Physcis Holiday Home Work

Ch 01 Units and measurement

Objective Questions

Multiple Choice Questions

1. The quantity having the same unit in all system of unit is

(a) mass (b) time
(c) length (d) temperature

2. The SI unit of thermal conductivity is

(a) $J\ m^{-1}K^{-1}$ (b) W-m K^{-1}
(c) $W\ m^{-1}K^{-1}$ (d) Jm K^{-1}

3. The damping force on an oscillator is directly proportional to the velocity. The unit of the constant of proportionality is

(a) kg-ms^{-1} (b) kg-ms^{-2}
(c) kgs^{-1} (d) kg-s

4. The density of a material in SI units is 128 kg m^{-3}. In certain units in whichthe unit of length is 25 cm and the unit of mass is 50 g, the numerical value of density of the material is

(a) 40 (b) 16 (c) 640 (d) 410

5. If the value of work done is 10^{10} g-cm ^{2} s $^{-2}$, then its value in SI units will be

(a) 10 kg-$m^2 s^{-2}$ (b) 10^2 kg-$m^2 s^{-2}$
(c) 10^4 kg-$m^2 s^{-2}$ (d) 10^3 kg-$m^2 s^{-2}$

6. Amongst the following options, which is a unit of time?

(a) Light year (b) Parsec
(c) Year (d) None of these

7. The moon is observed from two diametrically opposite points *A* and *B* on earth. The angle θ subtended at the moon by the two directions of observation is 1°54′; given that the diameter of the earth to be about 1.276×10^7 m. Compute the distance of the moon from the earth.

(a) 4.5×10^9 m
(b) 3.83×10^8 m
(c) 2.5×10^4 m
(d) 4×10^7 m

8. The ratio of the volume of the atom to the volume of the nucleus is of the order of

(a) 10^{15} (b) 10^{25}
(c) 10^{20} (d) 10^{10}

9. Which of the following measurement is most precise? ***(NCERT Exemplar)***

(a) 5.00 mm (b) 5.00 cm
(c) 5.00 m (d) 5.00 km

10. A student measured the length of a rod and wrote it as 3.50 cm. Which instrument did he use to measure it?

(a) A meter scale
(b) A vernier calliper where the 10 divisions in vernier scale matches with 9 divisions in main scale and main scale has 10 divisions in 1 cm
(c) A screw gauge having 100 divisions in the circular scale and pitch as 1 mm
(d) A screw gauge having 50 divisions in the circular scale and pitch as 1 mm

11. The length, breadth and height of a rectangular block of wood were measured to be $l = 12.13 \pm 0.02$ cm, $b = 8.16 \pm 0.01$ cm and $h = 3.46 \pm 0.01$ cm.

(a) 0.88% (b) 0.58%
(c) 0.78% (d) 0.68%

12. A student measures the time period of 100 oscillations of a simple pendulum four times. The data set is 90 s, 91s, 92s and 95s. If the minimum division in the measuring clock is 1s, then the reported mean time should be

(a) (92 ± 2)s (b) (92 ± 5)s
(c) (92 ± 1.8)s (d) (92 ± 3)s

13. In successive experiments while measuring the period of oscillation of a simple pendulum. The readings turn out to be 2.63 s, 2.56 s, 2.42 s, 2.71s and 2.80 s. Calculate the mean absolute error.

(a) 0.11 s (b) 0.42 s (c) 0.92 s (d) 0.10 s

14. The period of oscillation of a simple pendulum is $T = 2\pi\sqrt{L/g}$. Measured value of L is 20 cm known to 1 mm accuracy and time for 100 oscillations of the pendulum is found to be 90 s using a wrist watch of 1s resolution.What is the percentage error in the determination of g?

(a) 5% (b) 3%
(c) 4% (d) 7%

15. Calculate the mean percentage error in five observations,

80.0, 80.5, 81.0, 81.5 and 82.

(a) 0.74% (b) 1.74%
(c) 0.38% (d) 1.38%

16. Calculate the relative errors in measurement of two masses 1.02 g ± 0.01g and 9.89g ± 0.01g .

(a) ± 1% and ± 0.2% (b) ± 1% and ± 0.1%
(c) ± 2% and ± 0.3% (d) ± 3% and ± 0.4%

17. The density of a material in the shape of a cube is determined by measuring three sides of the cube and its mass. If the relative errors in measuring the mass and length are respectively 1.5% and 1%, the maximum error in determining the density is

(a) 2.5% (b) 3.5% (c) 4.5% (d) 6%

18. Percentage errors in the measurement of mass and speed are 2% and 3%, respectively. The error in the estimation of kinetic energy obtained by measuring mass and speed will be

(a) 8% (b) 2%
(c) 12% (d) 10%

19. If the length of a pendulum is increased by 2%, then in a day, the pendulum

(a) loses 764 s (b) loses 924 s
(c) gains 236 s (d) loses 864 s

20. The length and breadth of a rectangular sheet are 16.2 cm and 10.1 cm, respectively. The area of the sheet in appropriate significant figures and error is

(NCERT Exemplar)

(a) 164 ± 3 cm^2 (b) 163.62 ± 2.6 cm^2
(c) 163.6 ± 2.6 cm^2 (d) 163.62 ± 3 cm^2

21. In an experiment, four quantities a, b, c and d are measured with percentage error 1%, 2%, 3% and 4%, respectively. Quantity P is calculated as follows $P = \frac{a^3 b^2}{cd}$, percentage error in P is

(a) 14% (b) 10% (c) 7% (d) 4%

22. A physical quantity z depends on four observables a, b, c and d, as $z = \frac{a^2 b^{2/3}}{\sqrt{c} d^3}$.

The percentages of error in the measurement of a, b, c and d are 2%, 1.5%, 4% and 2.5% respectively. The percentage of error in z is

(a) 13.5% (b) 16.5% (c) 14.5% (d) 12.25%

23. The respective number of significant figures for the numbers 23.023, 0.0003 and 2.1×10^{-3} are

(a) 5, 1, 2 (b) 5, 1, 5
(c) 5, 5, 2 (d) 4, 4, 2

24. If 3.8×10^{-6} is added to 42×10^{-6} giving due regard to significant figures, then the result will be

(a) 4.58×10^{-5} (b) 4.6×10^{-5}
(c) 45×10^{-5} (d) None of these

25. The numbers 5.355 and 5.345 on rounding off to 3 significant figures will give

(a) 5.35 and 5.34 (b) 5.36 and 5.35
(c) 5.35 and 5.35 (d) 5.36 and 5.34

26. The mass and volume of a body are 4.237 g and 2.5 cm^3, respectively. The density of the material of the body in correct significant figures is ***(NCERT Exemplar)***

(a) 1.6048 gcm^{-3} (b) 1.69 gcm^{-3}
(c) 1.7 gcm^{-3} (d) 1.695 gcm^{-3}

27. If mass M, distance L and time T are fundamental quantities, then find the dimensions of torque.

(a) $[ML^2T^{-2}]$ (b) $[MLT^{-2}]$
(c) $[MLT]$ (d) $[ML^2T]$

28. Let l, r, c and v represent inductance, resistance, capacitance and voltage, respectively. The dimension of $\frac{l}{rcv}$ in SI units will be

(a) $[LT^2]$ (b) $[LTA]$
(c) $[A^{-1}]$ (d) $[LA^{-2}]$

29. Obtain the dimensional formula for universal gas constant.

(a) $[ML^2T^{-2}mol^{-1}K^{-1}]$
(b) $[ML^3T^{-1}mol^{-2}K^{-2}]$
(c) $[M^2LT^{-1}mol^{-1}K^{-1}]$
(d) $[M^3LT^{-2}mol^{-1}K^{-2}]$

30. Which two of the following five physical parameters have the same dimensions?

I. Energy density
II. Refractive index
III. Dielectric constant
IV. Young's modulus
V. Magnetic field

(a) I and IV (b) III and V
(c) I and II (d) I and V

31. If P, Q, R are physical quantities, having different dimensions, which of the following combinations can never be a meaningful quantity?

