



PHYSICS

BOOKS - CENGAGE PHYSICS

UNITS AND MEASUREMENT

Worked Examples

1. The radius of the Earth is approximately $6.37 \times 10^6 m$.

Find (i) circumference in kilometres,

(ii) surface area in square kilometres,
and (iii) volume in cubic kilometres.



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2. Estimate the number of heartbeats during a life span of 70 years. (Assume that normal rate of heartbeat is 70 per min.)



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3. Calculate the volume of a cube of side 2 cm in cubic centimeter. Express the answer in cubic meter.



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4. What is the value of gravitational constant

$G = 6.67 \times 10^{-11} Nm^2 / kg^2$ in CGS units?



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5. State the number of significant figures in the following

(a) 0.04m^2 (b) $2.64 \times 10^{24}\text{kg}$

(c) 6.320 J (d) 0.0006043 s

(e) 6943.20 m



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Mandatory Exercise Exercise Set I

1. Convert 72 km h^{-1} into m s^{-1} .



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2. Convert g L^{-1} into kg m^{-3} .



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3. How many mm^3 in 1m^3 ?

A. 10^{-3}

B. 10^{-2}

C. 10^{-4}

D. 10^{-5}

Answer: A



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4. Express the speed of light in meter per pico second ($c = 3 \times 10^8 \text{ms}^{-1}$).



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5. The distance from the Sun to the Earth is 1 AU = 1.5×10^{11} . The speed of light is $3 \times 10^8 \text{ms}^{-1}$.

Express the speed of light in terms of (a) AU per minute and (b) AU per second.



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$$6.675 \times 10^3 \text{ cm} + 4.52 \times 10^2 \text{ cm} = \underline{\hspace{2cm}}$$



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7. Express 9.8 m s^{-2} in km h^{-2} .



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8. Express $2 \text{ kg m}^2 \text{ s}^{-2}$ to $\text{g cm}^2 \text{ s}^{-2}$.



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9. The velocity of a body is 72 km h^{-1} . Express it in m s^{-1} .



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10. The height of mercury column in a barometer in the Kolkata laboratory was recorded to be 75 cm. Calculate the pressure at Kolkata in SI unit

using the following data:

Density of mercury = $13.6 \times 10^3 \text{ kgm}^{-3}$, pressure

= ρgh , where h is the height of mercury column,

ρ is the density of mercury, and g is the

acceleration due to gravity)



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11. The time of heartbeat is of the order of

A. 10^0 s

B. 10^2 s

C. 10^1 s

D. $10^{-2} s$

Answer:



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12. Ratio of the mass of the Earth ($5.98 \times 10^{24} kg$) to the average mass of human (60 kg) is

A. 0.99×10^{22}

B. 9.96×10^{22}

C. 99×10^{22}

D. 9.96×10^{21}

Answer:



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13. Human life expectancy is of the order of

A. $10^5 s$

B. $10^7 s$

C. $10^{10} s$

D. $10^9 s$

Answer:



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14. $1m^3 =$

A. $10^9 mL$

B. $10^{-9} mL$

C. $10^3 mL$

D. $10^6 mL$

Answer:



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15. 1 mg =

A. $10^{-6} kg$

B. $10^{-4} kg$

C. $10^3 kg$

D. $10^{-2} kg$

Answer:

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16. A student measured the diameter of a wire using a micrometer with least count 0.001 cm and listed the measurement. The correct measurement is

A. 5.320 cm

B. 5.3 cm

C. 5.32 cm

D. 5.3200 cm

Answer:



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17. The length, breadth, and thickness of a rectangular sheet of metal are 4.234 m, 1.005 m, and 2.01 cm. Approximate the volume of the sheet correct to three decimal places.

A. $0.085m^3$

B. $0.086m^3$

C. $0.0855m^3$

D. $0.080m^3$

Answer:



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18. What is the dimension of force?

A. ML^2T^{-1}

B. MLT^{-1}

C. MLT^{-2}

D. M^2LT^{-3}

Answer:



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19. Ampere second is a unit of

A. power

B. energy

C. current

D. charge

Answer:



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20. What is the unit of latent heat?

A. N/mol

B. N/kg

C. J/mol

D. J/kg

Answer:



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21. What is the unit of surface tension ?

