1. Measurement and Measuring Instruments

Multiple Choice Questions

1. Question

Choose the correct one

A. mm< cm < m < km

B. mm > cm > m > km

C. km < m < cm < mm

D. mm > m> cm> km

Answer

We know that 1km = 10^3 m = 10^5 cm = 10^6 mm

So, mm < cm < m < km.

2. Question

Rulers, measuring tapes and metre scales are used to measure

A. Mass

B. Weight

C. Time

D. Length

Answer

Metre is a unit of length and rulers, metre scales and measuring tapes are used to measure length.

3. Question

1 metric ton is equal to

A. 100 quintals

B. 10 quintals

C. 1/10 quintals

D. 1/100 quintals

Answer

1 metric ton = 1000 kg and 1 quintal = 100 kg

So, 1 metric ton = 10 quintals.

4. Question

Distance between Chennai and Kanyakumari can be found in

A. Kilometres

B. Metres

C. Centimetres

D. Millimetres

Answer

Chennai and Kanyakumari are two cities and distance between them is large. So, it is measured in kilometres.

5. Question

Which among the following is not a device to measure mass?

A. Spring balance

B. Beam balance

C. Physical balance

D. Digital balance

Answer

Spring balance is used to measure weight not mass.

Fill In the Blanks

1. Question

Metre is the unit of _____

Answer

Metre is the unit of length.

Explanation: Metre is the SI unit of Length.

2. Question

1 kg of rice is weighed by _____

Answer

1 kg of rice is weighed by beam balance.

Explanation:

A beam balance compares the sample mass with a standard reference mass. Standard reference masses are 5g, 10g, 20g, 50g, 100g, 200g, 500g, 1kg, 2kg, 5kg. So it is used to measure 1 kg of rice.

3. Question

The thickness of a cricket ball is measured by _____

Answer

The thickness of a cricket ball is measured by vernier scale.

Explanation:

The diameters of spherical objects such as cricket ball and hollow objects such as a pen cap cannot be measured with a meter scale. For this purpose, we use vernier scale to measure inner and outer diameter.

4. Question

The radius of a thin wire is measured by _____

Answer

The radius of a thin wire is measured by screw gauge.

Explanation: Radius of a thin wire is very small to measure. It can't be measured by metre scale or vernier scale. But screw gauge can measure upto 0.01 mm. So, it is used for measuring radius of a thin wire.

5. Question

A physical balance measures small differences in mass up to _____

Answer

A physical balance measures small differences in mass up to milligram.

Explanation: Physical balance is very sensitive and used in labs for measuring. It is similar to beam balance. It can measure correctly up to milligram.

True or False

1. Question

The SI unit of electric current is kilogram

Answer

False

Explanation: Kilogram is unit of mass and electric current is measured in ampere.

2. Question

Kilometre is one of the SI units of measurement

Answer

True

Explanation: Kilogram is SI unit of mass.

3. Question

In everyday life, we use the term weight instead of mass.

Answer

True

Explanation: In day-to-day life, we generally ask for the weight of a substance.

4. Question

A physical balance is more sensitive than a beam balance as it can accurately measure even a very small mass, even milligram

Answer

True

Explanation: Physical balance is very sensitive and used in labs for measuring. It is similar to beam balance. It can measure small differences in mass up to milligram.

5. Question

One Celsius degree is an interval of 1K and zero degree Celsius is 273.15 K.

Answer

True

Explanation: Zero degree Celsius is equal to 273.15 K and 1 degree Celsius is equal to interval of 1 K.

1 degree Celsius = 273.15 K + 1 K = 274.15 K

Match The Following

1. Question

Column I	**Column II**
Length	Kelvin
Mass	metre
Time	kilogram
Temperature	second

Answer

Hint: Based on SI unit of measurement.

SI unit of length is metre.

SI unit of mass is kilogram.

SI unit of time is second.

SI unit of temperature is Kelvin.

Column I	Column II
Length	metre
Mass	kilogram
Time	second
Temperature	Kelvin

2. Question

Column I	Column II
Screw gauge	Vegetables
Vernier caliper	Coins
Beam balance	Gold ornaments
Digital balance	Cricket ball

Answer

Hint: Based on things measured by devices.

Thickness of coins can be measured by using screw gauge.

Diameter of cricket ball can be measured by using vernier caliper.

Mass of vegetables can be measured by using beam balance.

Mass of Gold can be measured by using Digital balance.