(a) $(P-Q)/R$ (b) $PQ-R$
(c) PQ/R (d) $(PR-Q^2)/R$

32. The potential energy of a particle varies with distance x from a fixed origin as $U=\frac{A\sqrt{x}}{x+B}$, where A and B are constants. The dimensions of AB are

(a) $[ML^{5/2}T^{-2}]$ (b) $[ML^2T^{-2}]$
(c) $[M^{3/2}L^3T^{-2}]$ (d) $[ML^{7/2}T^{-2}]$

33. In the formula, $X=3YZ^2$, X and Z have dimensions of capacitance and magnetic induction. The dimensions of Y in MKSQ system are

(a) $[M^{-3}L^{-2}T^4Q^4]$ (b) $[ML^2T^8Q^4]$
(c) $[M^{-2}L^{-3}T^2Q^4]$ (d) $[M^{-2}L^{-2}TQ^2]$

34. If the velocity v (in cms^{-1}) of a particle is given in terms of t (in second) by the relation $v=at+\frac{b}{t+c}$,

then the dimensions of a, b and c are

	a	b	c
(a)	$[L]$	$[LT]$	$[T^2]$
(b)	$[L^2]$	$[T]$	$[LT^{-2}]$
(c)	$[LT^2]$	$[LT]$	$[L]$
(d)	$[LT^{-2}]$	$[L]$	$[T]$

35. A book with many printing errors contains four different formulae for the displacement y of a particle under going a certain periodic motion,

where, a = maximum displacement of the particle, v = speed of the particle, T = time period of motion.
Which are the correct formulae on dimensional grounds?

(a) $y=a\sin\frac{2\pi t}{T}$ (b) $y=a\sin vt$
(c) $y=\left(\frac{a}{T}\right)\sin(t/a)$ (d) None of these

36. If speed V, area A and force F are chosen as fundamental units, then the dimensional formula of Young's modulus will be

(a) $[FA^2V^{-3}]$ (b) $[FA^{-1}V^0]$
(c) $[FA^2V^{-2}]$ (d) $[FA^2V^{-1}]$

37. If dimensions of critical velocity v_c of a liquid flowing through a tube are expressed as $[\eta^x \rho^y r^z]$, where η, ρ and r are the coefficient of viscosity of liquid, density of liquid and radius of the tube respectively, then the values of x, y and z are given by

(a) 1, −1, −1 (b) −1, −1, 1
(c) −1, −1, −1 (d) 1, 1, 1

38. The density of a material in CGS system is 10 g cm^{-3}. If unit of length becomes 10 cm and unit of mass becomes 100 g, the new value of density will be

(a) 10 units (b) 100 units
(c) 1000 units (d) 1 unit

39. When 1 m, 1 kg and 1 min are taken as the fundamental units, the magnitude of the force is 36 units. What will be the value of this force in CGS system?

(a) 10^5 dyne (b) 10^3 dyne
(c) 10^8 dyne (d) 10^4 dyne

40. The solid angle subtended by the periphery of an area 1 cm^2 at a point situated symmetrically at a distance of 5 cm from the area is ……… steradian.

(a) 2×10^{-2} (b) 4×10^{-2} (c) 6×10^{-2} (d) 8×10^{-2}

41. Measure of two quantities along with the precision of respective measuring instrument is $A = 2.5\ ms^{-1} \pm 0.5\ ms^{-1}$, $B = 0.10\ s \pm 0.01\ s$. The value of AB will be ……… . ***(NCERT Exemplar)***

(a) (0.25 ± 0.08) m (b) (0.25 ± 0.5) m
(c) (0.25 ± 0.05) m (d) (0.25 ± 0.135) m

42. It is claimed that two cesium clocks, if allowed to run for 100 yrs without any disturbance may differ by only about 0.02 s. Then the accuracy of the clock in measuring a time interval of 1 s is ……… .

(a) 10^{-10} (b) 10^{-11}
(c) 10^{-5} (d) 10^{-8}

43. Photon is quantum of radiation with energy $E = h\nu$, where ν is frequency and h is Planck's constant. The dimensions of h are the same as that of ……… .

(a) linear impulse
(b) angular impulse
(c) linear momentum
(d) energy

44. Which amongst the following statement is incorrect regarding mass?

(a) Its SI unit is kilogram.
(b) It does not depend on the location of the object in space.
(c) It is the basic property of matter.
(d) While dealing with atoms, kilogram is a convenient unit for measuring mass.

45. Choose the incorrect statement out of the following.

(a) Every measurement by any measuring instrument has some errors.
(b) Every calculated physical quantity that is based on measured values has some errors.
(c) A measurement can have more accuracy but less precision and *vice-versa*.
(d) The percentage error is different from relative error.

46. Given that T stands for time period and l stands for the length of simple pendulum. If g is the acceleration due to gravity, then which of the following statements about the relation $T^2 = l/g$ is correct?

(a) It is correct both dimensionally as well as numerically.
(b) It is neither dimensionally correct nor numerically.
(c) It is dimensionally correct but not numerically.
(d) It is numerically correct but not dimensionally.

47. Match the following columns.

	Column I		Column II
A.	Capacitance	p.	volt $(\text{ampere})^{-1}$
B.	Magnetic induction	q.	volt-sec $(\text{ampere})^{-1}$
C.	Inductance	r.	newton $(\text{ampere})^{-1}$ $(\text{metre})^{-1}$
D.	Resistance	s.	$\text{coulomb}^2(\text{joule})^{-1}$

Codes

	A	B	C	D
(a)	q	r	s	p
(b)	s	r	q	p
(c)	r	s	p	q
(d)	s	p	q	r

48. Match the Column I (unit) with Column II (value) and select the correct option from the codes given below.

	Column I		Column II
A.	1 are	p.	200 mg
B.	1 bar	q.	1.013×10^5 Pa
C.	1 carat	r.	10^2 m^2

Codes

	A	B	C		A	B	C
(a)	q	p	r	(b)	r	r	p
(c)	r	q	p	(d)	r	p	q

49. Names of units of some physical quantities are given in Column I and their dimensional formulae are given in Column II and select the correct option from the codes given below.

	Column I		Column II
A.	Pa-s	p.	$[L^2T^{-2}K^{-1}]$
B.	Nm-K^{-1}	q.	$[MLT^{-2}A^{-1}K^{-1}]$
C.	J kg^{-1} K^{-1}	r.	$[ML^{-1}T^{-1}]$
D.	Wb m^{-1} K^{-1}	s.	$[ML^2T^{-2}K^{-1}]$

Codes

	A	B	C	D
(a)	s	r	p	q
(b)	r	q	s	p
(c)	r	p	s	q
(d)	r	s	p	q

Assertion-Reasoning MCQs

For question numbers 50 to 59, two statements are given-one labelled ***Assertion*** *(A) and the other labelled* ***Reason*** *(R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) are as given below*

(a) Both A and R are true and R is the correct explanation of A.
(b) Both A and R are true but R is not the correct explanation of A.
(c) A is true but R is false.
(d) A is false and R is also false.