A. Nm

B. N/m^2

C. N/m

D. degree/cm

Answer:



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22. What does watt-hour measure?

A. energy

B. power

C. voltage

D. current

Answer:



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23. What is the SI unit of pressure ?

A. atm

B. bar

C. pascal

D. mm of Hg

Answer:



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24. SI unit of magnetic flux is

A. ampere/metre

B. oersted

C. weber

D. gauss

Answer:



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25. Which of the following physical quantities will have same dimension?

- A. Work and power
- B. Force and power
- C. Latent heat and specific heat
- D. Torque and work

Answer:



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26. Given is the relation of force F with time, $F = a + bt$. What are the dimensions of a and b ?

A. $M^0 L^1 T^{-1}$, $M^0 L^1 T^{-3}$

B. $M^0 L^1 T^{-2}$, $M^0 L^1 T^{-2}$

C. $M^0 L^1 T^{-2}$, $M^0 L^1 T^{-3}$

D. $M^0 L^1 T^{-2}$, $M^0 L^1 T^{-4}$

Answer:



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27. ML^2T^{-2} is a dimension of which of the following physical quantity?

A. Momentum

B. Force

C. Torque

D. Power

Answer:



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28. What is the value of $1\mu m$?

A. $10^{-3}m$

B. $10^{-6}m$

C. $10^{-9}m$

D. none of the above

Answer:





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29. The number of significant figures in 0.00060 is

A. 4

B. 3

C. 2

D. 1

Answer:



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30. The equation of distance travelled by a body s with time t is given as $S = A(t + B) + Ct^2$.

The dimension of B is given by

A. $M^0 L^2 T^{-2}$

B. $M^0 L^{-1} T^{-2}$

C. $M^0 L^0 T^1$

D. $M^0 L^1 T^{-1}$

Answer:



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31. How many Ohms does $1M\Omega$ have

A. $10^3\Omega$

B. $10^9\Omega$

C. $10^6\Omega$

D. $10^{12}\Omega$

Answer:



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32. Which physical quantity has a unit of electron volt.

A. Charge

B. energy

C. Potential difference

D. Voltage

Answer:



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33. Which of the following is a distance?

- A. Solar year
- B. Leap year
- C. Light year
- D. None of these

Answer:



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34. Length of 1 nm is equal to

A. $10^{-3}m$

B. $10^{-6}m$

C. $10^{-9}m$

D. $10^{-12}m$

Answer:



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35. How many joules are there in 1 kwh?

A. $3.6 \times 10^6 J$

B. 3600 J

C. 1000 J

D. None of these

Answer:



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36. What is the unit of impulse?

A. N

B. kg m/s

C. m/s

D. None of these

Answer:



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37. When 96.25 is divided by 2.37 the correct result is

A. 40.6

B. 40.61

C. 40.61

D. 40.6118

Answer:



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38. What is the unit of coefficient of viscosity?

A. Nm^2 / s

B. Nm/s

C. N / m^2

D. None of these

Answer:



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39. Which of the following is a dimensionless quantity?

A. Energy/work

B. Velocity/acceleration

C. Force/acceleration

D. Volume/are

Answer:



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40. The number of significant figures in 0.00060 m is

A. 1

B. 2

C. 3

D. 4

Answer:



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41. The SI unit is based on how many fundamental units?

A. 5

B. 3

C. 7

D. None of these

Answer:



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42. $\left(P + \frac{a}{v^2}\right)(v - b) = \text{Constant}$. In the given equation P is pressure and v is volume. What is the unit of a ?

A. $\text{dyne} \times \text{cm}^2$

B. $\text{dyne} \times \text{cm}^3$

C. $\text{dyne} \times \text{cm}^4$

D. dyne $\times cm^5$

Answer:



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43. Which of the given measurements is more precise?

A. 3 cm

B. 3.0 cm

C. 3.00 cm

D. 3.000 cm

Answer:



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44. Which of the following is a unit of potential difference?

A. joules/coulomb

B. watt/coulomb

C. newton-second

D. none of these

Answer:



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45. What is the SI unit of coefficient of mutual inductance?

A. volt

B. weber

C. farad

D. henry

Answer:



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46. Which of the following is dimension of universal gas constant R?

