} = lmm per day

Growth rate of hair in one day = 24 x 60 x 60 s

(Since 1 mm 10^{-3} m and one day = 24 x 60 x 60 s), hence

1 mm per day = l x 10^{-3} m x 1/24 x 60 x 60 s

$= 1 \times 10^{-3}$ m x 1/8400 m s^{-1}

$= 1 \times 10^{-3}$ m x 0.00001157

$= 1 \times 10^{-3}$ m x 1157 x 10^{-8} ms^{-1}

$= 1157 \times 10^{-2}$m x $10^{-9}ms^{-1}$

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

1 mm per day =11.57 nms^{-1}

(because 10^{-9} ms^{-1} = 1n ms^{-1}).

1.4 Rewrite the following In Standard form. (Scientific notation)

(a) 1168 x 10^{-27} **(b) 32 x 10^{5}**

(C) 725 x 10 kg^{-5} **(d) 0.02 x 10^{-8}**

{(a) 1.168x10^{-24} (b) 3.2x10^{6} (c) 7.25g (d) 2 x10^{-10} }

Solution: (a) 1168 x 10^{-27} = 1.168 x 10^{3} x 10^{-27} = 1.168 x 10^{-24}

(b) 32 x 10^{5} = 3.2 x 10^{1} x 10^{5} = 3.2 x 10^{6}

(C) 725 x 10^{-5} kg=7.25X 10^{2} x 10^{-5} kg = 7.25 x 10^{-3} kg

As (10^{-3} kg = 1g), therefore

7.25 x 10^{-3} kg = 7.25g

(d) 0.02 x 10^{-8} = 2 x 10^{-2} x 10^{-8} = 2 x 10^{-10}

1.5 Write the following quantities in standard form.

(a) 6400 km **(b) 38000 km**

(c) 300000000 ms^{-1} **(d) seconds in a day**

{(a) 6.4x10^{3} km (b) 3.8 x 10^{5} km (c) 3 x 10^{8} ms^{-1} (d) 0.64x10^{4}s)

Solution:

(a) 64000 km

Multiplying and dividing by "10^3"

$=6400\ m/1000 \times 10^3 km$

$=64\ m/\ 10 \times 10^3 km$

$=6.4x10^3\ km$

(b) 38000 km

Multiplying and dividing by "10^5"

$=38000\ /\ 10^5 \times 10^5 km$

$=380000\ /\ 10^50000 \times 10^5 km$

$= 3.8 \times 10^5\ km$

(c) 300000000 ms^{-1}

Multiplying and dividing by "10^8"

$300000000\ ms^{-1}\ /\ 100000000 \times 10^8 km$

$= 3 \times 10^8\ km$

(d) seconds in a day

As we know

1 day =24 hours

1 hour= 60 minutes

1 minute = 60 seconds so

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1 day = 24 x 60 x 60 seconds

1 day = 86400 s

Multiplying and dividing by 10^4

$=86400 / 10000 \times 10^4$ s

$=8.4 \times 10^4$ s

1.6 On closing the jaws Of a Vernier Calipers, zero of the Vernier sale is on the right to its main scale such that 4th division of its Vernier scale coincides with one of the main scale division. Find its zero error and zero correction. (+0.04cm, -0.04 cm)

Solution:

Main scale reading = 0.0 cm.

Vernier division coinciding with main scale = 4th division

Vernier scale reading = 4 x 0.01 cm = 0.04 cm

Zero error = 0.0 cm + 0.04 cm = 0.04 cm

Zero correction (Z.C) = -0.04 cm

The zero error of the Vernier scale is 0.04cm and its zero correction is -0.04cm

(Vernier division coinciding with main scale) = 4 div

Vernier scale reading = 4 x 0.01 cm

= 0.04 cm

Since zero of the Vernier scale is on the right side of the zero of the main scale, thus the instrument has measured more than the actual reading. It IS said to be positive zero error.

Zero correction is the negative of zero error. Thus

Zero error = +0.04 cm

and Zero correction = - 0.04 cm

1.7 A screw gauge has 50 divisions on its circular sale. The pitch of the screw gauge is 0.5 mm. What is its least count?
(0.001 cm)

Solution:

Number Of division on the circular scale = 50

Pitch of screw gauge = 0.5 mm

Least count Of screw gauge L.C. = ?

Least count = Pitch / Number Of division on the circular scale

Least count = 0.5mm / 50

= 0.01 mm = 0.01 x 1/10 cm

Least count = 0.001 cm

1.8 Which of the following quantities have three figures?

(a) 3.0066 m **(b) 0.00309 kg**

(c) 5.05x 10^{-27}kg **(d) 301.0 s**

{(b) and (c)}

Solution:

(a) 3.0066m

Zeros between significant digits are significant. Therefore, there are 5 significant figures in 3.0066m.

(b) 0.00309kg

Zeros used for spacing the decimal point are not significant. Therefore, there are 3 significant figures in 0.00309kg.

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

Only the digits before the exponent are considered, thus there are 3 significant figures.

(d) 301.0s

Final zeros or zeros after the decimal are significant. Therefore, there are 4 significant figures.

Result:

Quantities (b) and (c) have three significant figures

1.9 What are the significant figures in the following measurements?

(a) 1.009 m **(b) 0.00450 kg**

(c) 1.66 x 10^{-27}kg **(d) 2001 s**

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

Solution:

(a) 1.009m

Since zeros between two significant figures are Significant, so there are 4 significant figures.

(b) 0.00450

Zeros used for spacing the decimal point are not significant. Hence, there are 3 significant figures.

(c) 1.66 x 10^{-27}kg

Only the digits before the exponent are considered so there are 3 significant figures.

(d) 2001s

Since zeros between two significant figures are significant so there are 3 significant figures.

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.
(36 cm^2)

Solution:

Length of chocolate wrapper l = 6.7 cm

Width of chocolate wrapper w = 5.4 cm

Area = A = ?

Area = Length x Width

A = l x w

A=6.7cm x 5.4 cm =36.18 cm^2 = 36cm^2

Note:

Answer should be in two significant figures because in data the least significant figures are two therefore answer is 36 cm^2.

ClassNotes