PHYSICS

AAKASH INSTITUTE ENGLISH

UNITS AND MEASUREMENTS

Example

1. What is the SI unit of mass density of a substance ?

2. The acceleration of an object is 5 km h^{-2}.

What is its value in SI units ?

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3. What is the order of magnitude of the distance of the sun from the earth in SI unit?

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4. The parallax of a heavenly body measured from tow points diametrically opposite on equator of earth is 2.0 minute. If radius of earth is 6400 km, calculate distance of heavenly body.

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5. A drop of olive oil of radius 0.25 mm spreads into a circular film of radius 5 cm on the water surface. Estimate the molecular size of the olive oil

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6. The age of the universe is about 10^{17} years whereas the mankind has existed for 10^{9} years. For how many seconds would the man have existed if the age of universe were 1 day ?

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7. The true value of a particular length is 4.283 cm. The three instuments A,B and C , used to measure this length give the readings 4.1 cm, 4.24 cm and 4.093cm. Arrange these readings in the increasing order of accuracy and precision. Which instrument is most reliable for measuring this length ?

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8. The length of a rod as measured in an experiment is found to be 2.48 m, 2.46 m , 2.49 m , 2.49 m and 2.46 m. Find the average length

, the absolute error in each observation and the percentage error.

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9. Two resistors of resistances $R_1 = (100 \pm 3)\Omega$ and $R_2 = (200 \pm 4)\Omega$ are connecrted in parallel. The equivalent resistance of the parallel combination is

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10. The percentage error in the measurement of the radius of a sphere is 1.5%. What would be the percentage error in the volume of the sphere ?

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11. A vernier callipers is used to measure the width and the length of a rectangular plate. The measured values are 1.38 cm and 4.02 cm respectively.Find the uncertainly in the value of its area.

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12. Find the relative error in Z, if $Z = A^4 B^{1/3} / CD^{3/2}$ and the percentage error in the measurements of A,B,C and D are 4%,2%,3% and 1% respectively.

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13. How many significant figures are there in the measured values

(i)227.2 g , (ii)3600 g and (iii)0.00602 g

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14. The time taken by a pendulum to complete 25 vibrations is 88.0 s. Find the time period of the pendulum in second upto appropriate significant figures.

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15. The length and breadth of a rectangular plate are measured to be 14.5 cm and 4.2cm respectively. Find its area to appropriate significant figures.

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16. Round off the following numbers upto three significant figures.

(i)2.520 , (ii)4.645 , (iii)22.78 , (iv)36.25

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17. Find the dimensions of the following physical quantities .

(i)Frictional force , (ii)Charge , (iii)Refractive index

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18. Check the correctness of the following equation by the method of dimensions

(i) $v^2 = u^2 + 2gs$ (ii) $s = ut + \frac{1}{2}\mathrm{gt}^2$ (iii) $v = u + \mathrm{gt}$

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19. The following equation gives a relation between the mass m_1 kept on a surface of area A and the pressure p exerted on this area.

$$p = \frac{(m_1 + m_2)x}{A}$$

What must be the dimensions of the quatities x and m_2?

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20. If an object of mass m moves in uniform circular motion, a formce F acts on it, whose direction is always towards the centre of the the circular path. If F depends on m, speed v of the object and radius r of the circular path, find an expression for F.

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21. For which of the following quantities does ratios are dimensionless?

(i) $\frac{\text{work}}{\text{Energy}}$ (ii) $\sin\theta$ (iii) $\frac{Momentum}{Time}$

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22. When a body moves with velocity V_1 for first half of the journey and V_2 for remaining half of the journey, its average velocity is given by $\frac{2}{V_{\text{av}}} = \frac{1}{V_1} + \frac{1}{V_2}$. If V_1 and V_2 are (15 ± 0.5) m/s and (30 ± 0.1) m/s, find the average velocity within error limits.

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40. An object acceleraties uniformly from initial velocity u to final velocity v. if travels distance s in time t. Then check the dimensional consistency of the following equations. Which of them are correct physically?

(i) $v_{av}=\frac{u+v}{3}$

(ii) $s=ut+\frac{1}{2}at^2$

(iii) $v^2-u^2=\frac{2s}{a}$

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Try Yourself

1. Unit of energy is SI system is

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2. How many seconds make one day?

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3. How many degrees make π rad?

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4. Write SI unit of angular momentum:

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5. What is the order of magnitude of second in a day ?

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6. The suns angular diameter is measured to be 1920 the distance of the sun from the earth is $1.496 \times 10^{11} m$. What is the diameter of the sun?

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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 $1^\circ 54'$. Given the diameter of the Earth to be about $1.276 \times 10^7 m$, compute the distance of the moon from the earth.

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8. A drop of olive oil of radius 0.30 mm spreads into a nearly circular film of radius 12 cm on the water surface. Estimate the molecular size of olive Oil

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9. If the size of a nucleus (in the range of 10^{-15} to $10^{-14}m$) is scaled up to the tip of a sharp pin, what roughly is the size of an atom ? Assume tip of the pin to be in the range $10^{-5}m$ to $10^{-4}m$.

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10. What is order of mass of a human?

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11. 10 drops of an oleic acid solution of concentration $\frac{1}{400} cm^3$ per cm^3 of alcohol, are dropped on a water surface. The circular film thus produced has radius 10 cm. Find the molecular size of oleic acid, if the radius of each drop is 1.4 mm.

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12. If a human heart beats once in every 0.8 s, find the number of times it has beaten in the life of a 10 year old boy

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13. If the average human life span were of the order 10^4 s, what would the revolution period of earth on this scale be?

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14. Two clocks are being tested againest a standard clock located in a national laboratory. At 12 : 00 : 00 noon by the standard clock, the readings of the two clocks are

	Day 1	Day 2	Day 3	Day 4	Day 5
Clock 1	12 : 00 : 04	12 : 02 : 19	12 : 01 : 50	11 : 59 : 04	11 : 59 : 08
Clock 2	11 : 15 : 24	11 : 15 : 01	11 : 14 : 59	11 : 15 : 00	11: 14 : 58

Which of the two clocks will you prefer to measure the time intervals during an experiment?

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15. हम एक सरल लोलक कस दोलन - काल ज्ञात करते है । प्रयोग के क्रमिक मापनों में लिए गए पाठ्यांक हैं : 2.63 s, 2.56 s, 2.42 s, 2.71 s एवं 2.80 s । निरपेक्ष त्रुटि , सापेक्ष त्रुटि एवं प्रतिशत त्रुटि परिकलित कीजिए ।

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16. The diameter of a wire as measured by a screw gauge was found to be 0.026 cm, 0.028 cm, 0.029 cm, 0.027cm, 0.024cm and 0.027 cm. Calculate

(i) mean value of diameter

(ii) mean absoulte error

(iii) relative error (iv) percentage error. Also express the result in terms of absolute error and percentage error.

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17. The least count of three instruments are 1 mm, 0.1 mm and 0.01 mm. Which one has the greatest precision?

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18. If A =12.0 cm $\pm$ 0.1 cm and B 8.5 cm $\pm$ 0.5 cm, find A + B

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19. If $l_1 = (10.0 \pm 0.1)$ cm and $l_2 = (9.0 \pm 0.1)$ cm , find the their sum , difference and error in each .

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20. The error in the measurement of the radius of a sphere is 2%. What will be the error in the calculation of its surface area?

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21. The voltage across a lamp is $(6.0 \pm 0.1)V$ and the current passing through it is (4.0 ± 0.2) ampare. Find the power consumed by the lamp.

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22. The measured mass and volume of a body are 2.00 g and $5.0cm^3$ respectively . With possible errors of 0.01 g and $0.1cm^3$, what would be the percent error in density ?

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23. A Physical quantity P is given by P=$\frac{A^2\sqrt{B}}{C}$, and the percentage errors in the measurements of A, B and C are 1% , 2 % and 4% respectively. Find the percentage error in P.

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24. For two resistors R_1 and R_2, connected in parallel, find the relative error in their equivalent resistance, if $R_1 = (50 \pm 2)\Omega$ and $R_2 = (100 \pm 3)\Omega$.

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25. How many significant figures are there in the value 250×10^{10} m?

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26. How many zeroes are significant in the following measured values?

(i) 60400

(ii) 0.030600

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27. A force of 8.26 N is applied normally over an area of $4.2m^2$. Calculate the pressure exerted over the area to appropriate significant figures.

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28. The voltage across a lamp is 6.82 V when the current passing through it is 4.1 A. Find the power consumed to appropriate significant figures.

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29. Each side of a cube is measured to be 7.241 m. Find its total surface area to correct number of significant figures.

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30. A substance having mass 5.74 g occupies a volume of $1.2cm^3$. Caluclate its density with due regard to significant digits.

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31. Round off the number 970.02 to one decimal place.

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32. Two sticks of lengths 12.132 cm and 10.2 cm are placed end to end. Find their total length with due regard to decimal places.

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33. Find the dimensions for electric power.

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34. Dimensions of relative density is

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35. Check the dimensional consistency of the equation, force = $\frac{(\text{Change in Momentum})}{\text{Time}}$

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36. Check the dimensional correctness of the following relation.

Volume of a sphere $= \frac{4}{3}\pi(\text{radius})^2$

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37. Total mechanical energy E of an object of mass m, at a height h above the ground is given by the relation

$$E = mgh + \frac{p^2}{2m}$$

Find the dimensions of p. (g = acceleration due to gravity).

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38. The time period Of oscillation of a simple pendulum depends on the following quantities

Length of the pendulum (l),

Mass of the bob (m), and

Acceleration due to gravity (g)

Derive an expression for Using dimensional method.

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39. How are the wavelength and frequency of a sound wave related to its speed ?

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40. Pick up the dimensionless quantities among the following:

(i) Power of a lens ,(ii) Relative density ,(iii) Average velocity ,(iv) Magnification

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41. If two quantities have same dimensions, do they represent same physical content?

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42. SI unit of energy

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Assume tip of the pin to be in the range $10^{-5}m$ to $10^{-4}m$.

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54. If the average human life span were of the order 10^4 s, what would the revolution period of earth on this scale be?

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55. Two clocks A and B being tested against a standard clock located in the national laboratory At 10.00 AM by the standard clock, the readings of the two clocks are shown in following table

Day	Clock A	Clock B
I^{st}	$10:00:06$	$8:15:00$
II^{nd}	$10:01:13$	$8:15:0.1$
III^{rd}	$9:59:0.8$	$8:15:04$
IV^{th}	$10:02:15$	$8:14:58$
V^{th}	$9:58:10$	$8:15:02$

If you are doing an experiment that requires precision time interval measurements, which of the two clocks will you prefer ?

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56. The period of oscillation of a simple pendulum in the experiment is recorded as

$2.63s, 2.56s, 2.42s, 2.71s, \text{ and } 2.80s$. Find the average absolute error.

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57. The values for the diameter of a wire as measured by a screw gauge were found to be 0.026 cm, 0.028 cm, 0.029 cm, 0.027 cm, 0.024 cm and 0.027 cm. Find the mean value and the relative error.

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60. If

$x_1 = 100cm \pm 0.1cm$ and $x_2 = 90.0cm \pm 0.1cm$

, find their difference and the error in it.

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61. The error in the measurement of the radius of a sphere is 2%. What will be the error in the calculation of its surface area?

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62. The voltage across a lamp is (6.0 $\pm$ 0.1) V and the current flowing through it is (4.0 $\pm$ 0.2)A. Find the power consumed with maximum permissible error in it.