A. $M^2 L^2 T^{-2} K^{-1} mol^{-1}$

B. $M^1 L^1 T^{-2} K^{-1} mol^{-1}$

C. $M^2 L T^{-2} K^{-1} mol^{-1}$

$$D. M^1 L^2 T^{-2} K^{-1} mol^{-1}$$

Answer:



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Mandatory Exercise Exercise Set II Comprehension

1. What is meant by dimensional analysis? What use its applications?



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Mandatory Exercise Exercise Set II Match The Columns

1. Match the following:

A

- (1) 10^9
- (2) Electric current
- (3) Pressure
- (4) One kilogram
- (5) Steradian

B

- (a) supplementary unit
- (b) 10^6 milligram
- (c) fundamental quantity
- (d) giga
- (e) pascal



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2. Match the quantities with their SI unit.

(A)

(B)

(A) Mass

(p) Ampere

(B) Temperature

(q) Metre

(C) Length

(r) Kelvin

(D) Current

(s) Kilogram



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3. Match the correct dimension with the given physical quantities.

A

B

(A) Energy

(p) $ML^{-1}T^{-1}$

(B) Force

(q) MLT^{-1}

(C) Momentum

(r) MLT^{-2}

(D) Coefficient of viscosity

(s) ML^2T^{-2}



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4. Match the quantities with their respective dimensions.

A

B

(A) Displacement	(p) MLT^{-2}
(B) Velocity	(q) M^0LT^{-2}
(C) Acceleration	(r) M^0LT^{-1}
(D) Force	(s) M^0LT^0

A. A-s, B-r, C-q, D-p

B. A-r, B-s, C-q, D-p

C. A-s, B-q, C-r, D-p

D. A-s, B-r, C-p, D-q

Answer:



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5. Match the following column.

A

B

(A) Work (p) kgm / s^2

(B) Force (q) m^2

(C) Speed (r) m / s

(D) Area (s) kgm^2 / s^2

A. A-s, B-p, C-r, D-q

B. A-p, B-s, C-r, D-q

C. A-s, B-r, C-p, D-q

D. A-s, B-p, C-q, D-r

Answer:



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Mandatory Exercise Exercise Set Ii Multiple Choice Questions With One Or More Than One Correct Answers

1. Which of the following are physical quantities?

A. Length

B. Mass

C. Colour

D. Wavelength

Answer:



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2. Which of the following are fundamental units?

A. newton

B. kelvin

C. pascal

D. ampere

Answer:



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3. Which of the following are not the units of distance?

A. Light year

B. Leap year

C. Square metre

D. Angstrom

Answer:



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4. Which of the following are derived units?

A. pascal

B. second

C. kilogram

D. litre

Answer:



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Mandatory Exercise Exercise Set Iii

1. Which of the following are not fundamental units?

A. ohm

B. mole

C. joule

D. hertz

Answer:



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2. If each drop of water has a radius of 1 mm, find the number of drops that may be filled in a cubical container of side 1 cm.



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3. The blinking time of an eye is equal to $30\mu\text{s}$.

What is the speed of light in metres per blink?

How far does light travel in one blink? Assume

the speed of light in vacuum is $3 \times 10^8 \text{ m s}^{-1}$.



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4. The angular speed of the Earth decreases with

time. This pace is indicated by the observations

of the occurrences of solar eclipse during this

period. Let us assume that the length of the day

uniformly increases by 0.001 s per century.

Calculate the cumulative effect on the measure

of time for a period of 10 centuries. (Express it in seconds).



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5. Suppose, it rains continuously at a constant rate during a thunderstorm and 1 million rain drops fall per second, the volume of each drop = 216mm^3 . If it rains continuously for 4 h, calculate the volume of water in liters ($1\text{ L} = 1000\text{ cm}^3 = 10^{-3}\text{ m}^3$).



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6. Estimate the number of atoms in a ring made out of 1cm^3 of gold.



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7. A cube has a side of length 2.342 m. Find the volume and the surface area with correct approximations.



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8. Find the density when a mass of 9.23 kg occupies a volume of $1.1m^3$ with correct approximations.



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9. A thin wire has a length of 21.7 cm and radius of 0.46 mm. Calculate the volume of the wire correct to two decimal places.