50. Assertion Unit chosen for measuring physical quantities should not be easily reproducible.

Reason Unit should change with the changing physical conditions like temperature, pressure, etc.

51. Assertion The unit used for measuring nuclear cross-section is ‘barn’.

Reason 1 barn = 10^{-14} m^2.

52. Assertion When we change the unit of measurement of a quantity, its numerical value changes.

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

53. Assertion Parallax method is used for measuring distances of nearby stars only.

Reason With increase in the distance of star from earth, the parallactic angle becomes too small to be measured accurately.

54. Assertion Out of two measurements l = 0.7 m and l = 0.70 m, the second one is more accurate.

Reason In every measurement, the last digit is not accurately know.

55. Assertion Random errors arise due to random and unpredictable fluctuations in experimental conditions.

Reason Random errors occurred due to irregularly with respect to sign and size.

56. Assertion When a quantity appears with a power n greater than one in an expression, its error contribution to the final result decreases n times.

Reason In all mathematical operations, the errors are not additive in nature.

57. Assertion Special functions such as trigonometric, logarithmic and exponential functions are not dimensionless.

Reason A pure number, ratio of similar physical quantities, such as angle and refractive index, has some dimensions.

58. Assertion Specific gravity of a fluid is a dimensionless quantity.

Reason It is the ratio of density of fluid to the density of water.

59. Assertion The method of dimensions analysis cannot validate the exact relationship between physical quantities in any equation.

Reason It does not distinguish between the physical quantities having same dimensions.

Case Based MCQs

Direction Answer the questions from 60-64 on the following case.

Measurement of Physical Quantity

All engineering phenomena deal with definite and measured quantities and so depend on the making of the measurement. We must be clear and precise in making these measurements. To make a measurement, magnitude of the physical quantity (unknown) is compared.

The record of a measurement consists of three parts, i.e. the dimension of the quantity, the unit which represents a standard quantity and a number which is the ratio of the measured quantity to the standard quantity.

60. A device which is used for measurement of length to an accuracy of about 10^{-5} m, is

(a) screw gauge (b) spherometer
(c) vernier callipers (d) Either (a) or (b)

61. Which of the technique is not used for measuring time intervals?

(a) Electrical oscillator
(b) Atomic clock
(c) Spring oscillator
(d) Decay of elementary particles

62. The mean length of an object is 5 cm. Which of the following measurements is most accurate?

(a) 4.9 cm (b) 4.805 cm
(c) 5.25 cm (d) 5.4 cm

63. If the length of rectangle l = 10.5 cm, breadth b = 2.1 cm and minimum possible measurement by scale = 0.1 cm, then the area is

(a) 22.0 cm^2 (b) 21.0 cm^2
(c) 22.5 cm^2 (d) 21.5 cm^2

64. Age of the universe is about 10^{10} yr, whereas the mankind has existed for 10^6 yr. For how many seconds would the man have existed, if age of universe were 1 day?

(a) 9.2 s (b) 10.2 s
(c) 8.6 s (d) 10.5 s

Direction *Answer the questions from 65-69 on the following case.*

Significant Digits

Normally, the reported result of measurement is a number that includes all digits in the number that are known reliably plus first digit that is uncertain. The digits that are known reliably plus the first uncertain digit are known as significant digits or significant figures.

e.g. When a measured distance is reported to be 374.5 m, it has four significant figures 3, 7, 4 and 5. The figures 3, 7, 4 are certain and reliable, while the digit 5 is uncertain. Clearly, the digits beyond the significant digits reported in any result are superfluous.

65. In 4700 m, significant digits are

(a) 2 (b) 3 (c) 4 (d) 5

66. To determine the number of significant figures, scientific notation is

(a) a^b (b) $a \times 10^b$
(c) $a \times 10^2$ (d) $a \times 10^4$

67. 5.74 g of a substance occupies $1.2\ cm^3$. Express its density by keeping the significant figures in view.

(a) $4.9\ g\ cm^{-3}$ (b) $5.2\ g\ cm^{-3}$
(c) $4.8\ g\ cm^{-3}$ (d) $4.4\ g\ cm^{-3}$

68. Choose the correct option.

(a) Change in unit does not change the significant figure.
(b) 4.700 m = 4700 mm, here there is a change of significant number from 4 to 2 due to change in unit.
(c) 4700 m = 4.700×10^3 m, here there is change in numbers of significant numbers.
(d) Change in unit changes the number of significant figure.

69. Consider the following rules of significant figures.

I. All the non-zero digits are significant.
II. All the zeroes between two non-zero digits are significant.
III. The terminal or trailing zero(s) in a number without a decimal point are significant.

Which of the above statement(s) is/are correct?

(a) I and II (b) II and III
(c) I and III (d) All of these

Direction *Answer the questions from 70-74 on the following case.*

Combination of Errors

Maximum absolute error in the sum or difference of two quantities is equal to sum of the absolute error in the individual quantities, i.e. $Z = A + B$, then $\pm \Delta Z = \pm \Delta A \pm \Delta B$

Maximum fractional error in a product or division of quantities is equal to the sum of fractional errors in the individual quantities

i.e. AB or $\frac{A}{B}$, then $\frac{\Delta Z}{Z} = \pm \frac{\Delta A}{A} + \frac{\Delta B}{B}$

Two resistors of resistances $R_1 = 100 \pm 3\ \Omega$ and $R_2 = 200 \pm 4\Omega$ are connected (a) in series and (b) in parallel.

70. The percentage error in the value of R_1 is

(a) 3% (b) 4% (c) 6% (d) 0.3%

71. The fractional error in the value of R_2 is

(a) $\frac{1}{40}$ (b) $\frac{1}{50}$
(c) $\frac{1}{100}$ (d) $\frac{1}{200}$

72. Find the equivalent resistance of the series combination.

(a) $(250 \pm 7)\ \Omega$
(b) $(320 \pm 6)\ \Omega$
(c) $(300 \pm 7)\ \Omega$
(d) $(300 \pm 1)\ \Omega$

73. The percentage error in equivalent resistance in series combination is

(a) 2% (b) 2.3%
(c) 2.5% (d) 3%

74. Find the equivalent resistance of the parallel combination having error of $1.8\ \Omega$.

(a) $(66 \pm 1)\ \Omega$ (b) $(66.7 \pm 1.8)\ \Omega$
(c) $(66.3 \pm 2)\ \Omega$ (d) $(67 \pm 3)\ \Omega$

Direction *Answer the questions from 75-79 on the following case.*

Dimensional analysis and its applications

The expression which shows how and which of the base quantities represent the dimensions of a physical quantity is called the dimensional formula of the given physical quantity. The recognition of concepts of dimensions, which guide the description of physical behaviour is of basic importance as only those physical quantities can be added or subtracted which have the same dimensions. A thorough understanding of dimensional analysis helps us in deducing certain relations among different physical quantities and checking the derivation, accuracy and dimensional consistency or homogeneity of various mathematical expressions. When magnitudes of two or more physical quantities are multiplied, their units should be treated in the same manner as ordinary algebraic symbols. We can cancel identical units in the numerator and denominator. The same is true for dimensions of a physical quantity. Similarly, physical quantities represented by symbols on both sides of a mathematical equation must have the same dimensions.

