# PHYSICS

# BOOKS - MTG IIT JEE FOUNDATION

# MEASUREMENTS AND MOTION

## Illustrations

**1.** Calculate the number of astronomical units in one metre.

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**2.** A ball placed on the ground seems to be at rest for us. Is it actually at rest? If not then why?

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**3.** Show the following vectors graphically:

a displacement of 2.5 m towards $30°$ west of north on a scale, 1 cm=1 m

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**4.** Show the following vectors graphically:

a force of 5 N towards north-east on a scale 1 cm=1N

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**5.** Can displacement of an object in motion be zero or negative?

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**6.** A body thrown vertically upward rises up to a height h, and comes back to the initial position. Calculate

the total distance travelled by the body

**7.** A body thrown vertically upward rises up to a height h, and comes back to the initial position. Calculate

the displacement of the body.

**8.** A scooterist covers a distance of 3 kilometres in 5 minutes Calculate his speed in:

centimetres per second (cm/s)

**9.** A scooterist covers a distance of 3 kilometres in 5 minutes. Calculate his speed in:

(a) centimetres per second (cm/s)

(b) metres per second (m/s)

(c ) kilometres per hour (km/h)

**10.** A bus covers a distance of 250 km from Delhi to Jaipur towards West in 5 hours in the morning and returns to Delhi in the evening covering the same distance of 250 km in the same time of 5 hours. Find (a) average speed, and (b) average velocity, of the bus for the whole journey.

**11.** A bus covers a distance of 250 km from Delhi to Jaipur towards West in 5 hours in the morning and returns to Delhi in the evening covering the same distance of 250 km in the same time of 5 hours. Find (a) average speed, and (b) average velocity, of the bus for the whole journey.

**12.** A train is moving at a speed of $100ms^{-1}$ comes to rest in 5 seconds. Find its retardation.

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**13.** A train starting from rest moves with a uniform acceleration of $0.2m/s^2$ for 5 minutes . Calculate the speed acquired and the distance travelled in this time.

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**14.** A body is accelerating at a constant rate of $10m/s^2$ . If the body starts from rest , how much distance will it cover in 2 seconds ?

**15.** A car acquires a velocity of $72km/h$ in 10 seconds starting from rest. Find (a) the acceleration (b) the average speed ( c ) the distance travelled in this time.

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**17.** A car acquires a velocity of $72km/h$ in 10 seconds starting from rest. Find (a) the

acceleration (b) the average speed ( c ) the distance travelled in this time.

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## Solved Examples

**1.** What is SI system of units?

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**2.** When do the velocity and speed of a moving body become identical?

**3.** Convert 72 km $h^{-1}$ in to cm $s^{-1}$.

**4.** Suppose a person walk across a room of length 17 m with a velocity of 3.7 km $h^{-1}$. Find

the time he will take to move across the room.

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**5.** Give two examples of non-uniform motion.

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**6.** What do you mean by a body at rest and a body at motion ?

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**7.** A particle is moving in a circle of radius 2 m.

Show the following position of the particle.

2 m from the centre, $30°$ west-north.

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**8.** A particle is moving in a circle of radius 2 m.

Show the following position of the particle.

2 m from the centre towards south.

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**9.** Why are the states of motion and rest considered relative?

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**10.** Convert 1 light year into meters.

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**11.** A car travels at a speed of 30 km per hour for 30 minutes and then at a speed of 45 km

per hours. What is the total distance travelled by the car in 2 hours ?

**12.** A ball is rolling in a straight line slows down from 8 m $s^{-1}$ to 2 m $s^{-1}$ in 10 s. What is its acceleration?

**13.** A cyclist decelerates uniformly at 0.4 m $s^{-2}$ from velocity 5 m $s^{-1}$ to a complete stop. How long does he take to stop?

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**1.** Among the following, identify the derived quantity?