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63. The measure of mass and volume of a body are 2.00 g and $5.0 cm^3$ respectively, with possible errors of 0.01g and $0.1 cm^3$. What would be the maximum permissible error in its density?

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82. Do the quantities having same dimensions always have same units?

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ASSIGNMENT SECTION A Objective (One option is correct)

1. The base quantity among the following is

A. Speed

B. Weight

C. Length

D. Area

Answer: 3

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2. Which of the following is not a unit of time

A. second

B. minute

C. hour

D. light year

Answer: 4

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3. Astronomical unit (AU) is the distance betweene arth and the sun, 1 AU is equal to

A. 9.46×10^{15} m

B. 1.496×10^{11} m

C. 3×10^{8} m

D. 3.08×10^{16} m

Answer: 2

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4. The volume of a cube having sides 1.2 m is appropriately expressed as

A. $1.728 \times 10^6 cm^3$

B. $1.7 \times 10^6 cm^3$

C. $1.8 \times 10^6 cm^3$

D. $1.73 \times 10^6 cm^3$

Answer: 2

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5. Ampere second is a unit of

A. Current

B. Charge

C. Energy

D. Power

Answer: 2

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6. The most precise reading of the mass of an object among the following is

A. 20 g

B. 20.0 g

C. 20.01 g

D. 20×10^0 g

Answer: 3

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7. The most accurate reading of the length of a 6.28 cm long fibre is

A. 6 cm

B. 6.5 cm

C. 5.99 cm

D. 6.0 cm

Answer: 2

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8. Which of the following is a unit that of force?

A. Nm

B. mN

C. Nm^2

D. Ns

Answer: 2

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9. The value of 60° in radian is

A. $\frac{\pi}{2}$

B. $\frac{\pi}{3}$

C. $\frac{\pi}{4}$

D. $\frac{\pi}{5}$

Answer: 2

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10. The total plane angle subtended by a circle at its centre is

A. π rad

B. 2π rad

C. $\frac{2\pi}{3}$ rad

D. $\frac{\pi}{2}$ rad

Answer: 2

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11. A far off planet is estimated to be at a distance D from the earth. If its diametrically opposite extremes subtend an angle θ at an observatory situated on the earth, the approximate diameter of the planet is

A. $\frac{\theta}{D}$

B. $\frac{D}{\theta}$

C. $D\theta$

D. $\frac{1}{D\theta}$

Answer: 3

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12. 1 unified atomic mass unit (1u) is equal to

A. 10^{-30} kg

B. 1.66×10^{27} kg

C. 1.66×10^{-27} kg

D. 10^{30} kg

Answer: 3

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13. If the average life of a person is taken as 100 s, the age of the universe on this scale is of the order

A. 10^{10} s

B. 10^{8} s

C. 10^{17} s

D. 10^{9} s

Answer: 1

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14. Which of the following is the most precise measurement?

A. 3×10^{-3} m

B. $0.0030m$

C. 30×10^{-4} m

D. 300×10^{-5} m

Answer: 4

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15. The number of significant figures in a pure number 410 is

A. Two

B. Three

C. One

D. Infinite

Answer: 4

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16. Thickness of a pencil measured by using a screw gauge (least count.001 cm) comes out to be 0.802 cm .The percentage error in the measurement is

A. 0.125%

B. 2.43%

C. 4.12%

D. 2.14%

Answer: 1

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17. The percentage error in the measurement of the voltage V is 3% and in the measurement of the current is 2%. The percentage error in the measurement of the resistance id

A. 3%

B. 2%

C. 1%

D. 5%

Answer: 4

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18. The relative error in the measurement of the side of a cube is 0.027. The relative error in the measurement of its volume is

A. 0.027

B. 0.054

C. 0.081

D. 0.046

Answer: 3

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19. Zero error of an instrument introduces

A. Systematic error

B. Random error

C. Least count error

D. Personal error

Answer: 1

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20. A packet contains silver powder of mass 20.23 g $\pm$ 0.01 g Some of the powder of mass 5.75 g $\pm$ 0.01 g is taken out from it The mass of the powder lell back is

A. $14.48g \pm 0.00g$

B. $14.48 \pm 0.02g$

C. $14.5g \pm 0.1g$

D. $14.5g \pm 0.2g$

Answer: 2

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21. The addition of three masses 1.6 g, 7.32 g and 4.238 g. addressed upto proper decimal places is

A. 13.158 g

B. 13.2 g

C. 13.16 g

D. 13.15 g

Answer: 2

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22. The area of a sheet of length 10.2 cm and width 68 cm addressed upto proper number of significant figures is

A. $69.26cm^2$

B. $69.4cm^2$

C. $69cm^2$

D. $70cm^2$

Answer: 2

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23. The radius of a sphere is (2.6 $\pm$ 0.1) cm.

The percentage error in its volume is

A. $\frac{0.1}{2.6} \times 100\ \%$

B. $3 \times \frac{0.1}{2.6} \times 100\ \%$

C. $\frac{0.1}{3 \times 2.6} \times 100\ \%$

D. $\frac{0.1}{2.6}\ \%$

Answer: 2

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24. The uncertain digit in the measurement of a length reported as 41.68 cm is

A. 4

B. 1

C. 6

D. 8

Answer: 4

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25. The best method to reduce random error is

A. Taking large number of observations

B. Corrected zero error

C. By following proper technique of experiment

D. Both (1) & (3)

Answer: 1

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26. The number of significant figures in the measured value 0.0204 is

A. Five

B. Three

C. Four

D. Two

Answer: 2

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27. The number of significant figures in the measured value 26000 is

A. Five

B. Two

C. Three

D. Infinite

Answer: 2

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28. The number of significant zeros present in the measured value 0.020040 , is

A. Five

B. Two

C. One

D. Three

Answer: 4

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29. The number of significant figures in the measured value 4.700 m is the same as that in the value

A. 4700 m

B. 0.047 m

C. 4070 m

D. 470.0 m

Answer: 4

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30. If a calculated value 2.7465 g contains only three significant figures, the two insignificant digits in it are

A. 2 and 7

B. 7 and 4

C. 6 and 5

D. 4 and 6

Answer: 3

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31. An object of mass 4.237 g occupies a volume $1.72cm^3$. The density of the object to appropriate significant figures is -

A. 2.46g cm^{-3}

B. 2.463g cm^{-3}

C. 2.5g cm^{-3}

D. 2.50g cm^{-3}

Answer: 1

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32. Round off the value 2.845 to three significant figures

A. 2.85

B. 2.84

C. 2.80

D. 2.83

Answer: 2

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33. A length 5.997 m rounded off to three significant figures is written as

A. 6.00 m

B. 5.99 m

C. 5.95 m

D. 5.90 m

Answer: 1

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34. The order of the magnitude of speed of light in SI unit is

A. 16

B. 8

C. 4

D. 7

Answer: 2

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35. The values of a number of quantities are used in a mathematical formula The quantity that should be most precise and accurate in measurement is the one

A. Having smallest magnitude

B. Having largest magnitude

C. Used in the numerator

D. Used in the denominator

Answer: 1

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36. What are the dimensions of the change in velocity ?

A. $[M^0L^0T^0]$

B. $[LT^{-1}]$

C. $[MLT^{-1}]$

D. $[LT^{-2}]$

Answer: 2

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37. The dimensional formula for energy is

A. $\left[MLT^{-2}\right]$

B. $\left[ML^2T^{-2}\right]$

C. $\left[M^{-1}L^2T\right]$

D. $\left[ML^2T\right]$

Answer: 2

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38. The pair of the quantities having same dimensions is

A. Displacement, velocity

B. Time, frequency

C. Wavelength focal length

D. Force, acceleration

Answer: 3

Watch Video Solution

39. The dimensional formula for refractive index is

A. $[M^1L^1T^1]$

B. $[M^0L^0T^0]$

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

D. $[MLT^{-1}]$

Answer: 2

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40. The dimensional formula $\left[ML^{-1}T^{-2}\right]$ is for the quantity

A. Force

B. Acceleration

C. Pressure

D. Work

Answer: 3

Watch Video Solution

41. In what direction does the buoyant force on an object immersed in a liquid act?

A. $V\rho g$

B. $\frac{\rho g}{V}$

C. $\rho g V^2$

D. $\sqrt{\rho g V}$

Answer: 1

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42. The dimensionally correct expression for the resistance R among the following is

[P = electric power, I = electric current, t = time, V = volatge and E = electric energy]

A. $R=\sqrt{Pl}$

B. $R=\frac{E}{l^2 t}$

C. $R=V^2 P$

D. R=VI

Answer: 2

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43. Which of the following does not have dimensions of force?

A. Weight

B. Rate of change of momentum

C. Work per unit length

D. Work done per unit charge

Answer: 4

Watch Video Solution

44. The potential energy of a particle varies with distance x from a fixed origin as $U = \frac{A\sqrt{x}}{x^2 + B}$, where A and B are dimensional constants , then find the dimensional formula for AB.

A. $\left[ML^{5/2}T^{-2}\right], [L]$

B. $MLT^{-2}], [L^2]$

C. $[L], \left[ML^{3/2}T^{-2}\right]$

D. $[L^2], [MLT^{-2}]$

Answer: 1

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45. The time dependence of a physical quantity P is given by $P = P_0 \exp(-\alpha t^2)$, where α is a constant and t is time. The constant α

A. [T]

B. $[T^2]$

C. $[T^{-1}]$

D. $[T^{-2}]$

Answer: 4

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46. The dimensions of potential energy of an object in mass, length and time are respectively

A. 2,2,1

B. 1,2,-2

C. $-2, 1, 2$

D. $1, \ -1, 2$

Answer: 2

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47. Which of the following is a dimensional constant ?

A. Magnification

B. Relative density

C. Gravitational constant

D. Relative error

Answer: 3

Watch Video Solution

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48. Solar constant is defined as energy received by Earth per cm^2 per minute. Find the dimensions of solar constant.

A. $[M^0L^0T^0]$

B. $[MLT^{-2}]$

C. $[ML^2T^{-2}]$

D. $[MT^{-3}]$

Answer: 4

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49. The amount of heat energy Q, used to heat up a substance depends on its mass m its specific heat capacity (s) and the change in temperature ΔT of the substance. Using dimensional method, find the expression for s is (Given that $[S] = [L^2T^{-2}K^{-1}]$) is

A. $Qm\Delta T$

B. $\frac{Q}{m\Delta T}$

C. $\frac{\text{Qm}}{\Delta T}$

D. $\frac{m}{Q\Delta T}$

Answer: 2

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50. The power of lens is $P = \frac{1}{f'}$ where f is focal length of the lens. The dimensions of power of lens is

A. [L]

B. $[ML^2T^{-3}]$

C. $[L^{-1}]$

D. $[MLT^{-3}]$

Answer: 3

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ASSIGNMENT SECTION B Objective (One option is correct)

1. If n is the numerical value of a physical quantity in the system in which its unit is u.

then which of the following relations is correct?

