

1. Units

Necessity

All physical quantities are to be measured in terms of standard quantities.

Unit

A unit is defined as a standard or fixed quantity of one kind used to measure other quantities of the same kind.

Classification

Fundamental units and derived units are the two classifications.

Fundamental units

Units of basic quantities of Length, Mass and Time (L,M,T).

Derived units

Units which are derived from basic units and bear a constant relationship with the fundamental units. E.g. area, volume, pressure, force etc.

Systems of units

- F.P.S system is the British system in which the basic units of length, mass and time are foot, pound and second respectively.

- C.G.S system is the metric system in which the basic units of length, mass and time are centimeter, gram and second respectively.

- M.K.S system is another metric system in which the basic units of length, mass and time are metre, kilogram and second respectively.

- S.I. units is referred to as Systems of International units which is again of metric and the basic units, their names and symbols are as follows.

Basic quantity	Basic unit	
	Name	Symbol
length	Metre	m
mass	Kilogram	Kg
time	Second	s
current	Ampere	A
temperature	Kelvin	K
light intensity	Candela	Cd

Length, Mass and Time are the fundamental units in all the systems (i.e) F.P.S, C.G.S, M.K.S and S.I. systems.

Example (Length):

A reel of copper wire has a mass of 800 gm of which 250 gm is the mass of the empty reel. Estimate the length of wire on the reel if the diameter of the wire is 0.9 mm.

Solution:

Mass of copper on reel = $800 - 250 = 550 \text{ gm} = 0.55 \text{ kg}$.

One cubic meter of copper has a mass of $8.95 \times 1000 = 8950 \text{ kg}$.

Therefore volume of copper on reel = $0.55/8950 = 0.0000615 \text{ m}^3 = 61.5 \times 10^{-6} \text{ m}^3$

Cross section area of wire = $n/4 \times (0.9)^2/(1000)^2 = 0.635 \times 10^{-6} \text{ m}^2$

Therefore length of wire = $61.5 \times 10^{-6} \text{ m}^3 / 0.635 \times 10^{-6} \text{ m}^2 = 97 \text{ meter}$ (Approximately 96.850 m)

Time: The S.I. unit of time, the second, is another of the base units of S.I. it is defined as the time interval occupied by a number of cycles of radiation from the calcium atom. The second is the same quantity in the S.I. in the British and in the U.S. systems of units.

Derived units of S.I. system

Quantity	Unit	Symbol
Area	Square metre	m^2
Volume	Cubic metre	m^3
Density	Kilogram per cubic metre	kg/m^3
Density	Kilogram per cubic metre	kg/m^3
Velocity	Metre per second	m/s
Acceleration	Metre per second per second	m/sec^2
Force	Newton	$\text{N}(\text{kgm/sec}^2)$
Pressure, stress	Newton per square metre	N/m^2
Moment of force	Newton metre	Nm
Work, energy, heat	Joule	$\text{J}(\text{Nm})$
Power	Watt	$\text{W}(\text{J/s})$

Units and abbreviations

Quantity	Units	Abbreviation of unit
Calorific value	kilojoules per kilogram	kJ/kg
	megajoules per litre	MJ/l
Specific fuel consumption	kilograms per kilowatt hour	kg/kWh
Length	millimetres, metres, kilometres	mm, m, km
Mass	kilograms, grams	kg, g
Time	seconds, minutes, hours	s, min, h
Speed	centimetres per second, metres per second	cm/s, m/s
	kilometres per hour, miles per hour	kmph, mph
Acceleration	metres-per-second per second	m/s ²
Force	newtons, kilonewtons	N, kN
Moment	newton-metres	Nm
Work	joules	J
Power	horsepower, watts, kilowatts	Hp, W, kW
Pressure	newtons per square metre	N/m ²
	kilonewtons per square metre	kN/m ²
Angles	radians	rad
Angular speed	radians per second	rad/s
	radians-per-second per second	rad/s ²
	revolutions per minute	Rpm
	revolutions per second	rev/s

Decimal multiples and parts of unit

Decimal power		Prefixes	Symbol	Stands for
10 ¹²	↑	tera	T	billion times
10 ⁹		giga	G	thousand million times
10 ⁶		mega	M	million times
10 ³		kilo	K	thousand times
10 ²		hecto	h	hundred times
10 ¹		deca	da	ten times
10 ⁻¹	↓	deci	d	tenth
10 ⁻²		centi	c	hundreth
10 ⁻³		milli	m	thousandth
10 ⁻⁶		micro	μ	millionth
10 ⁻⁹		nano	n	thousand millionth
10 ⁻¹²		pico	p	billionth