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10. Convert $G = 6.67 \times 10^{-11} Nm^2kg^{-2}$ to $cm^3s^{-2}g^{-1}$, where G is the universal gravitational constant.



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11. The value of Stefan's constant is $\sigma = 5.67 \times 10^{-8} Js^{-1}m^2K^{-4}$. Find its value in CGS system, where joule (J) and erg are the units of energy in SI and CGS system, respectively.



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12. Duration of the physics practical class in a school is 100 min. Express this period in microcenturies.



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General Exercise

1. What do you mean by unit?



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2. Define the fundamental units of SI system.



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3. Name a physical quantity which has same unit as of work?



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4. A unitless quantity is dimensionless. Is the statement true? If yes, explain.



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5. Derive the unit of energy in terms of the fundamental unit of SI system.



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6. What is the SI unit of pressure?



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7. What is the SI unit of angle, degree or radian?

Write down the relation between degree and

radian.



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8. Derive the dimension of gravitation constant

G. Given $F_{\text{gravitation}} = G \frac{m_1 m_2}{r^2}$.



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9. How is cm^3 related to litre as both of them are units of volume.



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10. What do you mean by a light year? Is a light year unit of time or a unit of length?



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11. Is it possible for two different physical quantities to have same dimension? If yes, give examples.



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12. Write down the CGS and SI unit of area. What is the relation between the CGS and SI unit of area?



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13. What is the unit of force in CGS system?



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14. Derive the SI unit of watt in terms of the fundamental unit.



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Olympiad And Ntse Level Exercises

1. If a new unit of length is chosen such that the distance travelled by light in vacuum in one second is unity, then the distance between the sun and the earth in terms of the new unit of light takes 8 min and 20 s to cover this distance is _____.

A. 500 new unit

B. 50 new unit

C. 5000 new unit

D. 5 new unit

Answer:



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2. If a force of 500 dyne is applied on a body to bring about a displacement of 200 m, then the amount of energy spent is equal to (take $1 \text{ J} = 1 \text{ Nm}$) _____.

A. 10 J

B. 1 J

C. 15 J

D. 20 J

Answer:



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3. The unit of the force is $\text{kg } m s^{-2}$. If the unit of length is halved and that of mass is doubled, then the unit of force will

A. be doubled

B. be quadrupled

C. become half of the original value

D. remain unaltered

Answer:



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4. 5.74 g of a substance occupies a volume of 1.2cm^3 . The density of this material with due regards to significant figures is _____.

A. $4.783gcm^{-3}$

B. $4.78gcm^{-3}$

C. $4.7gcm^{-3}$

D. $4.8gcm^{-3}$

Answer:



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5. To determine the Young's modulus of a wire,

the formula is $Y = \frac{F}{A} \times \frac{L}{\Delta L}$, where L = length,

A = area of cross-section of the wire, $\Delta L =$

change in length of the wire when stretched with a force F . The conversion factor to change it from CGS to MKS system is

A. 1

B. 10

C. 0.1

D. 0.01

Answer:



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6. If energy E , length L and time T are taken as fundamental quantities. The dimensional formula of gravitational constant is

A. $[FL^6E^{-2}]$

B. $[FL^5T^{-1}]$

C. $[E^2FL^6T^3]$

D. $[E^3F^{-1}L^6T^5]$

Answer:



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7. A bus travels distance x_1 when accelerates from rest at constant rate a_1 for some time and after that travels a distance x_2 when decelerates at a constant rate a_2 to come to rest. A student established a relation $x_1 + x_2 = \frac{a_1 a_2 t^2}{2(a_1 + a_2)}$.

Choose the correct option(s).

- A. The relation is dimensionally correct
- B. The relation is dimensionally incorrect
- C. The relation may be dimensionally correct
- D. None of the above

Answer:



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8. The position of a particle at time t is given by the relation $x(t) = \left(\frac{v_0}{\alpha}\right)(1 - e^{-\alpha t})$, where v_0 is a constant and $\alpha > 0$

The dimensions of v_0 and α are respectively

A. $M^0 L^{-1} T^{-1}$ and T^{-1}

B. $M^0 L^1 T^0$ and T^{-1}

C. $M^0 L^1 T^{-1}$ and LT^{-2}

D. $M^0 L^1 T^{-1}$ and T

Answer:



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