A. speed

B. Temperature

C. length

D. mass

**Answer: A**

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**2.** Light year is a unit of

A. Time

B. Speed

C. Distance

D. none of these

**Answer: C**

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**3.** Thickness of the page on which you are writing is in the order of

A. 0.1 cm

B. 0.1 micrometer

C. 0.1 angstrom

D. 0.1 mm

**Answer: D**

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**4.** Consider a person moving 3 km east of A. He then turns north and moves 4 km in total time 2 hours. (as shown in figure). Find his average speed.

A. 3.5 km $h^{-1}$

B. 2.5 km $h^{-1}$

C. 1.5 km $h^{-1}$

D. 0.5 km $h^{-1}$

**Answer: A**

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**5.** Two perosns X and Y take 10 hours and 12 hours, respectively to travel from Banglore to Hyderbad, then the

A. average velocity of X is equal to the

average velocity of Y.

B. average velocity of X is less than that of

Y.

C. average velocity of X is more than that

of Y.

D. we cannot compare their velocities.

**Answer: C**

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**6.** The odometer of a car reads 1800 km at the start of a trip and 2400 km to the end of the trip. If the trip took 10 h. Calculate the average speed of the car in km $h^{-1}$

    A. 30

    B. 40

    C. 50

    D. 60

**Answer: D**

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**7.** If a car covers 2/5 th of the total distance with v_(1) speed and 3/5th distance with v_(2) then average speed is

A. $\dfrac{1}{2}\sqrt{v_1 v_2}$

B. $\dfrac{v_1 + v_2}{2}$

C. $\dfrac{2v_1 v_2}{v_1 + v_2}$

D. $\dfrac{5v_1 v_{+}(2)}{3v_1 + 2v_2}$

**Answer: D**

**8.** If a particle moves with a constant speed, the distance-time graph is

A. straight line

B. curved line

C. horizontal line to time axis

D. parallel line to velocity axis

**Answer: A**

**9.** Suppose you walk across a room of length $9m$ with a velocity of one and a half kilometre per hour . Express this velocity in $m/s$ and find the time you will take to move across the room.

    A. 20.6 s

    B. 21.6 s

    C. 22.6 s

    D. 23.6 s

**Answer: B**

10. A body thrown vertically upwards reaches a maximum height $h$. It then returns to ground . Calculate the distance travelled and the dispacement .

    A. 2h, 0

    B. h, 0.

    C. 0,2h

D. 0, h



**Answer: A**

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**11.** Calculate the speed of the tip of second's hand of a watch of length $1.5cm$.

A. 0.32 cm $s^{-1}$

B. 1 cm $s^{-1}$

C. 0.16 cm $s^{-1}$

D. 0.5 cm $s^{-1}$

**Answer: C**

**12.** A body moves with uniform velocity. Which of the graphs shown here is a graph of velocity against time for this motion?

A. 

B. 

C. 

D. 

**Answer: B**

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**13.** A particle is travelling with a constant speed means

A. Its position remains constant as time passes

B. It covers equal distances in equal time intervals

C. Its acceleration is zero

D. It does not change its direction of motion.

Answer: B

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**14.** Physical quantity which we can't obtain from a distance-time graph is

A. Speed

B. Time taken

C. Change in position

D. Change in weight

**Answer: D**

**15.** The speed of a train which covers 200 kilometre in 4 hours is

    A. 30 km $h^{-1}$

    B. 50 km $h^{-1}$

    C. 80 km $h^{-1}$

    D. 70 km $h^{-1}$

**Answer: B**

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**16.** The distance between two stations is 240 km. A train takes 4 hours to cover this distance. Calculate the speed of the train.

A. 40 km $h^{-1}$

B. 50 km $h^{-1}$

C. 60 km $h^{-1}$

D. 70 km $h^{-1}$

**Answer: C**

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**17.** The basic unit of speed is:

A. km/minute

B. m/minute

C. km/h

D. m/s

**Answer: D**

**18.** Which of the following distance-time graphs shows a truck moving with speed which is not constant?

A. 