SI units and the old British units:

Quantity	SI unit → British unit	British unit → SI unit
Length	1 m = 39.37 inches 1 m = 3.281 ft 1 km = 0.621 mile	1 inch = 0.0254 m 1 ft = 0.3048 m 1 mile = 1.609 km
Speed	1 m/s = 3.281 ft/s 1 km/h = 0.621 mph	1 ft/s = 0.305 m/s 1 mph = 1.61 km/h
Acceleration	1 m/s ² = 3.281 ft/s ²	1 ft/s ² = 0.305 m/s ²
Mass	1 kg = 2.205 lb	1 lb = 0.454 kg
Force	1 N = 0.225 lbf	1 lbf = 4.448 N
Torque	1 Nm = 0.738 ft lbf	1 ft lbf = 1.356 Nm
Pressure	1 N/m ² = 0.000145 lbf/in ² 1 Pa = 1 N/m ²	1 lbf/in ² = 6.895 kN/m ²
Energy, work	1 bar = 14.5038 lbf/in ² 1 J = 0.738 ft lbf 1 J = 0.239 calorie	1 lbf/in ² = 6.895 kN/m ² 1 ft lbf = 1.3558 J 1 calorie = 4.186 J
Power	1 kJ = 0.9478 Btu 1 kW = 1.34 HP	1 Btu = 1.05506 kJ 1 HP = 0.746 kW

Units in measuring practice with definitions

Quantity	Notation	Unit	Explanation
Force	F	Newton N	1 Newton is equal to the force which imports an acceleration of 1m/s ² to a body of mass 1 kg 1N = 1 kg m/s ²
Pressure	p	Newton per square metre N/m ² Pascal Pa	1 Newton per square metre (1 pascal) is equal to the pressure with which the force of 1 N is exercised perpendicular to the area of 1 m ² 1Pa = 1 N/m ² . (1 Bar (bar) is the special name for 100 000 Pa.)
Normal stress tensile or compressive stress Shear stress		Newton per square metre N/m ²	1 Newton per square metre (1 pascal) to the mechanical stress with which the force of 1 N is exercised on the area of 1 m ² . In many branches of engineering, the mechanical stress and strength are specified in N/m ² .
Heat Energy Quantity of heat	W	Joule J	1 Joule is equal to the work that is done when the point of application of the force of 1 N is shifted by 1 m in the direction of the force. 1 J = 1 Nm 3600,000 J = 1 kWh

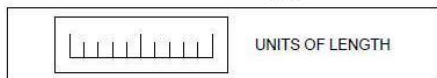
Quantity	Notation	Unit		Explanation
Moment of a force (torque)	M	Newton-meter Joule	Nm J	1 Newton is equal to the moment of a force which results from the product of the force of 1 N and the lever arm of 1 m. 1 Nm = 1 J
Power Energy flow	P	Watt	W	1 Watt is equal to the power with which the energy of 1 J is converted during the time of 1s. The unit watt is also called volt ampere in the specification of apparent electric power 1 W = 1 J/s = 1 Nm/s = 1 VA
	P	gram per kilowatt-hour	$\frac{g}{kWh}$	1 gram per kilowatt-hour is equal to the fuel consumption of the mass of 1 g for the work of 1 kWh.
Temperature	T	Kelvin	K	1 Kelvin is 273 degree
Electric current	I	Ampere	A	In a closed circuit, the current produced by voltage of 1 Volt against 1 Ohm resistance is called an ampere.
Electric voltage	U	Volt	V	1 Volt is equal to the electric voltage between two points of a metallic conductor in which a power of 1 W is expended for a current of 1 A strength.
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Electric resistance	R	Ohm	Ω	1 Ohm is equal to the electric resistance between two points of a metallic conductor in which an electric current of 1 A flows at a voltage of 1 V.

or decimal multiples and submultiples

Prefix	Value		Use		
Mega	M	1000 000	10^6	1 Megapascal = 1 MPa	= 1000000 Pa
Kilo	k	1000	10^3	1 Kilowatt = 1 kW	= 1000 W
Hecto	h	100	10^2	1 Hectolitre = 1 hL	= 100 L
Deca	da	$10 \cdot 10^1$	1	Decanewton = 1 daN	= 10 N
Deci	d	$0.1 \cdot 10^{-1}$	1	Decimetre = 1 dm	= 0.1 m
Centi	c	0.01	10^{-2}	1 Centimetre = 1 cm	= 0.01 m
Milli	m	0.001	10^{-3}	1 Millimetre = 1 mm	= 0.001 m
Micro	μ	0.000001	10^{-6}	1 Micrometre = 1 μ m	= 0.000001 m