75. Statement I The method of dimensions analysis cannot validate the exact relationship between physical quantities in any equation.

Statement II It does not distinguish between the physical quantities having same dimensions.

Which of the following statement(s) is/are correct?

(a) Only I (b) I and II
(c) Only II (d) None of these

76. The quantity having same dimension as that of Planck's constant is

(a) work (b) linear momentum
(c) angular momentum (d) impulse

77. If speed v, acceleration A and force F, are considered as fundamental units, the dimension of Young's modulus will be

(a) $[v^{-4}A^{-2}F]$ (b) $[v^{-2}A^{2}F^{2}]$
(c) $[v^{-2}A^{2}F^{-2}]$ (d) $[v^{-4}A^{2}F^{1}]$

78. Given that, the amplitude of the scattered light is

(i) directly proportional to amplitude of incident light
(ii) directly proportional to the volume of the scattering dust particle
(iii) inversely proportional to its distance from the scattering particle and
(iv) dependent upon the wavelength Z of the light.

Then, the relation of intensity of scattered light with the wavelength is

(a) $\frac{1}{Z^2}$ (b) $\frac{1}{Z^4}$ (c) $\frac{1}{Z^6}$ (d) $\frac{1}{Z^7}$

79. Find the value of power of 60 J/min on a system that has 100 g, 100 cm and 1 min as the base units.

(a) 2.16×10^4 units (b) 2.16×10^6 units
(c) 3×10^4 units (d) 4×10^7 units

ANSWERS

Multiple Choice Questions

1. (b)	2. (c)	3. (c)	4. (a)	5. (d)	6. (c)	7. (b)	8. (a)	9. (a)	10. (b)
11. (b)	12. (a)	13. (a)	14. (b)	15. (a)	16. (b)	17. (c)	18. (a)	19. (d)	20. (a)
21. (a)	22. (c)	23. (a)	24. (b)	25. (d)	26. (c)	27. (a)	28. (c)	29. (a)	30. (a)
31. (a)	32. (d)	33. (a)	34. (d)	35. (a)	36. (b)	37. (a)	38. (b)	39. (b)	40. (b)
41. (a)	42. (b)	43. (b)	44. (d)	45. (d)	46. (c)	47. (b)	48. (c)	49. (d)	

Assertion-Reasoning MCQs

50. (d)	51. (c)	52. (c)	53. (a)	54. (b)	55. (b)	56. (d)	57. (d)	58. (a)	59. (a)

Case Based MCQs

60. (d)	61. (c)	62. (a)	63. (a)	64. (c)	65. (a)	66. (b)	67. (c)	68. (a)	69. (a)
70. (a)	71. (b)	72. (c)	73. (b)	74. (b)	75. (b)	76. (c)	77. (d)	78. (b)	79. (b)

SOLUTIONS

1. Time is the quantity which has same unit in all systems of unit, i.e. second. Other three quantities, i.e. mass, length and temperature have different units in different system of units.

2. The coefficient of thermal conductivity is given by

$$K = \frac{L}{A\Delta T}\frac{dQ}{dt}$$

where, L = length of conductor, A = area of conductor, ΔT = change in temperature and $\frac{dQ}{dt}$ = rate of flow of heat.

$$\therefore \text{ Unit of } K = \frac{\text{metre}}{(\text{metre})^2 \times (\text{kelvin})} \times \text{watt}$$

$$= \text{Wm}^{-1}\text{K}^{-1}$$

3. Given, damping force $\propto$ velocity

$$F \propto v \Rightarrow F = kv \Rightarrow k = \frac{F}{v}$$

$$\text{Unit of } k = \frac{\text{Unit of } F}{\text{Unit of } v} = \frac{\text{kg - ms}^{-2}}{\text{ms}^{-1}} = \text{kg s}^{-1}$$

4. To convert a measured value from one system to another system, we use

$$N_1u_1 = N_2u_2$$

where, N is numeric value and u is unit.

We get,

$$\therefore \quad 128\,\frac{\text{kg}}{\text{m}^3} = N_2\,\frac{50\text{ g}}{(25\text{ cm})^3} \quad \left[\because \text{density} = \frac{\text{mass}}{\text{volume}}\right]$$

$$\Rightarrow \frac{128 \times 1000\text{ g}}{100 \times 100 \times 100\text{ cm}^3} = \frac{N_2 \times 50\text{ g}}{25 \times 25 \times 25\text{ cm}^3}$$

$$\Rightarrow \quad N_2 = \frac{128 \times 1000 \times 25 \times 25 \times 25}{50 \times 100 \times 100 \times 100} = 40$$

5. Given, work done,

$$W = 10^{10}\text{ g-cm}^2\text{s}^{-2}$$

which is in CGS system of units.

In SI unit, $W = 10^{10}\,\frac{\text{g}}{\text{s}^2}\,\text{cm}^2$

$$= 10^{10}\,\frac{(10^{-3}\text{ kg})(10^{-4}\text{ m}^2)}{1\text{s}^2}$$

$$= 10^3\text{ kg-m}^2\text{s}^{-2}$$

6. We know that, 1 light year $= 9.46 \times 10^{11}$ m

= distance that light travels in 1 year with speed 3×10^8 m/s.

1 parsec $= 3.08 \times 10^{16}$ m

= Distance at which average radius of earth's orbit subtends an angle of 1 parsecond.

Here, year represent time.

Objective Questions

Multiple Choice Questions

1. Which of the following is an example of one-dimensional motion?

(a) Landing of an aircraft
(b) Earth revolving around the sun
(c) Motion of wheels of moving train
(d) Train running on a straight track

2. The coordinates of object with respect to a frame of reference at $t = 0$ s are $(-1, 0, 3)$. If $t = 5$ s, its coordinates are $(-1, 0, 4)$, then the object is in

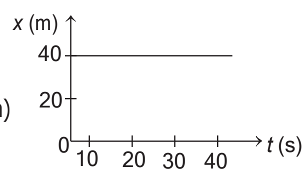
(a) motion along Z-axis
(b) motion along X-axis
(c) motion along Y-axis
(d) rest position between $t = 0$ s and $t = 5$ s

3. A person moves towards east for 3 m, then towards north for 4 m and then moves vertically up by 5 m. What is his distance now from the starting point?

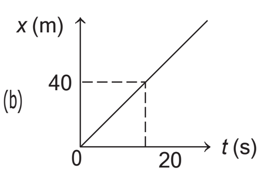
(a) $5\sqrt{2}$ m (b) 5 m (c) 10 m (d) 20 m

4. For a stationary object at $x = 40$ m, the position-time graph is

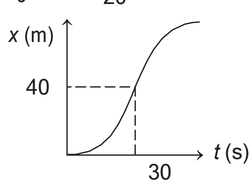
(a)



(b)



(c)



(d) None of the above

5. The displacement of a car is given as − 240 m, here negative sign indicates

(a) direction of displacement
(b) negative path length
(c) position of car at that point
(d) no significance of negative sign

6. Snehit starts from his home and walks 50 m towards north, then he turns towards east and walks 40 m and then reaches his school after moving 20 m towards south. Then, his displacement from his home to school is

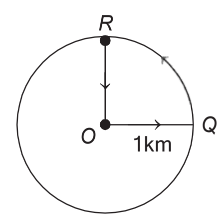
(a) 50 m (b) 110 m
(c) 80 m (d) 40 m

7. A vehicle travels half the distance l with speed v_1 and the other half with speed v_2, then its average speed is

(NCERT Exemplar)

(a) $\frac{v_1 + v_2}{2}$ (b) $\frac{2v_1 + v_2}{v_1 + v_2}$ (c) $\frac{2v_1 v_2}{v_1 + v_2}$ (d) $\frac{l(v_1 + v_2)}{v_1 v_2}$

8. A runner starts from O and comes back to O following path $OQRO$ in 1h. What is his net displacement and average speed?