B. 

C. 

D. 

**Answer: C**


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**19.** The relation between speed and displacement is

    A. displacement=speed/time

    B. displacement=speed x time

    C. displacement=time/speed

    D. none of the above

**Answer: B**

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**20.** Which one records the distance travelled by the vehicles?

    A. Manometer

    B. Odometer

    C. Speedometer

    D. None of these

**Answer: B**

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**21.** The density of aluminium in S.I. system is 2700 kg $m^{-3}$. Find its value in C.G.S. System.

A. 1.7 g $m^{-3}$

B. 2.7 g $m^{-3}$

C. 3.7 g $m^{-3}$

D. 4.7 g $m^{-3}$

**Answer: B**

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**22.** If the density of substance is 'P' gcm³. Then its density in Sl system is

    A. 1000 P kg $m^{-3}$

    B. 2000 P kg $m^{-3}$

    C. 3000 P kg $m^{-3}$

    D. 4000 P kg $m^{-3}$

**Answer: A**

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**23.** Choose the correct answer from the following.

   A. An area of one square centimeter is 10 times greater than one square meter.

   B. 1 hour 18 min is equal to 3618 seconds

   C. Sl unit of density is cubic metres.

   D. Metre is the standard unit to measure length.

**Answer: D**

**24.** Choose the correct statement from the following .

    A. Distance between earth and nearest star is of order in parsec.

    B. Thousand millimetre make one metre.

    C. tonne is equal to 10 g

    D. All of the above

**Answer: D**

**25.** The SI unit of luminous intensity is

A. ampere

B. candela

C. mole

D. None of these

**Answer: B**

**26.** 1 A.U. is equal to

A. $1.5 \times 10^{11}$ m

B. $1.5 \times 10^{10}$ m

C. $1.5 \times 10^{9}$ m

D. $1.5 \times 10^{-11}$ m

**Answer: A**

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**27.** Which of the following is different from others?

A. Speed

B. Acceleration

C. Force

D. Time

**Answer: D**

**28.** The amount of substance in the SI system of units is represented by

A. candela

B. mole

C. Weight

D. kilogram

**Answer: B**

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**29.** A body whose speed in a particular direction is constant

    A. must be accelerating

    B. must be retarding

    C. has a constant velocity

    D. all of these

**Answer: C**

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**30.** In the given figure, the velocity of body at point A is



A. zero

B. unity

C. maximum

D. infinite

**Answer: A**

**31.** Which of the following is different from others

A. mass

B. length

C. time

D. Density

**Answer: D**

**32.** The SI unit of temperature is

A. kelvin

B. second

C. mole

D. candela

**Answer: A**

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**33.** Which of the following relations represents the relationship between the average speed, time and distance correctly?

A. Average speed=distance x time

B. Average speed $= \dfrac{\text{total distance}}{\text{total time}}$

C. Time=average speed x distance

D. Distance=average speed/time

Answer: B

**34.** A man walks $8m$ towards east and $6m$ towards north. The magnitude of displacement is :

A. 10 m

B. 14 m

C. 2 m

D. zero

**Answer: A**

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**35.** A body moving along a circular path has

A. a constant speed

B. a constant velocity

C. no tangential velocity

D. no radial acceleration.

**Answer: A**

**36.** Which of the following represents distance(s)-time(t) graph for a retarded motion?

A. 

B. 

C. 

D. 