Units of physical quantities

Units of length



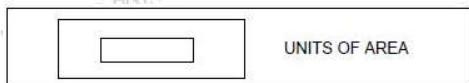
Conversion factors

1 inch	=	25.4 mm
1 mm	=	0.03937 inch
1 metre	=	39.37 inch
1 micron	=	0.00003937"
1 kilometre	=	0.621 miles
1 pound	=	453.6 gr
1 kg	=	2.205 lbs
1 metric ton	=	0.98 ton

Micron	1 μ	=	0.001 mm
Millimetre	1 mm	=	1000 μ
Centimetre	1 cm	=	10 mm
Decimetre	1 dm	=	10 cm
Metre	1 m	=	10 dm
Kilometre	1 km	=	1000 m

Kilometre	1 km	=	1000 m
Inch	1"	=	25.4 mm
Foot	1'	=	0.305 m
Yard	1 Yd	=	0.914 m
Nautical mile	1	=	1852 m
Geographical mile	1	=	7420 m

Area



Square millimetre	1 mm ²	
Square centimetre	1 cm ²	= 100 mm ²
Square inch	1 sq.in	= 6.45 cm ²
Square foot	1 sq.ft	= 0.093 m ²
Square metre	1 m ²	= 10.76 ft ²
1 Acre	=	100 cent
1 Hectare	=	2.47 acres
1 acre	=	0.4047 Hectare
1 Cent	=	436 Sq. ft.
1 Ground	=	2400 Sq.ft.
1 Hectare	=	10000 sq. metre

Units of volume and capacity



Cubic millimetre	mm ³	
Cubic centimetre	1 cm ³	= 1000 mm ³
Litre	1 l	= 1000 cm ³
Cubic inch	1 cu. in	= 16.387 cm ³
Cubic foot	1 cu. ft	= 28317 cm ³
Gallon (British)	1 gal	= 4.54 l
1 cubic metre	1 m ³	= 1000 litres
1000 Cu.cm	1000 cm ³	= 1 litre
1 cubic foot	1 ft ³	= 6.25 Gallon
1 litre	1lt	= 0.22 Gallon

Units of weight



Milligram-force	1 mgf	
Gram-force	1 gf	1000 mgf
Kilogram-force	1 kgf	= 1000 gf
Ton	1 ton	= 1000 kgf
Ounce	1 Oz	= 28.35 gf
Pound	1 lb	= 0.454 kgf
Pound	1 lb	= 0.454 kgf

Time



Second	1 S	
Minute	1 min	= 60 s
Hour	1 hr	= 60 min = 3600 sec

TEMPERATURE

Scale	Freezing point	Boiling point
Centigrade (°C)	0°C	100°C
Fahrenheit (°F)	32°F	212°F
Kelvin (K)	273K	373K
Reaumur (°R)	0°R	80°R

$$\frac{^{\circ}\text{R}}{80} = \frac{^{\circ}\text{C}}{100} = \frac{\text{K}-273}{100} = \frac{^{\circ}\text{F}-32}{180}$$



HEAT, WORK, POWER, ENERGY & FORCE

A, W	Work	kgfm	Joule (1 Joule = 1 N.m)	J (Nm)
P	Power	kgfm/s	Watt	W (J/s)
E, W	Energy	kgfm	Joule	J (Nm)
η	Efficiency	-	-	-
W, A, E, Q	Quantity of heat	kcal	Joule	J
	Specific heat	kcal/	Joule per newton per	J/N.°K
		kg°C	degree Kelvin	
F	Force	N	Newton	
In F.P.S. System : Force (Poundal) = Mass (lb) X Acceleration (ft./sec ²)				
In C.G.S. System : Force (Dyne) = Mass (gm) X Acceleration (Cm/sec ²)				
In M.K.S System : Force (Newton) = Mass (Kg) x Acceleration (m/sec ²)				
It means		= 1 Dyne = 1 gm x 1 cm/sec ²		
1 Poundal		= 1 lb x 1 ft/sec ²		
1 Newton		= 1 kg x 1 m/sec ² = 10 ⁵ dynes		
1gm weight		= Dyne = 980 Dynes		
1 lb weight		= poundal = 32 poundals		
1 kg weight		= Newton = 9.80 Newtons		