(a) 0,3.57 km/h (b) 0,0 km/h
(c) 0,2.57 km/h (d) 0,1 km/h

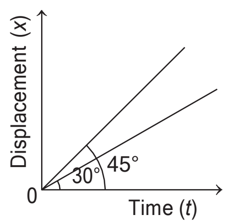
9. The sign (+ ve or – ve) of the average velocity depends only upon

(a) the sign of displacement
(b) the initial position of the object
(c) the final position of the object
(d) None of the above

10. Find the average velocity, when a particle completes the circle of radius 1m in 10 s.

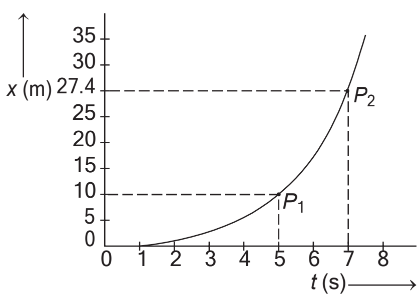
(a) 2 m/s (b) 3.14 m/s (c) 6.28 m/s (d) zero

11. The displacement-time graph of two moving particles make angles of 30° and 45° with the X-axis. The ratio of their velocities is



(a) $1:\sqrt{3}$ (b) 1:2 (c) 1:1 (d) $\sqrt{3}:2$

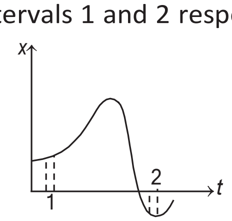
12. In figure, displacement-time (x - t) graph given below, the average velocity between time t = 5 s and t = 7 s is



(a) 8 ms^{-1} (b) 8.7 ms^{-1}

(c) 7.8 ms^{-1} (d) 13.7 ms^{-1}

13. Figure shows the x-t plot of a particle in one-dimensional motion. Two different equal intervals of time show speed in time intervals 1 and 2 respectively, then



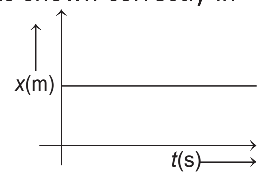
(a) $v_1 > v_2$

(b) $v_2 > v_1$

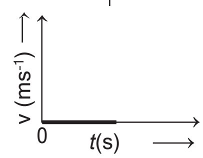
(c) $v_1 = v_2$

(d) Data insufficient

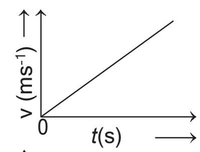
14. For the x-t graph given below, the v-t graph is shown correctly in



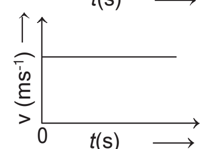
(a)



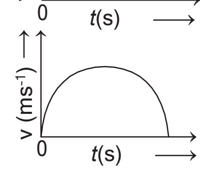
(b)



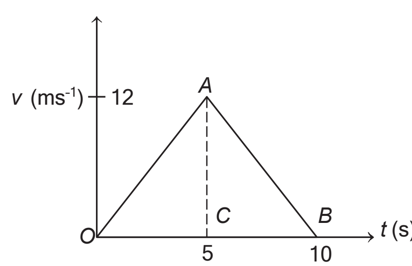
(c)



(d)



15. The speed-time graph of a particle moving along a fixed direction is as shown in the figure. The distance traversed by the particle between t = 0 s to t = 10 s is



(a) 20 m (b) 40 m (c) 60 m (d) 80 m

16. If an object is moving in a straight line, then

(a) the directional aspect of vector can be specified by + ve and – ve signs
(b) instantaneous speed at an instant is equal to the magnitude of the instantaneous velocity at that instant
(c) Both (a) and (b)
(d) Neither (a) nor (b)

17. In one dimensional motion, instantaneous speed v satisfies $0 \le v < v_0$. Then *(NCERT Exemplar)*

(a) displacement in time T must always take non-negative values
(b) displacement x in time T satisfies $-v_0 T < x < v_0 T$
(c) acceleration is always a non-negative number
(d) motion has no turning points

18. The x-t equation is given as $x = 2t + 1$. The corresponding v-t graph is

(a) a straight line passing through origin
(b) a straight line not passing through origin
(c) a parabola
(d) None of the above

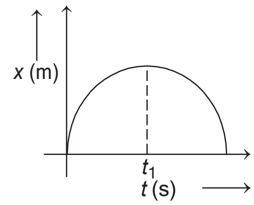
19. The displacement x of an object is given as a function of time, $x = 2t + 3t^2$. The instantaneous velocity of the object at $t = 2$ s is

(a) 16 ms^{-1} (b) 14 ms^{-1}
(c) 10 ms^{-1} (d) 12 ms^{-1}

20. The displacement of a particle starting from rest (at $t = 0$) is given by $s = 6t^2 - t^3$. The time in seconds at which the particle will attain zero velocity again is

(a) 2 (b) 4 (c) 6 (d) 8

21. A car moves along a straight line according to the x-t graph given below. The instantaneous velocity of the car at $t = t_1$ is

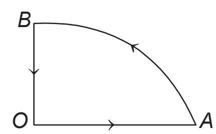


(a) zero
(b) positive
(c) Data insufficient
(d) Cannot be determined

22. A particle moves in a straight line. It can be accelerated

(a) only, if its speed changes by keeping its direction same
(b) only, if its direction changes by keeping its speed same
(c) Either by changing its speed or direction
(d) None of the above

23. An object is moving along the path $OABO$ with constant speed, then



(a) the acceleration of the object while moving along to path $OABO$ is zero
(b) the acceleration of the object along the path OA and BO is zero
(c) there must be some acceleration along the path AB
(d) Both (b) and (c)

24. The average velocity of a body moving with uniform acceleration travelling a distance of 3.06 m is 0.34 ms^{-1}. If the change in velocity of the body is 0.18 ms^{-1} during this time, its uniform acceleration is

(a) 0.01 ms^{-2}
(b) 0.02 ms^{-2}
(c) 0.03 ms^{-2}
(d) 0.04 ms^{-2}

25. The slope of the straight line connecting the points corresponding to (v_2, t_2) and (v_1, t_1) on a plot of velocity *versus* time gives

(a) average velocity
(b) average acceleration
(c) instantaneous velocity
(d) None of the above

26. The displacement x of a particle at time t along a straight line is given by $x = \alpha - \beta t + \gamma t^2$. The acceleration of the particle is

(a) $-\beta$ (b) $-\beta + 2\gamma$ (c) 2γ (d) -2γ

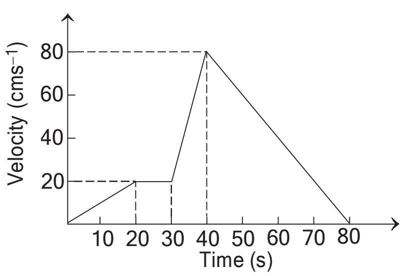
27. The displacement (in metre) of a particle moving along X-axis is given by $x = 18t + 5t^2$. The average acceleration during the interval $t_1 = 2$ s and $t_2 = 4$ s is