**Answer: C**

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**37.** The ratio of SI units to CGS units of retardation is

A. $10^{-2}$

B. $10^2$

C. 10

D. $10^{-1}$

**Answer: B**

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**38.** The velocity of a body at rest is always

A. unity

B. negative

C. zero

D. infinite

**Answer: C**

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**39.** A car increases its speed form 20km/h to 50km/h in 10 seconds. Its acceleration is

A. 30 m $s^{-2}$

B. 30 m $s^{-2}$

C. 18 m $s^{-2}$

D. None of these

**Answer: D**

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**40.** The speed of a body describing its motion is rate of change of

A. distance

B. position

C. displacement

D. None of these

Answer: A

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**41.** When a graph between two physical quantities is straight line, the two quantities are

A. constant

B. independent of each other

C. directly proportional to each other.

D. inversely proportional to each other.

**Answer: C**

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**42.** Choose the wrong statement

A. Retardation is a vector quantity.

B. Acceleration due to gravity is a vector quantity

C. Average speed is a vector quantity.

D. Displacement is a vector quantity.

**Answer: C**

**43.** SI unit of acceleration is

A. m/s

B. m s

C. $m/s^2$

D. None of these

**Answer: C**

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**44.** The second's hand of a watch is 2 cm long. The speed of the tip of this hand is

    A. 0.21 cm/s

    B. 2.1 cm/s

    C. 21.0 cm/s

    D. none of these

**Answer: A**

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**45.** 1 parsec is equal to

A. 3.26 A.U.

B. 3.26 ly

C. 3.26 A

D. none of these

**Answer: B**

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**46.** A quantity has a value of -6.0 m/s. It may be the

A. speed of a particle

B. velocity of a particle

C. position of a particle

D. displacement of a particle.

**Answer: B**

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List-I                          List-II

(P)Scalar quantity          (1)force

1. (Q)Vector quantity          $(2)ms^{-2}$

(R )Acceleration            $(3)ms^{-1}$

(S) Velocity                4time

A. P-4, Q-1, R-2, S-3

B. P-2, Q-3, R-1, 5-4

C. P-1, Q-4, R-3, 5-2

D. P-3, Q-2, R-4, S-1

**Answer: A**

|  | List-I | List-II |
|---|---|---|
|  | (P)1 parsec | (1)$9.46728 \times 10^{15} m$ |
| **2.** | (Q)1 light year | (2)$3.084 \times 10^{16} m$ |
|  | (R )Electric current | (3)kelvin |
|  | (S) Temperature | (4)ampere |

A. P-1, Q-2, R-3, S-4

B. P-3, Q-4, R-2, 5-1

C. P-2, Q-1, R-4, 5-3

D. P-4, Q-3, R-1, S-2

Answer: C

**3.**

List-I                          List-II
(P)Amount of substance   (1)SI system
(Q)Luminous intensity    (2)$CGS system$
(R )Metre                 (3)Mole
(S)Centimeter            (4)candela

    A. P-4, Q-1, R-2, S-3

    B. P-2, Q-3, R-4, S-1

    C. P-1, Q-2, R-3, S-4

    D. P-3, Q-4, R-1, 5-2

**Answer: D**

## Exercise Assertion Reason Type

**1.** Assertion: Though milligram is the unit of mass, it is not a fundamental unit. Reason : All practical units need not be. fundamental unit.

   A. If both assertion and reason are true and reason is the correct explanation of

assertion.

B. If both assertion and reason are true but

reason is not the correct explanation of

assertion.

C. If assertion is true but reason is false.

D. If assertion is false but reason is true.

**Answer: A**

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**2.** Assertion: When we change the unit of measurerment of a quantity its numerical value changes.

Reason: Smaller the unit of measurement smaller is its numerical value.

A. If both assertion and reason are true and reason is the correct explanation of assertion.

B. If both assertion and reason are true but reason is not the correct explanation of

assertion.

C. If assertion is true but reason is false.

D. If assertion is false but reason is true.

**Answer: C**

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**3.** Assertion: A physical quantity cannot be called as a vector if its magnitude is zero.

Reason: A vector has both, magnitude and direction.

A. If both assertion and reason are true and reason is the correct explanation of assertion.

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If assertion is false but reason is true.

**Answer: A**

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**4.** Assertion: Acceleration and displacement are in the opposite direction during retardation. Reason : Acceleration is given as the change in velocity per unit time.