A. $\frac{n}{u}$=constant

B. $\frac{u}{n}$=constant

C. nu=constant

D. n^2u=constant

Answer: 3

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2. Density of wood is $0.5g/cc$ in the CGS system of units. The corresponding value in MKS units is

A. 500

B. 0.5

C. 5×10^{-2}

D. 5000

Answer: 1

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3. A measured value 0.00274 expressed in two Significant digits is

A. 0.0

B. 0.0028

C. 0.0027

D. 2.8×10^{-3}

Answer: 3

Watch Video Solution

4. The number of significant figures in the number 0.010780×10^{-3} are

A. 6

B. 5

C. 7

D. 4

Answer: 2

Watch Video Solution

5. The least countof a stop watch is 0.2 second. The time of 29 oscillatios of a pendulum is measured to be 25 second.The percentage error in the time period is

A. 0.1%

B. 0.8%

C. 1.8%

D. 8%

Answer: 2

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6. A dimensionally correct equation _____be a correct equation and a dimensionally incorrect equation ________be incorrect The words (in order) to be filled in the blank spaces are

A. must, must

B. must, may

C. may ,may

D. may, must

Answer: 4

Watch Video Solution

7. Precision in measurement depends on

A. Zero error

B. Parallax

C. Least count of instrument

D. Calibration of instrument

Answer: 3

Watch Video Solution

8. In an experiment to measure the diameter of a wire using a screw gauge of resolution 0.001 cm, which of the following may correctly represent the measurement?

A. 01.235 cm

B. 01.2351 cm

C. 01.24 cm

D. $0.1.23500$ cm

Answer: 1

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9. 0.205-0.2014 can be expressed as

A. 0.0036

B. 3.6×10^{-3}

C. 4.0×10^{-3}

D. 4×10^{-3}

Answer: 4

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10. If speed of light is 3.00×10^{8} m/s and 1 year =365.25 days, then 1 light year is

A. 9.468×10^{15} m

B. 9.47 m

C. 9.47×10^{5} m

D. 9.46×10^{15} m

Answer: 3

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11. A wire has a mass $(0.3 \pm 0.003)g$, radius $(0.5 \pm 0.005)mm$ and length $(6 \pm 0.06)cm$. The maximum percentage error in the measurement of its density is

A. 1

B. 2

C. 3

D. 4

Answer: 4

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12. The breadth of a thin rectangular sheet is measured as 10.1 cm. The approximate error in the measurement is

A. $\pm 1\%$

B. $\pm 0.5\%$

C. $\pm 0.1\%$

D. $\pm 5\%$

Answer: 1

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13. The length of a rod is measured by four different instruments and the measurements are reported as

A. 500.0 mm , B. 50.0 cm , C.0.500 m , D. 5.0×10^{-4} km

We can conclude that

A. A is most accurate measurement

B. C is most accurate measurement

C. A, C and B are equally accurate measurements

D. The accuracy of all the measurements is the same

Answer: 1

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14. The density of a cube is found by measuring its mass and the length of its side of the maximum errors in the measurement of mass and length are 0.3% and 0.2% respectively, the maximum error in the measurement of density is

A. 0.3%

B. 0.5%

C. 0.9%

D. 1.1%

Answer: 3

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15. The linear momentum p of a particle is given as a function of time t as $p = At^2 + Bt + C$.The dimensions of constant B are

A. $[ML^{-1}T^{-1}]$

B. $[ML^{-1}T^{-2}]$

C. $[MLT^{-2}]$

D. $[MLT^{-1}]$

Answer: 3

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16. The kinetic energy of a particle depends on the square of speed of the particle. If error in measurement of speed is 30%, the error in the measurement of kinetic energy will be

A. $30\ \%$

B. $60\ \%$

C. $69\ \%$

D. $15\ \%$

Answer: 3

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17. In the relation $p = \frac{a}{\beta} e^{\frac{aZ}{k\theta}}$, p is pressure Z is distance .k is Boltzman constant and θ is the temperature . The dimensional formula of β will be

A. $[M^0 L^0 T^0]$

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

C. $[M^0 L^{-1} T^1]$

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

Answer: 3

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18. Find out the units and dimensions of the constants a and b in the vander waal.s equation $\left(P+\frac{a}{V^2}\right)(V-b)=RT.$

A. $[ML^5T^{-2}]$

B. $[ML^{-1}T^{-2}]$

C. $[M^0L^3T^0]$

D. $[M^0L^6T^0]$

Answer: 3

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19. The frequency f of vibrations of a mass m suspended from a spring of spring constant k is given by $f = Cm^x k^y$, where C is a dimensionnless constant. The values of x and y are, respectively,

A. $x = \frac{1}{2}, y = \frac{1}{2}$

B. $x = -\frac{1}{2}, y = -\frac{1}{2}$

C. $x = \frac{1}{2}, y = -\frac{1}{2}$

D. $x = -\frac{1}{2}, y = \frac{1}{2}$

Answer: 4

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20. Given that $y = a\cos\left(\frac{t}{P} - qx\right)$, where t represents distance is metre. Which of the following statements is true ?

A. The unit of t is same as that of q

B. The unit of x is same as that of p

C. The unit of x is same as that of q

D. The unit of t is same as that of p

Answer: 4

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21. Imagine a system of units in which the unit of mass is 100 kg, length is 1 km and time is 1 minute Then 1 joule in this system is equal to

A. 360

B. 3.6

C. 36×10^{5}

D. 36×10^{-6}

Answer: 4

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22. Which of the two have same dimensions

A. Force and strain

B. Force and stress

C. Angular velocity and frequency

D. Energy and strain

Answer: 3

Watch Video Solution

23. The dimensions of K in the equation $W = \frac{1}{2}Kx^2$ is

A. $[M^1L^0T^{-2}]$

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

C. $[M^1L^1T^{-2}]$

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

Answer: 1

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24. The physical quantities not having same dimensions are

A. Pressure and energy density

B. Torque and work

C. Momentum and Planck's constant

D. Stress and Young's modulus

Answer: 3

Watch Video Solution

25. Frequency is the function of density (ρ), length (a) and surface tension (T). Then its value is

A. $k\rho^{1/2}l^{3/2}T^{-1/2}$

B. $k\rho^{3/2}l^{3/2}T^{-1/2}$

C. $k\rho^{1/2}l^{3/2}T^{-3/4}$

D. $kT^{1/2}\rho^{-1/2}l^{-3/2}$

Answer: 4

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26. If force (F), length L and time T are taken as fundamental units, the dimensional formula for mass will be

A. $[FL^{-1}T^{2}]$

B. $[FL^{-1}T^{-2}]$

C. $[FL^{-1}T^{-1}]$

D. $[FL^{2}T^{2}]$

Answer: 1

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27. "Pascal-Second" has dimension of

A. Force

B. Energy

C. Pressure

D. Coefficient of viscosity

Answer: 4

Watch Video Solution

28. Newton - second is the unit of

A. Velocity

B. Angular momentum

C. Momentum

D. Energy

Answer: 3

Watch Video Solution

29. Which of the following is not represented in correct unit

A. $\frac{\text{Stress}}{\text{Strain}} = N/m^2$

B. Surface tension=N/m

C. Energy= kg-m/s

D. Pressure=N / m^2

Answer: 3

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30. One nanometre is equal to

A. 10^9 mm

B. 10^{-6} mm

C. 10^{-7} mm

D. 10^{-9} m

Answer: 3

Watch Video Solution

31. A suitable unit for gravitational constant is

A. kg-m $\sec^{-1}$

B. Nm^{-1} sec

C. Nm^2kg^{-2}

D. kgm sec

Answer: 3

Watch Video Solution

32. The S.I. unit of pressure is

A. Pascal

B. dynes/cm^2

C. cm of Hg

D. Atmosphere

Answer: 1

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33. The unit of angular acceleration in the SI system is

A. Nkg^{-1}

B. ms^{-2}

C. $rads^{-2}$

D. $mkg^{-1}K$

Answer: 3

Watch Video Solution

Watch Video Solution

34. Units of coefficient of viscosity are

A. m/kg-s

B. $m - s / kg^2$

C. $kg / m - s^2$

D. kg/m-s

Answer: 4

Watch Video Solution

35. To determine the young's modulus of a wire , the formula is $Y = \frac{F}{A} . \frac{L}{\Delta l}$, where L = l ength ,A = area of cross - section of the wire , ΔL = change in the length of the wire when streched with a force F. Find the conversion factor to change it from CGS t o MKS system.

A. 1

B. 10

C. 0.1

D. 0.01

Answer: 3

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36. If the dimensions of a physical quantity are given by $\left[M_{\alpha}L^{b}T^{c}\right]$, then the physical quantity will be

A. Pressure a = 1, b = 1,c = -2

B. Velocity if a=1 , b=0 , c=-1

C. Acceleration if a =1, b=1, c=-2

D. Force if a =0 , b=-1, c=-2

Answer: 1

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37. $\frac{h}{2\pi}$ is the dimension of

A. Velocity

B. Momentum

C. Energy

D. Angular momentum

Answer: 4

Watch Video Solution

38. The dimensions of calorie are ________

A. $[ML^{-2}T^{-2}]$

B. $[MLT^{-2}]$

C. $[ML^2T^{-1}]$

D. $[ML^2T^{-3}]$

Answer: 1

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39. The dimensions of universal gravitational constant are ____

A. $\left[M^{-2}L^{2}T^{2}\right]$

B. $\left[M^{-1}L^{3}T^{-2}\right]$

C. $\left[ML^{-1}T^{-2}\right]$

D. $\left[ML^{2}T^{-2}\right]$

Answer: 2

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40. What is the dimensional formula of angular velocity?

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

B. $[MLT^{-1}]$

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

D. $[ML^0T^{-2}]$

Answer: 1

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41. The dimensions of power are _____

A. $\left[M^1L^2T^{-3}\right]$

B. $\left[M^2L^1T^{-2}\right]$

C. $\left[M^1L^2T^{-1}\right]$

D. $\left[M^1L^1T^{-2}\right]$

Answer: 1

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42. The percentage error in measurement of a physical quantity [m given by $m = \pi \tan \theta$] is minimum when

(Assume that error in θ remain constant)

A. $\theta = 45^\circ$

B. $\theta = 90^\circ$

C. $\theta = 60^\circ$

D. $\theta = 30^\circ$

Answer: 1

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43. The unit of percentage error is

A. Same as that of physical quantity

B. Different from that of physical quantity

C. Percentage error is unit less

D. Errors have got their own units which are different from that of physical quantity measured

Answer: 3

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44. The period of oscillation of a simple pendulum in the experiment is recorded as $2.63s, 2.56s, 2.42s, 2.71s, \text{ and } 2.80s$. Find the average absolute error.

A. 0.1 s

B. 0.11 s

C. 0.01 s

D. 1.0 s

Answer: 2

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45. If A and B are two physical quantities having different dimensions then which of the following can denote a new physical quantity?

A. A+3B

B. 3A-B

C. $A^3 + (3B)^3$

D. $A^{1/3} \times (3B)^3$

Answer: 4

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ASSIGNMENT SECTION C Objective (More than one option is correct)

1. A dimensionless quantity

A. May have a unit

B. Must have a unit

C. May not have a unit

D. Must not have a unit

Answer: 1,3

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2. A length of 5.0×10^{1} cm when converted into meter can be written as

A. 0.5 m

B. 0.50 m

C. 5.0×10^{-1} m

D. 5.00×10^{-1} m

Answer: 2,3

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3. Which of the following units can possibly be a unit of time?