(a) 13 ms^{-2} (b) 10 ms^{-2}
(c) 27 ms^{-2} (d) 37 ms^{-2}

28. The relation between time and distance is $t = \alpha x^2 + \beta x$, where α and β are constants. The retardation is

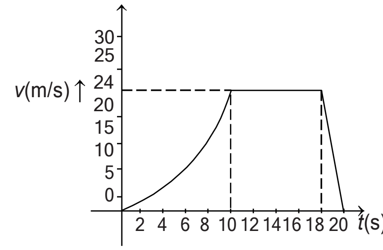
(a) $2\alpha v^3$ (b) $2\beta v^3$
(c) $2\alpha\beta v^3$ (d) $2\beta^2 v^3$

29. The v-t graph of a moving object is shown in the figure. The maximum acceleration is

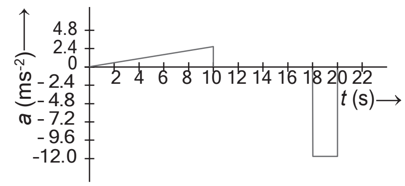


(a) 1 cms^{-2} (b) 2 cms^{-2}
(c) 3 cms^{-2} (d) 6 cms^{-2}

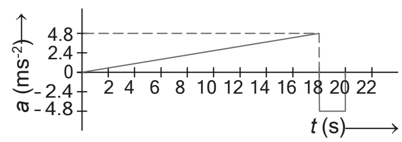
30. The resulting a-t graph for the given v-t graph is correctly represented in



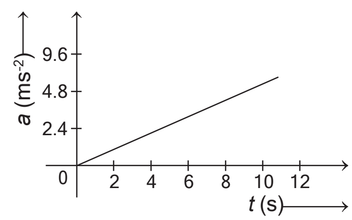
(a)



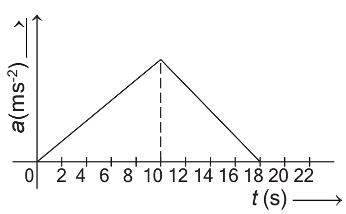
(b)



(c)



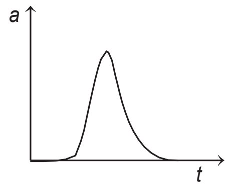
(d)



31. The kinematic equations of rectilinear motion for constant acceleration for a general situation, where the position coordinate at $t = 0$ is non-zero, say x_0 is

(a) $v = v_0 + at$
(b) $x = x_0 + v_0 t + \frac{1}{2}at^2$
(c) $v^2 = v_0^2 + 2a(x - x_0)$
(d) All of the above

32. The given acceleration-time graph represents which of the following physical situations?

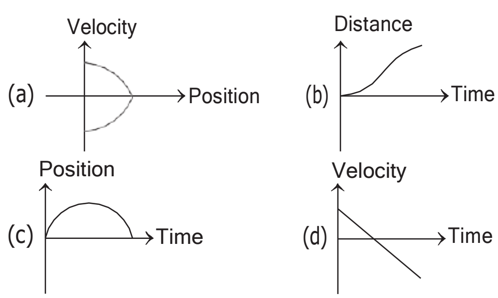


(a) A cricket ball moving with a uniform speed is hit with a bat for a very short time interval.
(b) A ball is falling freely from the top of a tower.
(c) A car moving with constant velocity on a straight road.
(d) A football is kicked into the air vertically upwards.

33. An object is moving with velocity $10\ ms^{-1}$. A constant force acts for 4 s on the object and gives it a speed of $2\ ms^{-1}$ in opposite direction. The acceleration produced is

(a) $3ms^{-2}$ (b) $-3ms^{-2}$
(c) $6\ ms^{-2}$ (d) $-6\ ms^{-2}$

34. All the graphs below are intended to represent the same motion. One of them does it incorrectly. Pick it up.



35. Velocity of a body moving along a straight line with uniform acceleration *a* reduces by (3/4)th of its initial velocity in time t_0. The total time of motion of the body till its velocity becomes zero is

(a) $\frac{4}{3}t_0$ (b) $\frac{3}{2}t_0$ (c) $\frac{5}{3}t_0$ (d) $\frac{8}{3}t_0$

36. A particle is situated at $x = 3$ units at $t = 0$. It starts moving from rest with a constant acceleration of $4\ ms^{-2}$. The position of the particle at $t = 3$ s is

(a) $x = +21$ units (b) $x = +18$ units
(c) $x = -21$ units (d) None of these

37. Consider the relation for relative velocities between two objects *A* and *B*,

$$v_{BA} = -v_{AB}$$

The above equation is valid, if

(a) v_A and v_B are average velocities
(b) v_A and v_B are instantaneous velocities
(c) v_A and v_B are average speed
(d) Both (a) and (b)

38. A person is moving with a velocity of $10\ \text{m s}^{-1}$ towards north. A car moving with a velocity of $20\ \text{ms}^{-1}$ towards south crosses the person.
The velocity of car relative to the person is

(a) $-30\ ms^{-1}$ (b) $+20ms^{-1}$
(c) $10\ ms^{-1}$ (d) $-10\ ms^{-1}$

39. A motion of a body is said to be ......, if it moves along a straight line in any direction.

(a) one-dimensional
(b) two dimensional
(c) three-dimensional
(d) All of the above

40. The numerical ratio of displacement to the distance covered by an object is always equal to or less than ....

(a) 1 (b) zero
(c) Both (a) and (b) (d) infinity

41. The time taken by a 150 m long train to cross a bridge of length 850 m is 80 s. It is moving with a uniform velocity of ...... km/h.

(a) 45 (b) 90
(c) 60 (d) 70

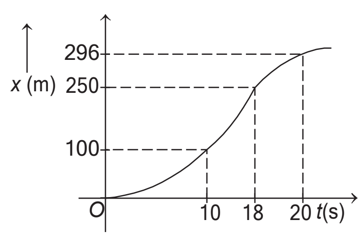
42. The distance-time graph of …… is a straight line.

(a) uniform motion
(b) non-uniform motion
(c) uniform acceleration
(d) None of the above

43. Which of the following statement is correct?

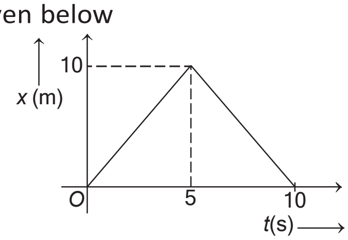
(a) The magnitude of average velocity is the average speed.
(b) Average velocity is the displacement divided by time interval.
(c) When acceleration of particle is constant, then motion is called as non-uniformly accelerated motion.
(d) When a particle returns to its starting point, its displacement is non-zero.

44. For motion of the car between $t = 18$ s and $t = 20$ s, which of the given statement is correct?



(a) The car is moving in a positive direction with a positive acceleration.
(b) The car is moving in a negative direction with a positive acceleration.
(c) The car is moving in positive direction with a negative acceleration.
(d) The car is moving in negative direction with a negative acceleration.

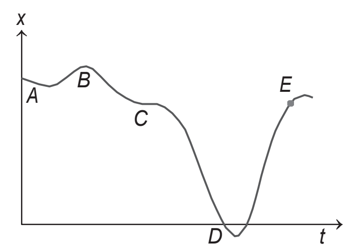
45. The x-t graph for motion of a car is given below



With reference to the graph, which of the given statement(s) is/are incorrect?