Column I	**Column II**
Screw gauge	Coins
Vernier caliper	Cricket ball
Beam balance	Vegetables
Digital balance	Gold ornaments

3. Question

Column I	**Column II**
Temperature	Beam balance
Mass	Ruler
Length	Digital clock
Time	Thermometer

Answer

Hint: Based on measuring devices and physical quantities.

Temperature can be measured by using Thermometer.

Mass can be measured by using Beam Balance.

Length can be measured by using Ruler.

Time can be measured by using Digital clock.

Column I	Column II
Temperature	Thermometer
Mass	Beam balance
Length	Ruler
Time	Digital clock

Assertion and Reason Type

1. Question

Assertion (A): The SI system of units is the improved system of units for measurement.

Reason (R): The SI unit of mass is kilogram

A. Both A and R are true but R is not the correct reason

B. Both A and R are true and R is the correct reason

C. A is true but R is false

D. A is false but R is true

Answer

Here, R is not giving proper reason that how SI system of units is the improved system of units of measurement. SI unit system is improved system as it has fixed reference and accepted in all over the world.

2. Question

Assertion (A): The skill of estimation is important for all of us in our daily life.

Reason (R): The skill of estimation reduces our consumption of time

A. Both A and R are true but R is not the correct reason

B. Both A and R are true and R is the correct reason

C. A is true but R is false

D. A is false but R is true

Answer

Estimating a value makes calculation easy.

When we're purchasing tickets for a group of people or splitting

the cost of dinner between 8 friends, we estimate for ease and to

save our time from more complex calculation.

3. Question

Assertion(A): The scientifically correct expression is " The mass of the bag is 10 kg"

Reason (R): In everyday life, we use the term weight instead of mass

A. Both A and R are true but R is not the correct reason

B. Both A and R are true and R is the correct reason

C. A is true but R is false

D. A is false but R is true

Answer

Reason behind assertion is "Kilogram is SI unit of mass". So, for correct scientific expression, mass of the bag is 10 kg.

4. Question

Assertion (A): 0 °C = 273.16 K. For our convenience we take it as 273 K after rounding off the decimal

Reason (R): To convert a temperature on the Celsius scale you have to add 273 to the given temperature

A. Both A and R are true but R is not the correct reason

B. Both A and R are true and R is the correct reason

C. A is true but R is false

D. A is false but R is true

Answer

We add 273 to temperature in Celsius to convert it into the Kelvin scale. Therefore, $0\ ^{o}$ c = 0+273 K = 273 K.

5. Question

Assertion (A): The distance between two celestial bodies is measured in the unit of light year

Reason (R): The distance travelled by the light in one year is one light year

A. Both A and R are true but R is not the correct reason

B. Both A and R are true and R is the correct reason

C. A is true but R is false

D. A is false but R is true

Answer

The distance between two celestial bodies is measured in the unit of light year because these bodies are very far from each other and light year is larger unit for measuring length.

Comprehensive Type

1. Question

Read the passage and answer the questions given below.

Mass is the amount of matter contained in an object. Measurement of mass helps us to distinguish between a lighter and a heavier body. Beam balance, spring balance and electronic balance are used to measure mass of different objects. The SI unit of mass is the kilogram (kg). But different units are used to measure the mass of different objects. E.g. weight (mass) of a tablet is measured in milligrams (mg), weight of a student is measured in kilogram (kg) and weight of a truck with goods is measured in metric tons. 1 metric ton is equal to 10 quintals and 1 quintal is equal to 100 kg. 1 gram is equal to 1000 mg.

The value of 1 metric ton is equal to

A. 1000 kg

B. 10 quintals

C. 10,00,000 g

D. 100 kg

Answer

1 metric ton = 10 quintals and 1 quintal = 100 kg

Therefore, 1 metric ton = 10 × 100 = 1000 kg

2. Question

Read the passage and answer the questions given below.

Mass is the amount of matter contained in an object. Measurement of mass helps us to distinguish between a lighter and a heavier body. Beam balance, spring balance and electronic balance are used to measure mass of different objects. The SI unit of mass is the kilogram (kg). But different units are used to measure the mass of different objects. E.g. weight (mass) of a tablet is measured in milligrams (mg), weight of a student is measured in kilogram (kg) and weight of a truck with goods is measured in metric tons. 1 metric ton is equal to 10 quintals and 1 quintal is equal to 100 kg. 1 gram is equal to 1000 mg.

How will you measure the weight of a tablet?

A. kg

B. g

C. mg

D. None of these

Answer

Weight of a tablet is very less. So, it is measured in milligrams (mg).

Very Short Answer Type

1. Question

Define measurement.

Answer

Measurement is the assignment of a number to a characteristic of an object or event which can be compared with other objects or events. It is determination of the size or magnitude of something.