A. Leap year

B. Tropical year

C. Sidereal year

D. Light year

Answer: 1,2,3

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4. Which of the following functions of A and B may be performed if A and B posses different dimensions

A. A+B

B. A-B

C. $\dfrac{A}{B}$

D. None of these

Answer: 1,2

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5. The radius of a spherical ball is (10.4 ± 0.4) cm Select the correct alternative

A. The percentage error in radius is 3.9%

B. The percentage error in radius is 0.4%

C. The percentage error in volume is 11. 5%

D. The absolute error in volume is 1.2 cm

Answer: 1,3

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6. The dimensions of length are expressed as $G^x c^y h^z$, where G, c and h are the universal gravitational constant, speed of light and Planck's constant respectively, then :

A. $x = \frac{1}{2}, y = \frac{1}{2}$

B. $x = \frac{1}{2}, z = \frac{1}{2}$

C. $y = \frac{1}{2}, z = \frac{3}{2}$

D. $y = -\frac{3}{2}, z = \frac{1}{2}$

Answer: 2,4

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7. The equation of a stationary wave is

$$y = 2A\sin\left(\frac{2\pi ct}{\lambda}\right)\cos\left(\frac{2\pi x}{\lambda}\right)$$

Which of the following is wrong?

A. Unit of ct is same as that of λ

B. Unit of x is same as that of λ

C. Unit of $\frac{2\pi c}{\lambda}$ is same as that of $\frac{2\pi x}{\lambda t}$

D. Unit of $\frac{c}{\lambda}$ is same as that of $\frac{x}{\lambda}$

Answer: 1,2,3

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8. A dimensionless quantity y is represented by the formula $y = \frac{a - bc}{d + e}$. Which of following is/arecorrect?

A. Dimensions of d and e are same

B. abc and de have same dimensions

C. $\frac{\mathrm{bc}}{\mathrm{ae+d}}$ is dimensionless

D. de+dc is not meaningful

Answer: 1,2,4

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9. Let $y = A\sin(\omega t - kx)$ represent the variation of distance y of a particle with time t. Which of the following is not meaningful?

A. $\frac{y}{A} + \omega$

B. $\frac{y}{\omega} + \frac{\mathrm{At}}{\mathrm{kx}}$

C. A-kx

D. $A + \frac{\omega}{k}$

Answer: 1,3,4

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10. A voltmeter has a least count of 0.1 V and an ammeter has a least count of 0.1 A. The potential drop V across a resistance is measured as 10.0 V and current through it is measured as 1.0 A .Select the correct alternative

A. The value of R is $(1.0 \pm 0.1) \times 10^{1} \Omega$

B. The relative error in measurement of current is $\frac{1}{10}$

C. The accuracy in measurement of potential drop is $\frac{1}{100}$

D. The value of R is $(10 + 0.2) \Omega$

Answer: 1,2,3

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ASSIGNMENT SECTION D (Linked Comprehension)

1. The energy E of a particle varies with time t according to the equation $E = E_0 \sin(\alpha t).\, e^{\frac{-\alpha t}{\beta x}}$, where x is displacement from mean position E_0 is energy at infinite position and α and β are constants .

Dimensional formula of α is

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

B. $\left[M^{-1}L^0T^0\right]$

C. $\left[M^0L^{-1}T^0\right]$

D. $\left[M^0L^0T^0\right]$

Answer: 1

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2. The energy E of a particle varies with time t according to the equation $E = E_0 \sin(\alpha t) . e^{\frac{-\alpha t}{\beta x}}$, where x is displacement from mean position E_0 is energy at infinite position and α and β are constants .

Dimensions of β are

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

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

C. $[M^0L^0T^{-1}]$

D. $[M^0L^0T^0]$

Answer: 2

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3. The energy E of a particle varies with time t according to the equation $E = E_0 \sin(\alpha t).\, e^{\frac{-\alpha t}{\beta x}}$, where x is displacement from mean position E_0 is energy at infinite position and α and β are constants .

Dimensions of $\sin\left(\frac{\alpha t}{\beta x}\right)$ are

A. $\left[M^1 L^0 T^0\right]$

B. $\left[M^0 L^1 T^0\right]$

C. $\left[M^0 L^0 T^0\right]$

D. Invalid expression

Answer: 3

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ASSIGNMENT SECTION E (Assertion-Reason)

1. STATEMENT-1: All instrumental errors are random errors.

STATEMENT-2:Some of the readings taken using an instrument may be more and some of the readings may be lesser than the actual value of the physical quantity.

A. Statement-1 is True , Statement-2 is True ,Statement-2 is a correct explanation for Statement-1

B. Statement-1 is True , Statement-2 is True ,Statement-2 is NOT a correct explanation for Statement-1

C. Statement-1 is True , Statement-2 is False

D. Statement-1 is False, Statement-2 is True

Answer: 4

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2. STATEMENT 1 meter of a cylinder measured using a Vernier caliper is more accurate than that measure using a meter scale

STATEMENT-2 Least count of vernier calliper is in ser than least count of a meter scale.

A. Statement-1 is True , Statement-2 is True ,Statement-2 is a correct explanation for Statement-1

B. Statement-1 is True , Statement-2 is True ,Statement-2 is NOT a correct explanation for Statement-1

C. Statement-1 is True , Statement-2 is False

D. Statement-1 is False, Statement-2 is True

Answer: 1

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3. STATEMENT-1 A dimensionless quantity may have a unit

STATEMENT-2 A constant may not be unitless.

A. Statement-1 is True , Statement-2 is True ,Statement-2 is a correct explanation for Statement-1

B. Statement-1 is True , Statement-2 is True ,Statement-2 is NOT a correct explanation for Statement-1

C. Statement-1 is True , Statement-2 is False

D. Statement-1 is False, Statement-2 is True

Answer: 2

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4. STATEMENT-1:Work done by a force on a body can be added to kinetic energy of the body.

STATEMENT:2-By principle of homogeneity, any two physical quantities which are added must have same dimensions.

A. Statement-1 is True , Statement-2 is True ,Statement-2 is a correct explanation for Statement-1

B. Statement-1 is True , Statement-2 is True ,Statement-2 is NOT a correct explanation for Statement-1

C. Statement-1 is True , Statement-2 is False

D. Statement-1 is False, Statement-2 is True

Answer: 1

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5. STATEMENT 1 The final result obtained after a number of calculations is rounded off to a proper number of significant figures.

STATEMENT 2. No final result can have more accuracy than the original data from which it was derived

A. Statement-1 is True , Statement-2 is True ,Statement-2 is a correct explanation for Statement-1

B. Statement-1 is True , Statement-2 is True ,Statement-2 is NOT a correct explanation for Statement-1

C. Statement-1 is True , Statement-2 is False

D. Statement-1 is False, Statement-2 is True

Answer: 1

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6. STATEMENT 1 Method of dimension cannot be used for deriving formula containing trigonometrical ratios

STATEMENT-2 Trigonometrical ratios have no dimension

A. Statement-1 is True , Statement-2 is True ,Statement-2 is a correct explanation for Statement-1

B. Statement-1 is True , Statement-2 is True ,Statement-2 is NOT a correct explanation for Statement-1

C. Statement-1 is True , Statement-2 is False

D. Statement-1 is False, Statement-2 is True

Answer: 1

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7. STATEMENT-1 The mass of an object is 132 kg. The number of significant figures in this measurement is 3

STATEMENT 2 The same mass when expressed in grams as 132000 g has six significant figures

A. Statement-1 is True , Statement-2 is True ,Statement-2 is a correct explanation for Statement-1

B. Statement-1 is True , Statement-2 is True ,Statement-2 is NOT a correct explanation for Statement-1

C. Statement-1 is True , Statement-2 is False

D. Statement-1 is False, Statement-2 is True

Answer: 3

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8. STATEMENT 1 When the unit for measurement of a quantity is changed, its numerical value changes

STATEMENT 2 Smaller the unit of measurement matter is its numerical value

A. Statement-1 is True , Statement-2 is True ,Statement-2 is a correct explanation for

Statement-1

B. Statement-1 is True , Statement-2 is True ,Statement-2 is NOT a correct explanation for Statement-1

C. Statement-1 is True , Statement-2 is False

D. Statement-1 is False, Statement-2 is True

Answer: 3

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9. STATEMENT-1 Dimensional constants are the quantities whose values are constant

STATEMENT 2 Quantities which are dimensionless are known as dimensional constants

A. Statement-1 is True , Statement-2 is True ,Statement-2 is a correct explanation for Statement-1

B. Statement-1 is True , Statement-2 is True ,Statement-2 is NOT a correct explanation for Statement-1

C. Statement-1 is True , Statement-2 is False

D. Statement-1 is False, Statement-2 is True

Answer: 3

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10. STATEMENT-1: In the expression $y = A \sin(kx - \omega t)$, dimensions of omega must be reciprocal of that of t.

STATEMENT 2 The expression (kx-omegat) must be dimensionless.

A. Statement-1 is True , Statement-2 is True ,Statement-2 is a correct explanation for Statement-1

B. Statement-1 is True , Statement-2 is True ,Statement-2 is NOT a correct explanation for Statement-1

C. Statement-1 is True , Statement-2 is False

D. Statement-1 is False, Statement-2 is True

Answer: 1

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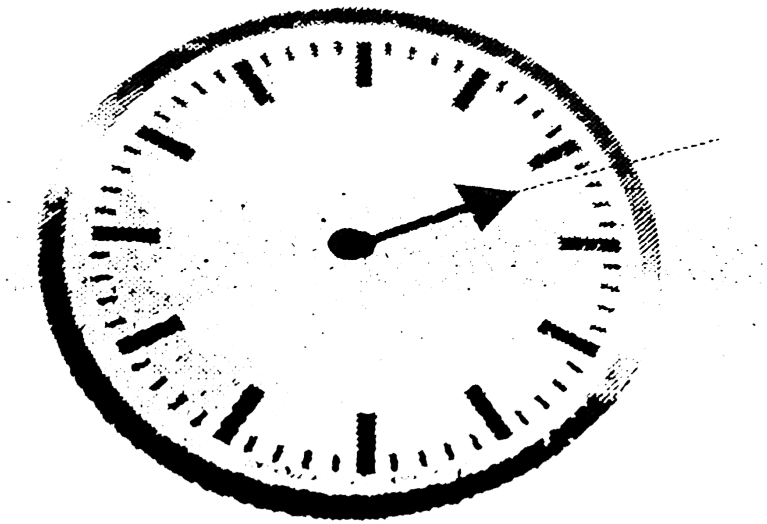
11. The figure shows a wall clock hanging on a wall it only has the hour hand



STATEMENT:1-The least count of the clock is 12 minutes.

STATEMENT:2-The observer reads 2hrs 12 minutes AM/PM

A. Statement-1 is True , Statement-2 is True ,Statement-2 is a correct explanation for Statement-1

B. Statement-1 is True , Statement-2 is True ,Statement-2 is NOT a correct explanation for Statement-1

C. Statement-1 is True , Statement-2 is False

D. Statement-1 is False, Statement-2 is True

Answer: 2

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ASSIGNMENT SECTION F (Matrix-Match)

1. In Column-I, some physical quantities are given and in column-II, dimensions of the physical quantities are given . Match the entries in column-I to each entry in Column-II.

Column-I	Column-II
(A) Pressure	(p) $[M^1 L^0 T^{-2}]$
(B) Potential energy/volume	(q) $[M^0 L T^{-2}]$
(C) Acceleration	(r) $[M L^{-1} T^{-2}]$
(D) $\frac{\text{Kinetic energy}}{\text{Mass} \times \text{distance}}$	(s) $[M^0 L^0 T^0]$

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2. Taking linear momentum (P), length (L) and time (T) to be fundamental quantities, relate quantities in the columns.