HEAT, WORK,
ENERGY



ELECTRICAL QUANTITIES

E	Electric potential	V	Volt	V (W/A)
E	Electromotive force	V	Volt	V (W/A)
I	Electric current	A	Ampere	A (W V)
R	Electric resistance	Ω	Ohm	Ω (V/A)
e	Specific resistance	Ω m	Ohm metre	Vm/A

ELECTRICAL
QUANTITIES



Worked out Examples

1. Convert 30 inches into cm

$$1 \text{ inch} = 2.54 \text{ cm}$$

$$\therefore 30'' = 2.54 \times 30$$

$$= 76.20 \text{ cm}$$

2. 6' 10'' = _____ cm

$$1' = 12''$$

$$6' = 6 \times 12 = 72''$$

$$\therefore 6' 10'' = 72'' + 10'' = 82''$$

$$1 \text{ inch} = 2.54 \text{ cm}$$

$$6' 10'' \text{ (or) } 82'' = 2.54 \times 82$$

$$= 208.28 \text{ cm}$$

3. 90 mm = _____ inches

$$1 \text{ cm} = 0.3937 \text{ inch}$$

$$90 \text{ mm (or) } 9 \text{ cm} = 9 \times 0.3937$$

$$= 3.5433''$$

4. Convert 25 miles into kilometer

$$\begin{aligned}
 1 \text{ mile} &= 1.609 \text{ km} \\
 \therefore 25 \text{ miles} &= 25 \times 1.609 \\
 &= 40.225 \text{ kilometer}
 \end{aligned}$$

5. 26 km = _____ miles

$$\begin{aligned}
 1 \text{ km} &= 0.6214 \text{ mile} \\
 \therefore 26 \text{ km} &= 26 \times 0.6214 \\
 &= 16.1564 \text{ miles}
 \end{aligned}$$

6. Convert 30 pounds into kg

$$\begin{aligned}
 1 \text{ pound} &= 0.4536 \text{ kg} \\
 \therefore 30 \text{ pounds} &= 30 \times 0.4536 \\
 &= 13.608 \text{ kg}
 \end{aligned}$$

7. 20 kg = _____ Pounds

$$\begin{aligned}
 1 \text{ kg} &= 2.205 \text{ pounds} \\
 \therefore 20 \text{ kg} &= 20 \times 2.205 \\
 &= 44.1 \text{ pound}
 \end{aligned}$$

8. Convert 3 hours 45 minutes into seconds

$$\begin{aligned}
 1 \text{ hour} &= 60 \text{ minutes} \\
 3 \text{ hours} &= 3 \times 60 \text{ minutes} \\
 &= 180 \text{ minutes} \\
 3 \text{ hr } 45 \text{ min} &= 180 + 45 \\
 &= 225 \text{ minutes} \\
 1 \text{ minute} &= 60 \text{ seconds} \\
 \therefore 225 \text{ mins} &= 225 \times 60 \\
 &= 13500 \text{ seconds}
 \end{aligned}$$

9. 21 Feet² = _____ meter²

$$\begin{aligned}
 1 \text{ Foot} &= 0.3048 \text{ m} \\
 1 \text{ Feet}^2 &= 0.3048 \times 0.3048 \\
 &= 0.0929 \text{ m}^2 \\
 \therefore 21 \text{ feet}^2 &= 21 \times 0.0929 \\
 &= 1.9509 \text{ m}^2
 \end{aligned}$$

10. 9.3 m² = _____ Feet²

$$\begin{aligned}
 1 \text{ m} &= 3.281 \text{ Feet} \\
 1 \text{ m}^2 &= 3.281^2 \\
 &= 3.281 \times 3.281 \\
 &= 10.76 \text{ Feet}^2 \\
 \therefore 9.3 \text{ m}^2 &= 9.3 \times 10.76 \\
 &= 100.068 \text{ Feet}^2
 \end{aligned}$$

11. 15 cm³ = _____ m³

$$\begin{aligned}
 1 \text{ cm} &= 1/100 \text{ m} \\
 &= 0.01 \text{ m} \\
 1 \text{ cm}^3 &= 0.000001 \text{ m}^3 \\
 \therefore 15 \text{ cm}^3 &= 15 \times 0.000001 \\
 &= 0.000015 \text{ m}^3
 \end{aligned}$$