2. Question

Define standard unit.

Answer

A standard unit is a reference point by which objects of weight, length, or capacity can be described. Reference point will be fixed everywhere and will not change from person to person or place to place.

3. Question

What is the full form of SI system?

Answer

Full form of SI system is International System of Units.

4. Question

Define least count of any device.

Answer

The smallest value that can be measured by the measuring device is called its least count.

5. Question

What do you know about pitch of screw gauge?

Answer

Pitch of screw gauge is equal to the distance travelled by the tip of the screw for one complete rotation of the head.

6. Question

Can you find the diameter of a thin wire of length 2 m using the ruler from your instrument box?

Answer

Yes. But it will not be much accurate as least count of my ruler is 1 mm.

Short Answer Type

1. Question

Write the rules that are followed in writing the symbols of units in SI system.

Answer

Rules that are followed in writing the symbols of units in SI system are:

i) The symbols of the units named after scientists should be written by the initial capital letter. E.g. N for newton, H for henry, A for ampere and W for watt.

ii) Small letters are used as symbols for units not derived from a proper noun. E.g. m for metre, kg for kilogram.

iii) No full stop or other punctuation marks should be used within or at the end of symbols. E.g. 50 m and not as 50 m.

iv) The symbols of the units are not expressed in plural form. E.g. 10 kg not as kgs.

v) Use of solidus is recommended for indicating a division of one unit symbol by another unit symbol. Not more than one solidus is used. E.g. ms^{-1} or m/s. J/K/mol should be JK^{-1} mol^{-1}

vi) Accepted symbols alone should be used. E.g. ampere should not be written as amp and second should not be written as sec.

2. Question

Write the need of a standard unit

Answer

Standard unit is needed due to following reasons:

i) We needed to have fixed reference for measurement so that it doesn't change from person to person.

ii) People in the different parts of the world were using different units which make the exchange of things difficult due to different units.

iii) We need units that will be accepted worldwide for ease of exchange and communication.

3. Question

Differentiate mass and weight

Answer

Mass	**Weight**
1. It is a fundamental quantity.	1. It is a derived quantity.
2. It is a scalar quantity.	2. It is a vector quantity.
3. It is the amount of matter contained in a body.	3. It is the normal force exerted by the surface on the object against gravitational pull.
4. It remains same everywhere.	4. It changes from place to place.
5. It is measured using physical balance.	5. It is measured using spring balance.
6. Its unit is kilogram.	6. Its unit is newton.

4. Question

What is the measuring unit of the thickness of a plastic carry bag?

Answer

Thickness of a plastic carry bag can be measured in micrometre because plastic bags are very thin and can be measured by using screw gauge.

5. Question

How will you measure the least count of vernier caliper?

Answer

Least count of vernier caliper can be measured by following steps:

i) Find main scale division. The main scale division can easily

be obtained by inspecting the main scale. It will be in centimetre, further divided into millimetre. The value of smallest main scale division is 1 mm.

ii) Then find the vernier scale division. The Vernier scale division is obtained by counting number of division in it. In the Vernier scale there will be 10 divisions.

iii) To obtain least count, divide the smallest main scale division by total number of vernier scale division.

$$\text{Least count} = \frac{\text{smallest main scale division}}{\text{total number of vernier scale division}} = \frac{1\text{ mm}}{10} = 0.1\text{ mm}$$

Numerical Problem

1. Question

Inian and Ezhilan argue about the light year. Inian tells that it is 9.46×10^{15} m and Ezhilan argues that it is 9.46×10^{12} km. Who is right? Justify your answer.

Answer

Speed of Light = 3×10^{8} ms^{-1}

Seconds in 1 year = $365 \times 24 \times 60 \times 60$

= 3.153×10^{7} seconds

Total distance in 1 light year = speed × time

= $3 \times 10^{8} \times 3.153 \times 10^{7}$

= 9.46×10^{15} m

1 m = 10^{-3} km

9.46×10^{15} m = 9.46×10^{12} km

Therefore, Inian and Ezhilan both are right.

2. Question

The main scale reading while measuring the thickness of a rubber ball using Vernier caliper is 7 cm and the Vernier scale coincidence is 6. Find the radius of the ball.

Answer

Here, thickness of the rubber ball = diameter of the ball.

Main scale reading = 7 cm

Vernier scale reading = 6

Least count = 0.01 cm

Assuming, there is no zero error

Diameter of the ball =

Main scale reading (MSR) +

(Vernier scale coincidence (VC) × least count (LC)) ± ZE

= 7 + (6 × 0.01) ± 0

= 7.06 cm

Radius of ball $= \frac{\text{diameter}}{2} = \frac{7.06}{2}$

= 3.53 cm

Hence, radius of the ball is 3.53 cm.