Column I	Column II
(A) Density	(p) $[PL^0 T^{-1}]$
(B) Pressure	(q) $[PL T^{-1}]$
(C) Force	(r) $[PL^{-1} T^{-1}]$
(D) Energy	(s) $[PL^{-4} T]$

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3. match the following

Column I	Column II
(A) Spring constant	(p) $M^1L^2T^{-2}$
(B) Pascal	(q) $M^0L^0T^{-1}$
(C) Hertz	(r) $M^1L^0T^{-2}$
(D) Joule	(s) $M^1L^{-1}T^{-2}$

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4. Column II gives some equations. In these equations x is distance, t is time , m is mass, v is velocity u is initial velocity and F is force . Match the statements in Column I to the equations in Column II.

Column I	Column II
(A) a and b have same dimensions	(p) $F = \frac{ax + c}{at^2 + bx^2}$
(B) Dimensional formula of a is $[MLT^{-1}]$	(q) $v = \frac{a}{b} e^{a/b}$
(C) Dimensional formula of b is $[M^0L^0T^1]$	(r) $\left(\frac{vb + x}{a^2 + t^2}\right) = \text{constant}$
(D) Equation is dimensionally inconsistent	(s) $v = \frac{a^2}{b} \sin\left(\frac{a}{u} + \frac{x}{tu}\right)$
	(t) $F = \frac{a}{b} e^{-\frac{mv}{a}}$

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5. Match the entries in column I and column II with same dimensional formula

Column I	Column II
(A) Surface tension	(p) Energy per unit area
(B) Pressure	(q) Energy per unit volume
(C) Young's modulus	(r) Energy × time
(D) Angular momentum	(s) Spring constant
	(t) Planck's constant

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6. match the following

Column I	Column II
(A) Angular Momentum	(p) $[ML^2T^{-2}]$
(B) Latent heat	(q) $[M^0LT^{-3}]$
(C) Torque	(r) $[ML^2T^{-1}]$
(D) Velocity gradient	(s) $[M^0L^0T^{-1}]$
(E) Time rate of change of acceleration	(t) $[L^2T^{-2}]$

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ASSIGNMENT SECTION G (Integer)

1. Frequency of sound that can be produced by a pipe depends on length (l) of the pipe, atmospheric pressure (p) and density (d) of air, according to relation $v = \frac{p^b d^c}{t^a}$. Find the value of (a +b + c).

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2. Find the maximum possible percentage error in the measurement of force on an object (of mass m) travelling at velocity v in a circle of radius r if m =(4.0 ± 0.1)kg, v= (10 ± 0.1) m/s and r=(8.0 ± 0.2) m

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3. In a new system, the unit of mass is made 10 times, the unit of length is made 1/100 times and unit of time is made 10 times. Magnitude of 1J in the new system of unit is 10^x.What is the value of x ?

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4. The least count of a stop watch is 0.2 second. The time of 20 oscillations of a pendulum is measured to be 25 seconds. The maximum percentage error in this measurement is found to be 0.x%. What is the value of x?

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5. A wire has a mass (0.3 ± 0.003)g, radius (0.5 ± 0.005) mm and length (0.6 ± 0.006) cm. The maximum percentage error in the measurement of its density

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6. The time dependence of a physical quantity P is given by $P = P_0 \exp(\propto t^2)$, where $\propto$ is constant $\propto$ is represented as $\left[M^0 L^x T^{-2}\right]$. Find x

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7. In a system of units if force (F), acceleration (A) and time (T) are taken as fundamental units, then the dimensional formula of energy will become $\left[FAT^{x/3}\right]$. Find value of x?

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8. The length of a pendulum is measured as 20.0 cm. The time interval for 100 oscillations is measured as 90 s with a stop watch of 1 s resolution. Find the approximate percentage change in g.

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ASSIGNMENT SECTION H (Multiple True-False)

1. STATEMENT-1 The accuracy in final result of an experiment is always less than the accuracy of any one of the quantities used to find it

STATEMENT-2 The accuracy with which you can report any reading depends on least count of measuring instrument

STATEMENT-3 Making a number of readings of a given quantity and taking an average will reduce the systematic errors

A. TFT

B. TTT

C. FFT

D. TTF

Answer: 4

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2. STATEMENT 1: Two quantities with different dimensions may have same unit.

STATEMENT-2 Two quantities with different units may have same dimensions

STATEMENT-3 Unitless quantities must be dimensionless too

A. TFT

B. TFF

C. TTT

D. FTT

Answer: 4

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3. STATEMENT-1: Dimensional constants are the quantities whose values are constant

STATEMENT-2: Dimensional constants are dimensionless

STATEMENT-3 Universal gravitational constant (G) is a dimensional constant

A. TFF

B. TFT

C. TTF

D. FTT

Answer: 2

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4. STATEMENT-1 Number of significant figures in 0.007 s one and that in 0.700 is true

STATEMENT 2 : All zeros in a number are not significant

STATEMENT 3: Length of a rod is measured 100 m .Number significant figures in this measurement 1

A. TFT

B. FFT

C. TFF

D. FTT

Answer: 3

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5. STATEMENT-1 The dimensional formula for relative velocity is same as that of the charge in velocity

STATEMENT-2 [Relative velocity] = [Change in velocity]

STATEMENT-3 In addition or subtraction of two physical quantities of same dimension, the result also have same dimensIon only.

A. TTT

B. FTF

C. TFF

D. TFT

Answer: 4

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6. STATEMENT-1: Velocity gradient has dimensions of frequency

STATEMENT-2: Temperature gradient has dimensions of frequency

STATEMENT-3: Unit nm is same as unit mN.

A. TFF

B. TTF

C. TFT

D. FTT

Answer: 1

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ASSIGNMENT SECTION I (Subjective)

1. Write down the number of significant figures in the following .

(A)8428 , (B)82.00 m , (C)0.828 cm , (D)8200 N

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2. Round off to four significant figures

(A) 49.687 ,(B) 2.0095

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3. The dimensions of $\frac{a}{b}$ in the equation $P = \frac{a - t^2}{bx}$ where P is pressure, x is distance and t is time are

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4. A body of mass m is moving in a circle of radius angular velocity ω. Find the expression for centripetal force acting on it by the method of dimensions

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5. Each side of a cube is measured to be 7.203 m. what are the total surface area and the volume of the cube to appropriate significant figures ?

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6. The temperature of two bodies measured by a thermomenter are $t_1 = 20^\circ C \pm 0.5^\circ C$ and $t_2 = 50^\circ C \pm 0.5^\circ C$. The temperature difference and the error there in is

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7. In an experiment the refractive index of glass was observed to be $1.45, 1.56, 1.54, 1.44, 1.54, \text{ and } 1.53.$

Calculate

(a). Mean value of refractive index

(b). Mean absolute error

(c) Fractional error

(d) Percentage error

(e) Express the result in terms of absolute error and percentage error

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8. Find density when a mass of 9.23 kg occupies a volume of $1.1m^3$. Take care of significant figures.

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9. Solve with due regards to significant figures $4.0 \times (10^{-4}) - 2.5 \times 10^{-6}$.

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10. Find the dimensions of a/b in the relation $F = a\sqrt{x} + \mathrm{bt}^2$, where F is force, x is distance and t is time.

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11. Time period of an oscillating drop of radius r, density ρ and surface tension T is $t = k\sqrt{\frac{\rho r^5}{T}}$. Check the correctness of the relation

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12. A physical quantity y is given by $y = \frac{P^2 Q^{3/2}}{R^4 S^{1/2}}$

The percentage error in P,Q ,R and S are 1%,2%, 4% and 2% respectively. Find the percentage error in y.

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13. Calculate focal length of a spherical mirror from the following observations. Object distance $u = (20.1 \pm 0.2)cm$ and image distance $v = (20.1 \pm 0.2)cm$

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14. The velocity of water waves may depend on their wavelength λ, the density of warter ρ and the acceleration due to gravity g. The method of dimensions gives the relations between these quantities as

where k is a dimensionless constant

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15. In an experiment of simple pendulum , the time period measured was $50 sf$ or 25 vibrations when the length of the simple pendulum was taken $100cm$. If the least count of stop watch is $0.1s$ and that of meter scale is $0.1cm$. Calculate the maximum possible error in the measurement of value of g. If the actual value of g at the place of experiment is $9.7720ms^{-2}$, Calculate the percentage error.

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16. if power P and linear mass density are related as $P = \frac{\alpha}{\beta^2 + \lambda^2}$, then find the dimensions of α and β

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17. The kinetic energy of a particle moving along x-axis varies with the distance x of the particle from origin as $K = \frac{A + x^3}{Bx^{1/4} + C}$ .Write the dimensional formula for A^2B

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18. $P = \frac{nx^yT}{V_0}e^{-\frac{Mgh}{nxT}}$, where n is number of moles, P is represents acceleration due to gravity and h is height. Find dimension of x and value of y.

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ASSIGNMENT SECTION J (Aakash Challengers)

1. Speed of light in SI system is 3×10^{8} m/s. What is the speed of light in a new system of units in which unit of length is x km and unit of time is Y millisecond?

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2. Spring constant of a spring is calculated using formule $K = \frac{4\pi^2 M}{T^2}$, where T is time period of vertical oscillation when mass M is hung with the help of spring to rigid support. If time of oscillation for 10 oscillations is measured to be 5.0 s and mass M=0.20 kg, find possible error in spring constant K.

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3. Find the maximum possible percentage error in the measurement of force on an object (of mass m) travelling at velocity v in a circle of radius r if m =(4.0 ± 0.1)kg, v= (10 ± 0.1) m/s and r=(8.0 ± 0.2) m

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4. In the formula , $p = \frac{nRT}{V-b}e^{\frac{a}{RTV}}$ find the dimensions of a and b, where p = pressure , n= number of moles , T = temperture , V = volume and R = universal gas constant .

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5. If E, M, L and G denote energy, mass, angular momentum and gravitational constant respectively, then the quantity $\left(E^2L^2 / M^5G^2\right)$ has the dimensions of

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6. A physical quantity x is being calculated by measuring y and z and using the formula x = y

.z. .In a particular set of values, the value of y is measured with an error + 10%, whereas the value of z is measured with an error of +10%. For this particular set of values the error in the calculation of x will be

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7. In two systems of units the relation between velocity, acceleration and force is given by $v_2 = \frac{v_1 \varepsilon^2}{\tau}, a_2 = a_1 \varepsilon \tau, F_2 = \frac{F_1}{\varepsilon \tau}$, where ε and

τ constants then find in this new system:

(a) $\dfrac{m_2}{m_1}$, (b) $\dfrac{L_2}{L_1}$

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8. Suppose two students trying to make a new measurement system so that they can use it like a code measurement system and others do not understand it Instead of taking 1 kg, 1 m and 1 second, as basic unit they took unit of mass as α kg, the unit of length as β m and unit of times as γ second. They called power in new system as "Aakash", then find The value of α "Aakash" in watt.

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EXERCISE

1. If in a Vernier callipers 10 VSD coincides with 8 MSD, then the least count of Vernier calliper is [given 1 MSD = 1mm]

A. $1 \times 10^{-4} m$

B. $2 \times 10^{-4} m$

C. $1 \times 10^{-3} m$

D. $8 \times 10^{-4} m$

Answer: B

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2. Which of the following measurement is more accurate?