12. 108.97 ft³ = _____ m³

$$\begin{aligned}
 1 \text{ ft} &= 0.3048 \text{ m} \\
 1 \text{ ft}^3 &= 0.3048^3 \\
 &= 0.3048 \times 0.3048 \times 0.3048 \\
 &= 0.0283168 \text{ m}^3
 \end{aligned}$$

13. 75m³ = _____ ft³

$$\begin{aligned}
 1 \text{ m} &= 3.281 \text{ ft} \\
 1 \text{ m}^3 &= 3.281^3 \\
 &= 3.281 \times 3.281 \times 3.281 \\
 &= 35.31 \text{ ft}^3 \\
 \therefore 75 \text{ m}^3 &= 75 \times 35.31 \\
 &= 2648.25 \text{ ft}^3
 \end{aligned}$$

14. 4 Gallons = _____ litre

$$\begin{aligned}
 1 \text{ Gallon} &= 4.546 \text{ litre} \\
 \therefore 4 \text{ Gallons} &= 4 \times 4.546 \\
 &= 18.184 \text{ litre}
 \end{aligned}$$

15. 9 litre = _____ Gallons

$$\begin{aligned}
 1 \text{ litre} &= 0.22 \text{ Gallon} \\
 \therefore 9 \text{ litre} &= 9 \times 0.22 \\
 &= 1.98 \text{ Gallons}
 \end{aligned}$$

16. 7 metre length of steel pipe costs Rs. 2000/-. What is the cost of 4 feet pipe?

$$\begin{aligned}
 1 \text{ metre} &= 3.281 \text{ ft} \\
 \therefore 7 \text{ metre} &= 22.967 \text{ ft} \\
 \therefore 23 \text{ ft pipe costs Rs. 2000/- (From Given statement) then one foot pipe costs} \\
 &= 2000/23 \\
 &= 86.96 \\
 &= 87/- (Rounded) \\
 \therefore 4 \text{ ft pipe costs} &= 87 \times 4 \\
 &= \text{Rs. } 348/-
 \end{aligned}$$

17. The weight of a plate is 12 pounds. What will be the weight in kilograms

$$\begin{aligned}
 1 \text{ Pound} &= 0.4536 \text{ kg} \\
 12 \text{ Pounds} &= 0.4536 \times 12 \\
 &= 5.4432 \text{ kg}
 \end{aligned}$$

18. Find the weight of 15,000 bolts and nuts in kilogram, if each bolt & nut together weighs 80 grams

1 bolt and nut weighs 80 gms, then the weight of 15,000 bolts & nuts
 $= 15,000 \times 80$
 $= 12,00,000 \text{ gm}$
 $1000 \text{ gm} = 1 \text{ kg}$
 $\therefore 12,00,000 \text{ gm} = 1200 \text{ kg}$

19. An oil tank has a capacity of 5646 litre. Find the capacity in cubic ft.

$1 \text{ m}^3 = 1000 \text{ litre}$
 $\therefore 5646 \text{ litre} = 5646/1000$
 $= 5.646 \text{ m}^3$
 $1 \text{ m}^3 = 35.31 \text{ ft}^3$
 $5.646 \text{ m}^3 = 35.31 \times 5.646$
 $= 199.36026 \text{ ft}^3$

20. Calculate the cost of 50 litre petrol at the rate of Rs. 61.50/-

One litre petrol = 61.50
 $\therefore 50 \text{ litre petrol} = 50 \times 61.50$
 $= 3075.00$
 The cost of 50 litre petrol is Rs. 3075/- Workshop Calculation

ASSIGNMENT

UNITS AND MEASUREM

1. Convert the following as indicated

- 15 miles into kilometres _____
- 320 kilometres into miles _____
- 5 pounds into kilograms _____
- 8.5 kilograms into pounds _____
- 40 inches into centimetres _____
- 12 feet into metres _____
- 5 metres into inches _____
- 8 metres into feet _____
- 2 cubic feet into gallon _____
- 2.5 gallons into litres _____
- 5 litres into gallons _____

2. Answer the following questions

- 8 mm = _____ inches
- 12 mm = _____ inches

3. Expand the abbreviations of the following

- km/L
- N/m²
- KW
- m/S²
- RPM

- 1.2 N = _____ kg
- 2.6 N = _____ kg
- 800 N = _____ kN
- 14.5 kg = _____ N
- 25 kg = _____ N