3. Question

Find the thickness of a five rupee coin with the screw gauge, if the pitch scale reading is 1 mm and its head scale coincidence is 68.

Answer

Given, Pitch scale reading (PSR) = 1 mm

Head scale coincidence (HSC) = 68

Least count (LC) = 0.01 mm

Assuming no zero error, we get

Corrected Head scale coincidence (CHSC) = 68

Thickness of the coin = PSR + (CHSC × LC)

= 1 + (68 × 0.01) mm

= 1.68 mm

Hence, Thickness of the coin is 1.68 mm.

4. Question

Find the mass of an object weighing 98 N.

Answer

weight = mass × gravity

We know that, gravity = 9.8 ms^{-2}

Given, weight = 98 N

$$\text{mass} = \frac{\text{weight}}{\text{gravity}}$$

$$= \frac{98}{9.8}$$

= 10 kg

Hence, mass of the object is 10 kg.

Long Answer Type

1. Question

Explain a method to find the thickness of a hollow tea cup.

Answer

We can find the thickness of a hollow tea cup by using screw gauge. To find the thickness of the cup, follow given steps:

i) Determine the least count, pitch and the zero error of the screw gauge.

ii) Hold the cup between anvil and spindle.

iii) Rotate the head until the cup is held firmly but not tightly, with the help of the ratchat .

iv)) Note the reading of the pitch scale crossed by the head scale (PSR) and the head scale division that coincides with the pitch scale axis (HSC).

v) The thickness of the cup is given by PSR + CHSR (Corrected HSR). Repeat the experiment for different positions of the coin.

vi) Note the readings in a table.

vii) The average of the last column readings gives the thickness of the cup.

2. Question

How will you find the thickness of a one rupee coin?

Answer

We can find the thickness of a one rupee coin by using a screw gauge. It can be done in following steps:

i) Determine the pitch, the least count and the zero error of the screw gauge.

ii) Place the coin between the two studs.

iii) Rotate the head until the coin is held firmly but not tightly, with the help of the ratchat .

iv) Note the reading of the pitch scale crossed by the head scale (PSR) and the head scale division that coincides with the pitch scale axis (HSC).

v) The width of the coin is given by PSR + CHSR (Corrected HSR). Repeat the experiment for different positions of the coin.

vi) Tabulate the readings.

vii) The average of the last column readings gives the thickness of the coin.

3. Question

Find out any ‘ten words’ related to measurement from the grid.

A	C	C	U	R	A	T	E	V	B
N	U	O	P	I	E	R	R	E	E
A	B	N	I	S	N	I	R	R	A
L	I	S	T	C	D	A	O	N	M
O	T	T	C	R	F	L	R	I	B
G	Z	A	H	E	H	S	M	E	A
U	Y	N	E	W	T	O	N	R	L
E	G	T	R	A	I	L	E	R	L
L	E	A	S	T	C	O	U	N	T
K	E	L	V	I	N	O	T	E	C
X	B	E	A	M	B	A	N	C	E