A. 40m

B. 4.0m

C. $4.00m$

D. $4.000m$

Answer: C

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3. if the randon error in the arithmetic mean of 50 observations is α, then the random error in the arithmetic mean of 150 observations would be

A. α

B. 3α

C. $\frac{\alpha}{3}$

D. 2α

Answer: C

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4. If momentum of an object is increased by 10%, then is kinetic energy will increase by

A. 20%

B. 21%

C. 40%

D. 19%

Answer: B

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5. Three measurements are made as 18.425 cm, 7.21 cm and 5.00 cm. The addition should be written as

A. 30.635 cm

B. 30.64 cm

C. 30.63 cm

D. 30.6 cm

Answer: D

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6. If $x = 10.0 \pm 0.1$ and $y = 10.0 \pm 0.1$, then 2x-2y is equal to

A. (0.0 ± 0.1)

B. Zero

C. (0.0 ± 0.4)

D. (20 ± 0.2)

Answer: C

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7. The diameter of a wire is measured to be 0.0250 $\times$ 10^{-4} m. The number of significant figures in the measurement is

A. Five

B. Four

C. Three

D. Nine

Answer: C

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8. The radius of a disc is 1.2 cm. Its area according to idea of significant figures, will be given by :-

A. $14.1124m^2$

B. $14.112m^2$

C. $14.11m^2$

D. $14.1m^2$

Answer: D

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9. If the value of resistance is 10.845 ohm and the value of current is 3.23 amp, the value of potential with significant numbers would be

A. 35.0 volt

B. 3.50 volt

C. 35.029 volt

D. 35.030 volt

Answer: A

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10. The length of a uniform rod is 100.0 cm and radius is 1.00 cm if length is measured with a meter rod having least count 1mm and radus is measured with vernier callipers having least count 0.1 mm the percentage error in calculated volume of cylinder is

A. 2.1%

B. 0.03

C. 2.01%

D. 3.2%

Answer: A

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11. The diamensions of time in energy are

A. 0

B. -2

C. 2

D. 1

Answer: B

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12. Which one of the following is dimensionless physical quantity?

A. Velocity gradient

B. Stress

C. Force gradient

D. Angle

Answer: D

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13. Two physical quantities A and B have different dimensions. Which mathematical operation given below is physically possible ?

A. $\sqrt{AB}$

B. A(1 + B)

C. A - B

D. A + B

Answer: A

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14. Which of the following is dimensionally correct?

A. u = v - at

B. $s - ut = \frac{1}{2}at^2$

C. $u^2 = 2a(gt - 1)$

D. $v^2 - u^2 = 2as$

Answer: C

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15. 1 joule of energy is to be converted into new system of units in which length is measured in 10 metre, mass in 10 kg and time in 1 minute. The numerical value of 1 J in the new system is :-

A. 36×10^{-4}

B. 36×10^{-3}

C. 36×10^{-2}

D. 36×10^{-1}

Answer: D

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16. If the unit of force is kN, the length is 1 km and time 100 s, then what will be the unit of mass?

A. 1000 kg

B. 1 kg

C. 10000 kg

D. 100 kg

Answer: C

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17. The dimensional formula for moment of couple is

A. $\left[ML^2T^{-2}\right]$

B. $\left[MLT^{-2}\right]$

C. $\left[ML^{-1}T^{-3}\right]$

D. $\left[ML^{-2}T^{-2}\right]$

Answer: A

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18. The potential energy of a particle varies with distance x from a fixed origin as $U = \dfrac{A\sqrt{x}}{x^2 + B}$, where A and B are dimensional constants , then find the dimensional formula for AB.

A. $\left[ML^{7/2}T^{-2}\right]$

B. $\left[ML^{11/2}T^{-2}\right]$

C. $\left[M^2L^{9/2}T^{-2}\right]$

D. $\left[ML^{13/2}T^{-3}\right]$

Answer: B

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19. Of the following quantities, which one has dimensions different from the remaining three ?

A. Energy per unit volume

B. Force per unit area

C. Product of voltage and charge per unit volume

D. Angular momentum per unit mass

Answer: D

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20. Which of the following relation cannot be deduced using dimensional analysis ? [the symbols have their usual meanings]

A. $y = A\sin(\omega t + kx)$

B. v = u + at

C. $k = \frac{1}{2}mv^2$

D. All of these

Answer: D

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ASSIGNMENT (SECTION - A)

1. The base quantity among the following is

A. Speed

B. Weight

C. Length

D. Area

Answer: C

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2. Which of the following is not a unit of time?

A. second

B. minute

C. hour

D. light year

Answer: D

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3. Astronomical unit (AU) is the distance betweene arth and the sun, 1 AU is equal to

A. $9.46 \times 10^{15} m$

B. $1.496 \times 10^{11} m$

C. $3 \times 10^{8} m$

D. $3.08 \times 10^{16} m$

Answer: B

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4. The volume of a cube having sides 1.2 m is appropriately expressed as

A. $1.728 \times 10^{6} cm^{3}$

B. $1.7 \times 10^{6} cm^{3}$

C. $1.8 \times 10^6 cm^3$

D. $1.73 \times 10^6 cm^3$

Answer: B

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5. Ampere second is a unit of

A. Current

B. Charge

C. Energy

D. Power

Answer: B

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6. The most precise reading of the mass of an object among the following is

A. 20 g

B. 20.0 g

C. 20.01 g

D. $20 \times 10^{0} g$

Answer: C

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7. The most accurate reading of the length of a 6.28 cm long fibre is

A. 6 cm

B. 6.5 cm

C. 5.99 cm

D. 6.0 cm

Answer: B

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8. Which of the following is a unit that of force?

A. N m

B. mN

C. nm

D. N s

Answer: B

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9. The value of 60° in radian is

A. $\frac{\pi}{2}$

B. $\frac{\pi}{3}$

C. $\frac{\pi}{4}$

D. $\frac{\pi}{5}$

Answer: B

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10. The total plane angle subtended by a circle at its centre is

A. π rad

B. 2π rad

C. $\frac{2\pi}{3}$ rad

D. $\frac{\pi}{2}$ rad

Answer: B

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11. A far off planet is estimated to be at a distance D from the earth. If its diametrically opposite extremes subtend an angle θ at an observatory situated on the earth, the approximate diameter of the planet is

A. $\frac{\theta}{D}$

B. $\frac{D}{\theta}$

C. $D\theta$

D. $\frac{1}{D\theta}$

Answer: C

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12. One unified atomic mass unit represents a mass of magnitude

A. $10^{-30} kg$

B. $1.66 \times 10^{27} kg$

C. $1.66 \times 10^{-27} kg$

D. $10^{30} kg$

Answer: C

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13. If the average life of a person is taken as 100 s the age of the universe on this scale is of the order

A. $10^{10} s$

B. $10^8 s$

C. $10^{17} s$

D. $10^9 s$

Answer: A

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14. Which of the following is the most precise measurement?

A. $3 \times 10^{-3} m$

B. 0.0030 m

C. $30 \times 10^{-4} m$

D. $300 \times 10^{-5} m$

Answer: D

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15. The number of significant figures in a pure number 410 is

A. Two

B. Three

C. One

D. Infinite

Answer: D

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16. Thickness of a pencil measured by using a screw gauge (least count.001 cm) comes out to be 0.802 cm .The percentage error in the measurement is

A. $0.125\ \%$

B. $2.43\ \%$

C. $4.12\ \%$

D. $2.14\ \%$

Answer: A

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17. The percentage error in the measurement of the voltage V is 3% and in the measurement of the current is 2%. The percentage error in the measurement of the resistance is

A. 0.03

B. 0.02

C. 0.01

D. 0.05

Answer: D

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18. The relative error in the measurement of the side of a cube is 0.027 The relative error in the measurement of its volume is

A. 0.027

B. 0.054

C. 0.081

D. 0.046

Answer: C

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19. Zero error of an instrument introduces

A. Systematic error

B. Random error

C. Least count error

D. Personal error

Answer: A

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20. A packet contains silver powder of mass 20.23 g $\pm$ 0.01 g Some of the powder of mass 5.75 g $\pm$ 0.01 g is taken out from it The mass of the powder lell back is

A. $14.48g \pm 0.00g$

B. $14.48g \pm 0.02g$

C. $14.5g \pm 0.1g$

D. $14.5g \pm 0.2g$

Answer: B

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21. The addition of three masses 1.6 g, 7.32 g and 4.238 g. addressed upto proper decimal places is

A. 13.158g

B. 13.2g

C. 13.16g

D. 13.15g

Answer: B

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22. The area of a sheet of length 10.2 cm and width 6.8 cm addressed upto proper number of significant figures is

A. $69.36cm^2$

B. $69.4cm^2$

C. $69cm^2$

D. $70cm^2$

Answer: C

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23. The radius of a sphere is (2.6 $\pm$ 0.1) cm The percentage error u iis volume is

A. $\frac{0.1}{2.6} \times 100\,\%$

B. $3 \times \frac{0.1}{2.6} \times 100\,\%$

C. $\frac{0.1}{3 \times 2.6} \times 100\,\%$

D. $\frac{0.1}{2.6}\,\%$

Answer: B

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24. The uncertain digit in the measurement of a length reported as 41.68 cm is

A. 4

B. 1

C. 6

D. 8

Answer: D

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25. We can reduce random errors by

A. Taking large number of observations

B. Corrected zero error

C. By following proper technique of experiment

D. Both (1) & (3)

Answer: A

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26. The number of significant figures in the measured value 0.0204 is

A. Five

B. Three

C. Four

D. Two

Answer: B

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27. The number of significant figures in the measured value 26000 is

A. Five

B. Two

C. Three

D. Infinite

Answer: B

Watch Video Solution

28. The number of significant zeros present in the measured value 0.020040 , is

A. Five

B. Two

C. One

D. Three

Answer: D

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29. The number of significant figures in the measured value 4.700 m is the same as that in the value

A. 4700 m

B. 0.047 m

C. 4070 m

D. 470.0 m

Answer: D

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30. If a calculated value 2.7465 g contains only three significant figures, the two insignificant digits in it are

A. 2 and 7

B. 7 and 4

C. 6 and 5

D. 4 and 6

Answer: C

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31. An object of mass 4.237 g occupies a volume $1.72 cm^3$. The density of the object to appropriate significant figures is -

A. $2.46 gcm^{-3}$

B. $2.463 gcm^{-3}$

C. $2.5 gcm^{-3}$

D. $2.50 gcm^{-3}$

Answer: A

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32. Round off the value 2.845 to three significant figures

A. 2.85

B. 2.84

C. 2.8

D. 2.83

Answer: B

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33. A length 5.997 m rounded off to three significant figures is written as

A. 6.00 m

B. 5.99 m

C. 5.95 m

D. 5.90 m

Answer: A

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34. The order of the magnitude of speed of light in SI unit is

A. 16

B. 8

C. 4

D. 7

Answer: B

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35. The values of a number of quantities are used in a mathematical formula The quantity that should be most precise and accurate in measurement is the one

A. Having smallest magnitude

B. Having largest magnitude

C. Used in the numerator

D. Used in the denominator

Answer: A

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36. What are the dimensions of the change in velocity ?