A. If both assertion and reason are true and reason is the correct explanation of assertion.

B. If both assertion and reason are true but reason is not the correct explanation of

assertion.

C. If assertion is true but reason is false.

D. If assertion is false but reason is true.

**Answer: B**

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**5.** Assertion: The distance travelled by an object in unit time is its speed.Reason : Speed is a scalar quantity.

A. If both assertion and reason are true and reason is the correct explanation of assertion.

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If assertion is false but reason is true.

**Answer: B**

**6.** Assertion: A body has a non-uniform motion, if it travels unequal distances in equal intervals of time. Reason : In non-uniform motion, the body covers equal distance in unequal intervals of time.

A. If both assertion and reason are true and reason is the correct explanation of assertion.

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If assertion is false but reason is true.

Answer: A

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**7.** Assertion: Graph drawn between distance and time in case of a uniform motion is a straight line. Reason : In case of uniform motion, the body covers equal distance in equal interval of time.

A. If both assertion and reason are true and reason is the correct explanation of assertion.

B. If both assertion and reason are true but reason is not the correct explanation of

assertion.

C. If assertion is true but reason is false.

D. If assertion is false but reason is true.

**Answer: A**

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**8.** Assertion: Measurement is a process of comparison. Reason: Comparison process is not a part of measurement.

A. If both assertion and reason are true and reason is the correct explanation of assertion.

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If assertion is false but reason is true.

**Answer: C**

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**1.** An athlete is throwing a discus in a sports event. He holds the discus in his hand and gives it a circular motion by rotating his own body. Then he releases the discus in the desired direction. The discus moves along a straight line.

Which statement about the direction of the velocity of this discus is correct?

A. the direction of velocity constantly

changes

B. the direction of velocity is constant

through out the motion

C. direction of velocity changes at some

points only.

D. both (b) and (d) are correct.

**Answer: A**

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**2.** An athlete is throwing a discus in a sports event. He holds the discus in his hand and gives it a circular motion by rotating his own body. Then he releases the discus in the desired direction. The discus moves along a straight line.

At a particular point, how can you find the direction of velocity of discus?

A. Draw a perpendicular at that point.

B. Draw a tangent at that point

C. Velocity may not have particular direction

D. None of these

**Answer: B**

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**3.** A force of certain magnitude acts on a body. The mass of the body is 10 kg. The time for which the force acting is 10 s. This force makes the body move at a distance of 50 m in 5 s

after the force cease to act on it

The final velocity of the body is

A. 5m $s^{-1}$

B. 10m $s^{-1}$

C. 15 m $s^{-1}$

D. 20 m $s^{-1}$

**Answer: B**

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**4.** A force of certain magnitude acts on a body. The mass of the body is 10 kg. The time for which the force acting is 10 s. This force makes the body move at a distance of 50 m in 5 s after the force cease to act on it

What is the magnitude of force applied on the body?

A. 5 N

B. 10 N

C. 15 N

D. 20 N

**Answer: B**

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## Exercise Integer Numerical Value Type

**1.** A car moves along a straight path with variable velocity as shown in the figure. When the car is at position A, its velocity is 10 m $s^{-1}$ and when it is at position B, its velocity is 20 m

$s^{-1}$ . If the car take 5 seconds of times to move from A to B, find the acceleration of the car.

**2.** A particle moved 5 m towards east then moved 8 m towards west. What is the total distance travelled and the magnitude of displacement?

**3.** Convert 18 km $h^{-1}$ into its equivalent in m $s^{-1}$

**4.** Rahul swims in a 60 m long pool. He covers 120 m in one minute by swimming from one end to the other and back along the same straight path. What is the average speed of Rahul in m $s^{-1}$ ?

**5.** An object is moving along a path in the shape of rectangle, the length and breadth of rectangular path is 42 m and 20 m respectively. The distance travelled by object when it completes the journey is $x24 \times 10^4$ cm. Find the value of x.