Answer

i) ACCURATE

ii) VERNIER

iii) KELVIN

iv) NEWTON

v) LEAST COUNT

vi) PITCH

vii) ERROR

viii) BEAM

ix) SCREW

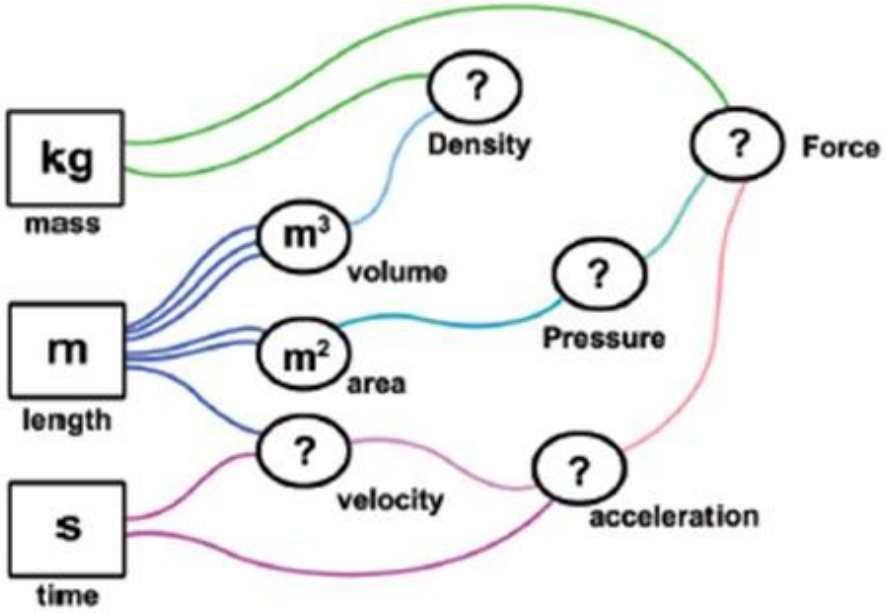
x) CONSTANT

A(i)	**C**	**C**(x)	**U**	**R**	**A**	**T**	**E**(vii)	**V**(ii)	B
N	U	**O**	**P**(vi)	I	E	R	**R**	**E**	E
A	B	**N**	**I**	**S**(ix)	N	I	**R**	**R**	A
L	I	**S**	**T**	**C**	D	A	**O**	**N**	M
O	T	**T**	**C**	**R**	F	L	**R**	**I**	B
G	Z	**A**	**H**	**E**	H	S	M	**E**	A
U	Y	**N**(iv)	**E**	**W**	**T**	**O**	**N**	**R**	L
E	G	**T**	R	A	I	L	E	R	L
L(v)	**E**	**A**	**S**	**T**	**C**	**O**	**U**	**N**	**T**
K(iii)	**E**	**L**	**V**	**I**	**N**	O	T	E	C
X	**B**(viii)	**E**	**A**	**M**	B	A	N	C	E

Activity

1. Question

Complete the flow chart



Answer

$$\textbf{density} = \frac{\textbf{mass}}{\textbf{volume}}$$

Unit of mass is kg and unit of volume is m^3. So Unit of Density is $\mathbf{kgm^{-3}}$.

$$\text{velocity} = \frac{\text{distance}}{\text{time}}$$

Unit of distance is m and unit of time is s. So unit of velocity is $\mathbf{ms^{-1}}$.

$$\text{acceleration} = \frac{\text{change in velocity}}{\text{time}}$$

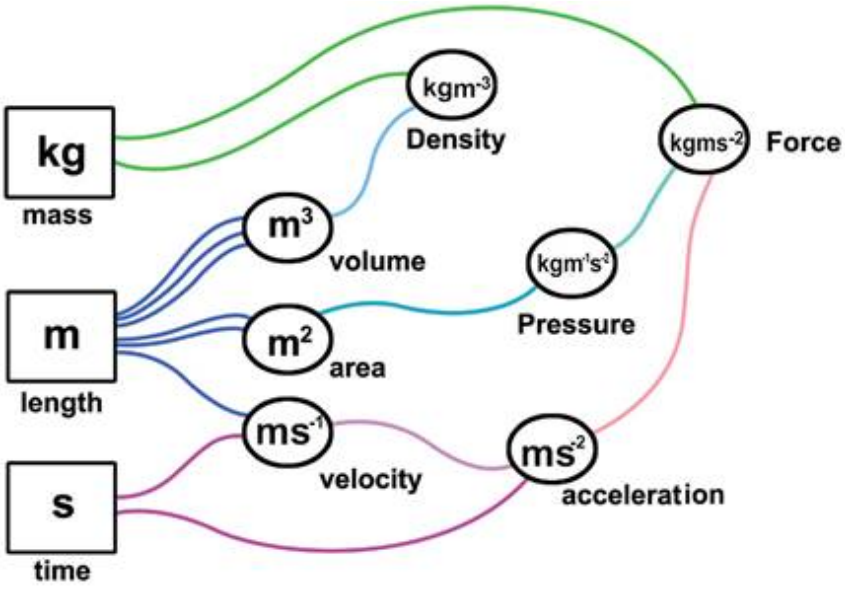
Change in velocity has unit ms^{-1} and time has unit s. So unit of acceleration is $\mathbf{ms^{-2}}$.

$$\text{Force} = \text{mass} \times \text{acceleration}$$

Unit of mass is kg and unit of acceleration is ms^{-2}. So Unit of Force in fundamental quantities is $\mathbf{kgms^{-2}}$.

$$\text{pressure} = \frac{\text{Force}}{\text{area}}$$

Unit of force is $kgms^{-2}$ and unit of area is m^2. So unit of pressure is $\mathbf{kgm^{-1}s^{-2}}$.


kg
mass
m
length
s
time
kgm-3
Density
m3
volume
m2
area
ms-1
velocity
kgms-2
Force
kgm-1s-2
Pressure
ms-2
acceleration