A. $\left[M^0L^0T^0\right]$

B. $\left[LT^{-1}\right]$

C. $\left[MLT^{-1}\right]$

D. $\left[LT^{-2}\right]$

Answer: B

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37. The dimensional formula for energy is

A. $[MLT^{-2}]$

B. $[ML^2T^{-2}]$

C. $[M^{-1}L^2T]$

D. $[ML^2T]$

Answer: B

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38. The pair of the quantities having same dimensions is

A. Displacement, velocity

B. Time, frequency

C. Wavelength, focal length

D. Force, acceleration

Answer: C

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39. The dimensional formula for relative refractive index is

A. $\left[M^1L^1T^1\right]$

B. $\left[M^0L^0T^0\right]$

C. $\left[M^1L^0T^0\right]$

D. $\left[MLT^{-1}\right]$

Answer: B

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40. The dimensional formula $\left[ML^{-1}T^{-2}\right]$ is for the quantity

A. Force

B. Acceleration

C. Pressure

D. Work

Answer: C

Watch Video Solution

41. The buoyant force F acting on a body depends on the density of medium ρ, volume of body immerese V and acceleration due to gravity g. Establish the relation using method of dimensions.

A. $V\rho g$

B. $\frac{\rho g}{V}$

C. $\rho g V^2$

D. $\sqrt{\rho g V}$

Answer: A

Watch Video Solution

42. The dimensionally correct expression for the resistance R among the following is [P= electric power, I= Electric current 1 = time, V = voltage and E=electric energy]

A. $R = \sqrt{Pl}$

B. $R = \dfrac{E}{l^2 t}$

C. $R = V^2 P$

D. R = VI

Answer: B

Watch Video Solution

43. Which of the following does not have dimensions of force?

A. Weight

B. Rate of change of momentum

C. Work per unit length

D. Work done per unit charge

Answer: D

Watch Video Solution

44. 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 A and B are respectively

A. $\left[ML^{5/2}T^{-2}\right], [L]$

B. $\left[MLT^{-2}\right], \left[L^2\right]$

C. $[L], \left[ML^{3/2}T^{-2}\right]$

D. $[L^2], [MLT^{-2}]$

Answer: A

Watch Video Solution

45. The time dependence of a physical quantity P is given by $P = P_0 e^{-\alpha t^2}$, where α is a constant and t is time . Then constant α is//has

A. [T]

B. $[T^2]$

C. $[T^{-1}]$

D. $[T^{-2}]$

Answer: D

Watch Video Solution

46. The dimensions of potential energy of an object in mass, length and time are respectively

A. $2, 2, 1$

B. $1, 2, -2$

C. $-2, 1, 2$

D. $1, -1, 2$

Answer: B

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47. Which of the following is a dimensional constant?

A. Magnification

B. Relative density

C. Gravitational constant

D. Relative error

Answer: C

Watch Video Solution

48. Dimension of solar constant is:

A. $[M^0 L^0 T^0]$

B. $[MLT^{-2}]$

C. $[ML^2T^{-2}]$

D. $[MT^{-3}]$

Answer: D

Watch Video Solution

49. The amount of heat energy Q, used to heat up a substance depends on its mass m its specific heat capacity (s) and the change in temperature ΔT of the substance. Using dimensional method, find the expression for s

is (Given that $[S] = [L^2T^{-2}K^{-1}]$) is

A. $Qm\Delta T$

B. $\frac{Q}{m\Delta T}$

C. $\frac{Qm}{\Delta T}$

D. $\frac{m}{Q\Delta T}$

Answer: B

Watch Video Solution

50. The power of lens is $P = \frac{1}{f}$ where f is focal length of the lens. The dimensions of power of lens is

A. [L]

B. $\left[ML^2T^{-3}\right]$

C. $\left[L^{-1}\right]$

D. $\left[MLT^{-3}\right]$

Answer: C

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ASSIGNMENT (SECTION - B)

1. The exchange particles responsible for weak interactions are

A. Gluons

B. π-mesons

C. Photons

D. W and Z bosons

Answer: D

Watch Video Solution

2. Maxwell unified

A. Electricity with gravitation

B. Electricity with magnetism

C. Electromagnetism with optics

D. Electromagnetism with weak interaction

Answer: C

Watch Video Solution

3. Which of the following is not a derived force?

A. Tension in a string

B. van der Waal force

C. Nuclear force between proton-proton

D. Electrostatic force between proton-proton

Answer: D

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4. Which one of the following does not experience strong nuclear force?

A. Leptons

B. Baryons

C. Hadrons

D. Proton

Answer: A

Watch Video Solution

5. Which of the following practical units of length is not correct?

A. 1 fermi = 10^{-15}m

B. 1 astronomical unit = 1.496×10^{11}m

C. 1 parsec = 3.26 light year

D. 1 light year = 9.46×10^{12}m

Answer: D

Watch Video Solution

6. Suppose y represents the work done and x the power, then dimensions of $\frac{d^2y}{dx^2}$ will be

A. $\left[ML^{-1}T^{-2}\right]$

B. $\left[M^2L^{-2}T^{-2}\right]$

C. $\left[ML^{-1}T^{0}\right]$

D. $\left[M^2L^{-2}T^{-4}\right]$

Answer: C

Watch Video Solution

7. The units of length, velocity and force are doubled. Which of the following is the correct change in th other units?

A. Unit of time is doubled

B. Unit of mass is doubled

C. Unit of momentum is doubled

D. Unit of energy is doubled

Answer: C

Watch Video Solution

8. The dimensions of $\frac{a}{b}$ in the equation $P = \frac{a - t^2}{bx}$ where P is pressure, x is distance and t is time are

A. $[MLT^{-1}]$

B. $[ML^{-1}T^{-2}]$

C. $[ML^3T^{-4}]$

D. $[ML^2T^{-4}]$

Answer: C

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9. Even if a physical quantity depends upon three quantities, out of which two ae dimensionally same, then the formula cannot be derived by the method of dimensions. This statement

A. May be true

B. May be false

C. Must be true

D. Must be false

Answer: C

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10. The unit of "impulse per unit area" is same as that of

A. Viscosity

B. Surface tension

C. Bulk modulus

D. Force

Answer: A

Watch Video Solution

Watch Video Solution

11. In a practical unit if the unit of mass becomes double and that of unit of time becomes half, then 8 joule will be equal to ________ unit of work.

A. 6

B. 4

C. 1

D. 10

Answer: C

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12. In a new system of units energy (E), density (d) and power (P) are taken as fundamental units, then the dimensional formula of universal gravitational constant G will be

A. $\left[E^{-1}d^{-2}P^{2}\right]$

B. $\left[E^{-2}d^{-1}P^{2}\right]$

C. $\left[E^{2}d^{-1}P^{-1}\right]$

D. $\left[E^1 d^{-2} P^{-2}\right]$

Answer: B

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13. In equation $y = x^2 \cos^2 2\pi \frac{\beta\gamma}{\alpha}$, the units of x, α, β are m, s^{-1} and $\left(ms^{-1}\right)^{-1}$ respectively. The units of y and γ are

A. m^2, ms^{-2}

B. m, ms^{-1}

C. m^2, m

D. m, ms^{-2}

Answer: A

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14. A dimensionally consistent relation for the volume V of a liquid of coefficiet of viscosity η flowing per second through a tube of radius r and length l and having a pressure difference p across its end, is

A. $V = \frac{\pi P r^4}{8 \eta l}$

B. $V = \frac{\pi \eta}{8 P r^4}$

C. $V = \frac{8 P \eta}{\pi r^4}$

D. $V = \frac{\pi P \eta}{8 r^4}$

Answer: A

Watch Video Solution

15. If E, M, J and G denote energy, mass, angular momentum and gravitational constant respectively, then $\frac{EJ^2}{M^5G^2}$ has the dimensions of

A. Angle

B. Length

C. Mass

D. Time

Answer: A

Watch Video Solution

16. Let P represent radiation pressure, c represent speed of light and I represents radiation energy striking a unit area per second, then $P^x I^y c^z$ will be dimensionless for

A. x = 0, y = z

B. x = y = z

C. x = z = -y

D. x = y = -z

Answer: C

Watch Video Solution

17. The number of particles is given by $n = -D\frac{n_2 - n_1}{x_2 - x_1}$ crossing a unit area perpendicular to X - axis in unit time , where n_1 and n_2 are particles per unit volume for the value of x meant to x_2 and x_1 . Find the dimensions of D called diffusion constant.

A. $\left[M^0 L^{-1} T^2\right]$

B. $\left[M^0 L^{-1} T^{-1}\right]$

C. $\left[M^0 L^2 T^{-1}\right]$

D. $\left[M^0L^2T^2\right]$

Answer: C

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18. The frequency f of vibrations of a mass m suspended from a spring of spring constant k is given by $f = Cm^x k^y$, where C is a dimensionnless constant. The values of x and y are, respectively,

A. $x = \frac{1}{2}, y = \frac{1}{2}$

B. $x = \frac{-1}{2}, y = \frac{-1}{2}$

C. $x = \frac{1}{2}, y = \frac{-1}{2}$

D. $x = \frac{-1}{2}, y = \frac{1}{2}$

Answer: D

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19. The equation of a stationary wave is $y = 2A \sin\left(\frac{2\pi ct}{\lambda}\right)\cos\left(\frac{2\pi x}{\lambda}\right)$

Which of the following is correct?

A. The unit of ct is same as that of λ

B. The unit of x is same as that of λ

C. The unit of $\frac{2\pi c}{\lambda}$ is same as that of $\frac{2\pi x}{\lambda t}$

D. The unit of $\frac{c}{\lambda}$ is same as that of $\frac{x}{\lambda}$

Answer: D

Watch Video Solution

20. If energy E, velocity v and time T are taken as fundamental quanties, the dimensional formula for surface tension is

A. $\left[EV^{-2}T^{-2}\right]$

B. $\left[E^{-2}VT^{-2}\right]$

C. $\left[E^{-2}V^{-2}T\right]$

D. $\left[E^{-2}V^{-2}T^{-2}\right]$

Answer: A

Watch Video Solution

21. If speed (V),acceleration (A) and force (F) are considered as fundamental units, the dimesnion of Young 's modulus will be :

A. $\left[F^{-1}A^{-1}D^{-1}\right]$

B. $\left[FA^{-2}D^{2}\right]$

C. $\left[FA^{-1}D\right]$

D. $\left[FA^{-1}D^{0}\right]$

Answer: D

Watch Video Solution

22. If the error in the measurement of radius of a sphere is 2%, then the error in the determination of volume of the sphere will be

A. 0.02

B. 0.04

C. 0.06

D. 0.08

Answer: C

Watch Video Solution

23. If a set of defective weights are used by a student to find the mass of an object using a physical balance, a large number of reading will reduce :-

A. Random error

B. Systematic error

C. Random as well as systematic error

D. Neither random nor systematic error

Answer: A

Watch Video Solution

24. A force F is applied on a square plate of side L. If the percentage error in the determination of L is 2% and that in F is 4%. What is the permissible error in pressure?