(a) The instantaneous speed during the interval $t = 5$ s to $t = 10$ s is negative at all time instants during the interval.
(b) The velocity and the average velocity for the interval $t = 0$ s to $t = 5$ s are equal and positive.
(c) The car changes its direction of motion at $t = 5$ s.
(d) The instantaneous speed and the instantaneous velocity are positive at all time instants during the interval $t = 0$ s to $t = 5$ s.

46. A graph of x *versus* t is shown in figure. Choose correct statement given below.



(a) The particle having some initial velocity at $t = 0$.
(b) At point B, the acceleration $a > 0$.
(c) At point C, the velocity and the acceleration vanish.
(d) The speed at E exceeds that at D.

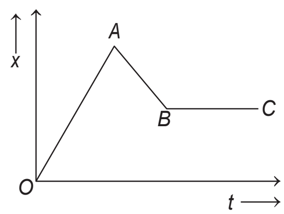
47. Match the Column I with Column II and select the correct option from the codes given below

	Column I		Column II
A.	$d\,\mathbf{v}/dt$	p.	Acceleration
B.	$d\,\lvert\mathbf{v}\rvert/dt$	q.	Rate of change of speed
C.	$\frac{d\,\mathrm{r}}{dt}$	r.	Velocity
D.	$\frac{d\,\lvert\mathrm{r}\rvert}{dt}$	s.	Magnitude of velocity

Codes

	A	B	C	D
(a)	p	q	r	s
(b)	p	r	s	q
(c)	q	p	r	s
(d)	s	r	p	q

48. Given x-t graph represents the motion of an object. Match the Column I (parts of graph) with Column II (representation) and select the correct option from the codes given below.

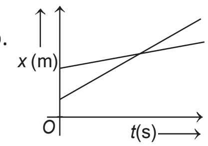
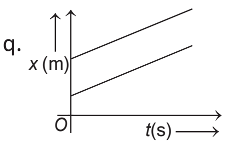
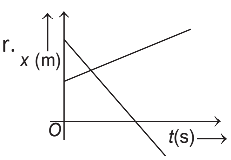


	Column I		Column II
A.	Part *OA* of graph	p.	Positive velocity
B.	Part *AB* of graph	q.	Object at rest
C.	Part *BC* of graph	r.	Negative velocity
D.	Point *A* in the graph	s.	Change in direction of motion

Codes

	A	B	C	D
(a)	p	q	r	s
(b)	p	r	q	s
(c)	q	p	r	s
(d)	s	r	q	p

49. Match the Column I (position-time graph) with Column II (representation) and select the correct option from the codes given below.

	Column I		Column II
A.	Position-time graph of two objects with equal velocities.	p.	
B.	Position-time graph of two objects with unequal velocities but in same direction.	q.	
C.	Position-time graph of two objects with velocities in opposite direction.	r.	

Codes

	A	B	C
(a)	p	q	r
(b)	q	p	r
(c)	p	r	q
(d)	q	r	p

Assertion-Reasoning MCQs

For question numbers 50 to 63, two statements are given-one labelled ***Assertion*** *(A) and the other labelled* ***Reason*** *(R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) are as given below*

(a) Both A and R are true and R is the correct explanation of A.
(b) Both A and R are true but R is not the correct explanation of A.
(c) A is true but R is false.
(d) A is false and R is also false.

50. Assertion In real-life, in a number of situations, the object is treated as a point object.

Reason An object is treated as point object, as far as its size is much smaller than the distance, it moves in a reasonable duration of time.

51. Assertion If the displacement of the body is zero, the distance covered by it may not be zero.

Reason Displacement is a vector quantity and distance is a scalar quantity.

52. Assertion An object can have constant speed but variable velocity.

Reason SI unit of speed is m/s.

53. Assertion The speed of a body can be negative.

Reason If the body is moving in the opposite direction of positive motion, then its speed is negative.

54. Assertion For motion along a straight line and in the same direction, the magnitude of average velocity is equal to the average speed.

Reason For motion along a straight line and in the same direction, the magnitude of displacement is not equal to the path length.

55. Assertion An object may have varying speed without having varying velocity.

Reason If the velocity is zero at an instant, the acceleration is zero at that instant.

56. Assertion Acceleration of a moving particle can change its direction without any change in direction of velocity.

Reason If the direction of change in velocity vector changes, direction of acceleration vector does not changes.

57. Assertion The v-t graph perpendicular to time axis is not possible in practice.

Reason Infinite acceleration cannot be realised in practice.

58. Assertion In realistic situation, the x-t, v-t and a-t graphs will be smooth.

Reason Physically acceleration and velocity cannot change values abruptly at an instant.

59. Assertion A body cannot be accelerated, when it is moving uniformly.

Reason When direction of motion of the body changes, then body does not have acceleration.

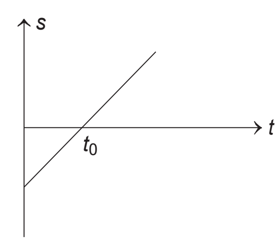
60. Assertion For uniform motion, velocity is the same as the average velocity at all instants.

Reason In uniform motion along a straight line, the object covers equal distances in equal intervals of time.

61. Assertion A body is momentarily at rest at the instant, if it reverse the direction.

Reason A body cannot have acceleration, if its velocity is zero at a given instant of time.

62. Assertion In the s-t diagram as shown in figure, the body starts moving in positive direction but not from $s = 0$.



Reason At $t = t_0$, velocity of body changes its direction of motion.

63. Assertion If acceleration of a particle moving in a straight line varies as a t^n, then s t^{n+2}.

Reason If a-t graph is a straight line,then s-t graph may be a parabola.

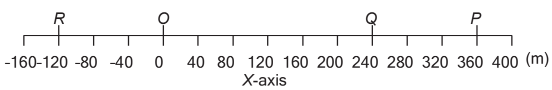
Case Based MCQs

Direction *Answer the questions from 64-68 on the following case.*

Motion in a Straight Line

If the position of an object is continuously changing w.r.t. its surrounding, then it is said to be in the state of motion. Thus, motion can be defined as a change in position of an object with time. It is common to everything in the universe.

In the given figure, let *P, Q* and *R* represent the position of a car at different instants of time.



64. With reference to the given figure, the position coordinates of points P and R are

(a) $P \,\Xi\, (+360,0,0); R \,\Xi\, (-120,0,0)$

67. f the car goes from O to P and

(b) $P \,\Xi\, (-360,0,0); R \,\Xi\, (+120,0,0)$

(c) $P \,\Xi\, (0,+360,0); R \,\Xi\, (-120,0,0)$

(d) $P \,\Xi\, (0,0,+360); R \,\Xi\, (0,0,-120)$

65. Displacement of an object can be

(a) positive
(b) negative
(c) zero
(d) All of the above

66. The displacement of a car in moving from O to P and its displacement in moving from P to Q are

(a) + 360 m and − 120 m
(b) − 120 m and + 360 m
(c) + 360 m and + 120 m
(d) + 360 m and − 600 m

returns back to O, the displacement of the journey is

(a) zero (b) 720 m
(c) 420 m (d) 340 m

68. The path length of journey from O to P and back to O is

(a) 0 m (b) 720 m
(c) 360 m (d) 480 m

Direction *Answer the questions from 69-73 on the following case.*

Average Speed and Average Velocity

When an object is in motion, its position changes with time. So, the quantity that describes how fast is the position changing w.r.t. time and in what direction is given by average velocity.