D

- 120 kJ = _____ J
- 40 J = _____ kJ
- 140 J = _____ kJ
- 300 wh = _____ kWh
- 0.746 kWh = _____ Wh

E

- 0.2 kW = _____ W
- 300 kW = _____ W
- 2 W = _____ kW
- 350 W = _____ kW
- 0.08 W = _____ W
- $2 \times 10^{-3} \text{ kW}$ = _____ W
- 10 HP = _____ kW
- 5 HP = _____ kW
- 20 kW = _____ HP

- b. N/m^2
- c. KW
- d. m/S^2
- e. RPM

4. Convert the following S.I. units as required,

A

- i. 3.4 m = _____ mm
- ii. 1.2 m = _____ cm
- iii. 0.8 m = _____ mm
- iv. 0.02 km = _____ cm
- v. 10.2 km = _____ mile
- vi. 6 m = _____ km
- vii. 18 m = _____ mm
- viii. 450 m = _____ km
- ix. 85 cm = _____ km
- x. 0.06 km = _____ mm

B

- i. 650 gm = _____ kg
- ii. 120 kg = _____ gm
- iii. 2.5 gm = _____ kg
- iv. 350 gm = _____ gm
- v. 0.05 MT = _____ kg

- v. 0.08 W = _____ kW
- vi. 2×10^{-3} kW = _____ W
- vii. 10 HP = _____ kW
- viii. 5 HP = _____ kW
- ix. 20 kW = _____ HP
- x. 33 kW = _____ HP

f Convert as required.

- i. 3 Nm = _____ J
- ii. 12 J = _____ KJ
- iii. 3 Nm/s = _____ J/s
- iv. 8 J/s = _____ J/s
- v. 5 N = _____ KN
- vi. 5 Ws = _____ Ws
- vii. 3 KJ = _____ Nm
- viii. 18 J/s = _____ W
- ix. 12 W = _____ J/s
- x. kJ/s = _____ Nm/s

5. Solve the following

- i. Distance between Chennai to Nagercoil is 725 kilometers. Find its distance in miles
- ii. An iron bar weighs 10 pounds per foot. Find the weight of 8 m long in kg.
- iii. Find the cost of one gallon of oil, when one litre costs Rs. 5.11/-

- iv. A workman works $6\frac{1}{2}$ hours a day for 6 days to complete a job. Calculate the time taken to finish the job in minutes.
- v. Convert 16m^2 room space into feet^2 after deducting 6m^2 area for washroom

Answer keys

1. UNITS

1.

- a. 24.135
- b. 198.848
- c. 2.268
- d. 18.7425
- e. 101.6
- f. 3.6576
- g. 196.85
- h. 26.248
- i. 12.5
- j. 11.365
- k. 1.1
- k. 1.1

iii. 0.0025

iv. 350

v. 50

C

ii. 0.1224

ii. 0.04

iii. 0.14

iv. 0.3

v. 746

E

i. 200

ii. 0.3

iii. 0.002

iii. 0.002

iv. 0.35

v. 0.0008

vi. 2

vii. 7.46

viii. 373

ix. 26.8

x. 44.22

2.

- a. 0.311496
- b. 0.47244

3.

- a. kilometre per litre
- b. Newton per square metre
- c. kilowatt
- d. Metre per second square
- e. Revolution per minute

F.

i. 3

ii. 0.012

e. Revolution per minute
4.

A

- i. 3400
- ii. 120
- iii. 800
- iv. 2000
- v. 6,338
- vi. 0.006
- vii. 18000
- viii. 0.45
- ix. 0.00085
- x. 60000

B.

- i. 0.65
- ii. 120000

GOVT of INDIA, MSDE, DGT, NIMI

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GOVT of INDIA, MSDE, DGT, NIMI

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GOVT of INDIA, MSDE, DGT, NIMI

GOVT of INDIA, MSDE, DGT, NIMI

ii. 0.012

iii. 3

iv. 8

v. 0.005

vi. 5

vii. 3000

viii. 18

ix. 12

x. 1000

5.

i. 450.515 miles

ii. 119.0609 kg

iii. Rs. 23.23

iv. 2340 minutes

v. 107.6 ft²

GOVT of INDIA, MSDE, DGT, NIMI

GOVT of INDIA, MSDE, DGT, NIMI

GOVT of INDIA, MSDE, DGT, NIMI

GOVT of INDIA, MSDE, DGT, NIMI

GOVT of INDIA, MSDE, DGT, NIMI