It is defined as the change in position or displacement (Δx) divided by the time interval (Δt) in which that displacement occur.

However, the quantity used to describe the rate of motion over the actual path, is average speed. It defined as the total distance travelled by the object divided by the total time taken.

69. A 250 m long train is moving with a uniform velocity of 45 kmh. The time taken by the train to cross a bridge of length 750 m is

(a) 56 s (b) 68 s
(c) 80 s (d) 92 s

70. A truck requires 3 hr to complete a journey of 150 km. What is average speed?

(a) 50 km/h (b) 25 km/h
(c) 15 km/h (d) 10 km/h

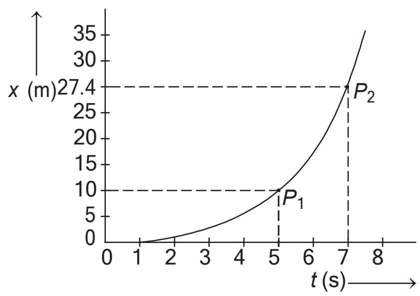
71. Average speed of a car between points A and B is 20 m/s, between B and C is 15 m/s and between C and D is 10 m/s. What is the average speed between A and D, if the time taken in the mentioned sections is 20s, 10s and 5s, respectively?

(a) 17.14 m/s (b) 15 m/s
(c) 10 m/s (d) 45 m/s

72. A cyclist is moving on a circular track of radius 40 m completes half a revolution in 40 s. Its average velocity is

(a) zero (b) 2 ms^{-1}
(c) 4π ms^{-1} (d) 8π ms^{-1}

73. In the following graph, average velocity is geometrically represented by



(a) length of the line P_1P_2
(b) slope of the straight line P_1P_2
(c) slope of the tangent to the curve at P_1
(d) slope of the tangent to the curve at P_2

Direction *Answer the questions from 74-78 on the following case.*

Uniformly Accelerated Motion

The velocity of an object, in general, changes during its course of motion. Initially, at the time of Galileo, it was thought that, this change could be described by the rate of change of velocity with distance. But, through his studies of motion of freely falling objects and motion of objects on an inclined plane, Galileo concluded that, the rate of change of velocity with time is a constant of motion for all objects in free fall.

This led to the concept of acceleration as the rate of change of velocity with time.

The motion in which the acceleration remains constant is known as to be uniformly accelerated motion. There are certain equations which are used to relate the displacement (x), time taken (t), initial velocity (u), final velocity (v) and acceleration (a) for such a motion and are known as kinematics equations for uniformly accelerated motion.

74. The displacement of a body in 8 s starting from rest with an acceleration of 20 cms^{-2} is

(a) 64 m (b) 640 m
(c) 64 cm (d) 0.064 m

75. A particle starts with a velocity of 2 ms^{-1} and moves in a straight line with a retardation of 0.1 ms^{-2}. The first time at which the particle is 15 m from the starting point is

(a) 10s (b) 20s
(c) 30s (d) 40s

76. If a body starts from rest and travels 120 cm in 6th second, then what is its acceleration?

(a) 0.20 ms^{-2} (b) 0.027 ms^{-2}
(c) 0.218 ms^{-2} (d) 0.03 ms^{-2}

77. An object starts from rest and moves with uniform acceleration a. The final velocity of the particle in terms of the distance x covered by it is given as

(a) $\sqrt{2ax}$ (b) $2ax$
(c) $\sqrt{\frac{ax}{2}}$ (d) $\sqrt{ax}$

78. A body travelling with uniform acceleration crosses two points A and B with velocities 20 ms^{-1} and 30 ms^{-1}, respectively. The speed of the body at mid-point of A and B is

(a) 25 ms^{-1} (b) 25.5 ms^{-1}
(c) 24 ms^{-1} (d) $10\sqrt{6}$ ms^{-1}

ANSWERS

Multiple Choice Questions

1. (d)	2. (a)	3. (a)	4. (a)	5. (a)	6. (a)	7. (c)	8. (a)	9. (a)	10. (d)
11. (a)	12. (b)	13. (b)	14. (a)	15. (c)	16. (c)	17. (b)	18. (b)	19. (b)	20. (b)
21. (a)	22. (c)	23. (d)	24. (b)	25. (b)	26. (c)	27. (b)	28. (a)	29. (d)	30. (a)
31. (d)	32. (a)	33. (b)	34. (b)	35. (a)	36. (a)	37. (d)	38. (a)	39. (a)	40. (a)
41. (a)	42. (a)	43. (b)	44. (a)	45. (a)	46. (c)	47. (a)	48. (b)	49. (b)	

Assertion-Reasoning MCQs

50. (a)	51. (b)	52. (b)	53. (d)	54. (c)	55. (d)	56. (d)	57. (a)	58. (a)	59. (d)
60. (b)	61. (c)	62. (c)	63. (b)						

Case Based MCQs

64. (a)	65. (d)	66. (a)	67. (a)	68. (b)	69. (c)	70. (a)	71. (a)	72. (b)	73. (b)
74. (c)	75. (a)	76. (c)	77. (a)	78. (b)					

SOLUTIONS

1. In one-dimensional motion, only one coordinate is required to specify the position of the object. So, a train running on a straight track is an example of one-dimensional motion.

2. Given, at $t = 0$ s, position of an object is $(-1, 0, 3)$ and at $t = 5$ s, its coordinate is $(-1, 0, 4)$. So, there is no change in x and y-coordinates, while z-coordinate changes from 3 to 4. So,the object is in motion along Z-axis.

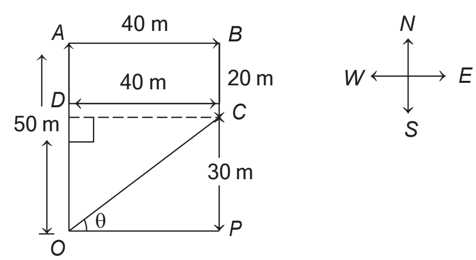
3. Distance from starting point

$$= \sqrt{(3)^2 + (4)^2 + (5)^2} = 5\sqrt{2} \text{ m}$$

4. For a stationary object, the position-time graph is a straight line parallel to the time axis, so for the given object at $x = 40$ m, x-t graph is correctly shown in option (a).

5. In I-D motion, positive and negative signs are used to specify the direction of motion. Since, displacement is a vector quantity, so negative sign in –240 m indicates the direction of displacement.

6. Let O be the starting point, i.e. home. So, according to the question, Snehit moves from O to A (50 m) towards north, then from A to B (40 m) towards east and from B to C (20 m) towards south as shown in the figure below.



Displacement of Snehit is OC, which can be calculated by Pythagoras theorem, i.e.

In ΔODC, $OC^2 = OD^2 + CD^2 = (30)^2 + (40)^2$

$$= 900 + 1600 = 2500$$

$$\rightarrow \quad OC = 50 \text{ m}$$

7. Time taken to travel first half distance,

$$t_1 = \frac{l/2}{v_1} = \frac{l}{2v_1}$$

Time taken to travel second half distance,

$$t_2 = \frac{l}{2v_2}$$

$$\text{Total time} = t_1 + t_2 = \frac{l}{2v_1} + \frac{l}{2v_2} = \frac{l}{2}\left[\frac{1}{v_1} + \frac{1}{v_2}\right]$$