A. 0.02

B. 0.04

C. 0.06

D. 0.08

Answer: D

Watch Video Solution

25. The radius of a sphere is (5.3 ± 0.1)cm` The perecentage error in its volume is

A. $\frac{0.1}{5.3} \times 100$

B. $3 \times \frac{0.1}{5.3} \times 100$

C. $\frac{3}{2} \times \frac{0.1}{5.3} \times 100$

D. $6 \times \frac{0.1}{0.3} \times 100$

Answer: B

Watch Video Solution

26. Percentage erros 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. 0.02

B. 0.01

C. 0.05

D. 0.07

Answer: D

Watch Video Solution

27. The acceleration due to gravity is measured on the surface of earth by using a simple pendulum. If α and β are relative errors in the measurement of length and time period respectively, then percentage error in the measurement of acceleration due to gravity is

A. $\left(\alpha + \frac{1}{2}\beta\right) \times 100$

B. $(\alpha - 2\beta)$

C. $(2\alpha + \beta) \times 100$

D. $(\alpha + 2\beta) \times 100$

Answer: D

Watch Video Solution

28. A public park , in the form of a square , has an area of $(100 \pm 0.2) m^2$ The side of park is

A. (10 $\pm$ 0.01) m

B. (10 $\pm$ 0.1) m

C. (10 $\pm$ 0.02) m

D. (10 ± 0.2) m

Answer: A

Watch Video Solution

29. A physical quantity is represented by $X = M^a L^b T^{-c}$.If the percentage error in the measurement of M,L and T are $\alpha \%$, $\beta \%$ and $\gamma \%$ to respectively, what is the total percentage error in X?

A. $(\alpha a - \beta b + \gamma c) \%$

B. $(\alpha a+\beta b+\gamma c)\,\%$

C. $(\alpha a-\beta b-\gamma c)\,\%$

D. $(\alpha a+\beta b-\gamma c)\,\%$

Answer: B

Watch Video Solution

30. The least count of a stop watch is 1/5 second. The time of 20 oscillations of a pendulum is measured to be 25 seconds. The maximum percentage error in the measurement of time will be

A. 0.1%

B. 0.8%

C. 1.8%

D. 0.08

Answer: B

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31. A student measures the distance traversed in free fall of a body, initially at rest in a given time. He uses this data to estimate g, the accelration due to gravity. If the maximum percentage errors in measurement of the distance and the time are e_1 and e_2 respectively, the percentage error in the estimation of g is -

A. $e_2 - e_1$

B. $e_1 + 2e_2$

C. $e_1 + e_2$

D. $e_1 - 2e_2$

Answer: B

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ASSIGNMENT (SECTION - C)

1. Planck 's constant (h) speed of length in vaccum (C) and newton 's gravitational constant (G) are three fundamental constant

.Which of the following combinations of these has the dimension of length?

A. $\dfrac{\sqrt{hG}}{c^{3/2}}$

B. $\dfrac{\sqrt{hG}}{c^{5/2}}$

C. $\sqrt{\dfrac{hc}{G}}$

D. $\sqrt{\dfrac{Gc}{h^{3/2}}}$

Answer: A

Watch Video Solution

2. In dimension of critical velocity v_c liquid following through a take 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 value of x, y and z are given by

A. $1, 1, 1$

B. $1, -1, -1$

C. $-1, -1, 1$

D. $-1, -1, -1$

Answer: B

Watch Video Solution

3. If energy (E), velocity (v) and time (T) are chosen as the fundamental quantities, the dimensional formula of surface tension will be

A. $\left[E^{-2}V^{-1}T^{-3}\right]$

B. $\left[EV^{-2}T^{-1}\right]$

C. $\left[EV^{-1}T^{-2}\right]$

D. $\left[EV^{-2}T^{-2}\right]$

Answer: D

Watch Video Solution

4. If force (F), velocity (v) and time (T) are taken as fundamental units, then the dimensions of mass is

A. $[FVT^{-1}]$

B. $[FVT^{-2}]$

C. $[FV^{-1}T^{-1}]$

D. $[FV^{-1}T]$

Answer: D

Watch Video Solution

5. 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 $P = \frac{a^3 b^2}{cd}\%$. Error in P is

A. 0.1

B. 0.07

C. 0.04

D. 0.14

Answer: D

Watch Video Solution

6. The damping force on an oscillator is directly proportional to the velocity. The units of the constant to proportionality are

A. kg s^{-1}

B. kg s

C. kg ms^{-1}

D. kgm s^{-2}

Answer: A

Watch Video Solution

7. The dimensions of $(\mu_0\varepsilon_0)^{-1/2}$ are

A. $\left[L^{-\frac{1}{2}}T^{\frac{1}{2}}\right]$

B. $\left[L^{\frac{1}{2}}T^{-\frac{1}{2}}\right]$

C. $\left[L^{-1}T\right]$

D. $[LT^{-1}]$

Answer: D

Watch Video Solution

8. The density of material in CGS system of mass is $4gcm^3$ in a system of unit in which unit of length is $10cm$ and unit of mass is $100g$ the value of density of material will be

A. 400

B. 0.04

C. 0.4

D. 40

Answer: D

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9. A student measures the distance traversed in free fall of a body, initially at rest in a given time. He uses this data to estimate g, the accelration due to gravity. If the maximum percentage errors in measurement of the distance and the time are e_1 and e_2 respectively, the percentage error in the estimation of g is -

A. $e_2 - e_1$

B. $e_1 + 2e_2$

C. $e_1 + e_2$

D. $e_1 - 2e_2$

Answer: B

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10. The dimensions of $\frac{1}{2}\varepsilon_0 E^2$, where ε_0 is permittivity of free space and E is electric field, are

A. ML^2T^{-2}

B. $ML^{-1}T^{-2}$

C. ML^2T^{-2}

D. MLT^{-1}

Answer: B

Watch Video Solution

11. If the dimensions of a physical quantity are given by $\left[M_{\alpha}L^{b}T^{c}\right]$, then the physical quantity will be

A. Velocity if a = 1, b = 0, c = -1

B. Acceleration if a = 1, b = 1, c = -2

C. Force if a = 0, b = -1, c = -2

D. Pressure if a = 1, b = -1, c = -2

Answer: D

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12. Which two of the following five physical paramenters have the same dimensions?

(i) Energy density

(ii) Refractive index

(iii) Dielectric constant

(iv) Young's modulus

(v) Magnetic field

A. (a) and (e)

B. (b) and (d)

C. (c) and (e)

D. (a) and (d)

Answer: D

Watch Video Solution

13. If the error in the measurement of radius of a sphere is 2%, then the error in the determination of volume of the sphere will be

A. 0.02

B. 0.04

C. 0.06

D. 0.08

Answer: C

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14. Dimensions of resistance in an electrical circuit, in terms of dimension of mass M, of length L, of time T and of current I, would be

A. $[ML^2T^{-3}I^{-2}]$

B. $[ML^2T^{-3}I^{-1}]$

C. $[ML^2T^{-2}]$

D. $[ML^2T^{-1}I^{-1}]$

Answer: A

Watch Video Solution

15. The velocity v of a particle at time t is given by $v = at + \frac{b}{t+c}$, where a, b and c are constants. The dimensions of a, b and c are, respectively.

A. $\left[LT^{-2}\right], [L]$ and $[T]$

B. $\left[L^2\right], [T]$ and $\left[LT^2\right]$

C. $\left[LT^2\right], [LT]$ and $[L]$

D. $[L], [LT]$ and $[T^2]$

Answer: A

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16. The ratio of the dimensions of Planck's constant and that of the moment of inertia has the dimensions of

A. Frequency

B. Velocity

C. Angular momentum

D. Time

Answer: A

Watch Video Solution

17. The pair of the quantities having same dimensions is

A. Young's modulus and Energy

B. Impulse and Surface Tension

C. Angular momentum and Work

D. Work and Torque

Answer: D

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18. The dimensions of μ_0 are

A. $\left[M^1L^{-1/2}T^{1/2}\right]$

B. $\left[M^1L^{1/2}T^{-1/2}\right]$

C. $\left[L^{-1}T\right]$

D. $\left[M^{1}L^{1}T^{-2}A^{-2}\right]$

Answer: D

Watch Video Solution

19. Dimensions of surface tension are

A. $\left[ML^{1}T^{0}\right]$

B. $\left[ML^{1}T^{-1}\right]$

C. $\left[ML^{0}T^{-2}\right]$

D. $\left[M^{1}L^{0}T^{-2}\right]$

Answer: C::D

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20. The dimensions of pressure are

A. $[MLT^{-2}]$

B. $[ML^{-1}T^{-2}]$

C. $[ML^{-2}T^{-2}]$

D. $[M^{-1}L^{-1}]$

Answer: B

Watch Video Solution

21. Percentage erros 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. 0.08

B. 0.02

C. 0.12

D. 0.1

Answer: A

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22. Which of the following is a dimensional constant ?

A. Relative density

B. Gravitational constant

C. Refractive index

D. Poisson's ratio

Answer: B

Watch Video Solution

23. Show that time constant $(\tau = RC)$ of $R - C$ circuit has the dimensions of time.

A. Square of time

B. Square of inverse time

C. Time

D. Inverse time

Answer: C

Watch Video Solution

24. The dimensions of impulse are equal to that of

A. Pressure

B. Linear momentum

C. Force

D. Angular momentum

Answer: B

Watch Video Solution

25. The density of a cube is measured by measuring its mass and the length of its sides. If the maximum errors in the measurement of mass and length are 3% and 2%, respectively, then find the maximum error in the measurement of the density of cube.

A. 0.12

B. 0.14

C. 0.07

D. 0.09

Answer: D

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26. An equation is given as $\left(p+\frac{a}{V^2}\right)=b\frac{\theta}{V}$,where $p=$ pressure $V=$ volumen and $\theta=$ absolute temperature. If a and b are constants, then dimensions of a will be

A. $[ML^{-5}T^{-1}]$

B. $[ML^{5}T^{1}]$

C. $[ML^{5}T^{-2}]$

D. $[M^{-1}L^{5}T^{2}]$

Answer: C

Watch Video Solution

27. Which of the following dimensions will be the same as that of time?

A. $\frac{L}{R}$

B. $\frac{C}{L}$

C. LC

D. $\frac{R}{L}$

Answer: A

Watch Video Solution

28. The dimensional formula for magnetic flux is

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

B. $[ML^0T^{-2}A^{-2}]$

C. $[ML^2T^{-2}A^{-1}]$

D. $[ML^2T^{-1}A^3]$

Answer: C

Watch Video Solution

29. Which pair have not equal dimensions :

A. Energy and torque

B. Force and impulse

C. Angular momentum and Planck's constant

D. Elastic modulus and pressure

Answer: B

Watch Video Solution

30. The dimension of Planck's constant are the same as that of

A. Energy

B. Momentum

C. Angular momentum

D. Power

Answer: C

Watch Video Solution

31. The dimensions of universal gravitational constant are ____

A. $[M^{-1}L^3T^{-2}]$

B. $[ML^2T^{-1}]$

C. $[M^{-2}L^3T^{-2}]$

D. $[M^{-2}L^2T^{-1}]$

Answer: A

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ASSIGNMENT (SECTION - D)

1. A : PARSEC and light year, both measure time

R : Both have dimension of time.

A. If both Assertion & Reason are true and the reason is the correct explanation of the assertion, then mark (1).

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark (2).

C. If Assertion is true statement but Reason is false, then mark (3).

D. If both Assertion and Reason are false statements, then mark (4).

Answer: D

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2. A : Displacement gradient is a dimensionless quantity.

R : Displacement is dimensionless quantity.

A. If both Assertion & Reason are true and the reason is the correct explanation of the assertion, then mark (1).

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark (2).

C. If Assertion is true statement but Reason is false, then mark (3).

D. If both Assertion and Reason are false statements, then mark (4).

Answer: C

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3. Assertion : Absolute error may be negative or positive.

Reason : Absolute error is the difference between the real value and the measured value of a physical quantity.

A. If both Assertion & Reason are true and the reason is the correct explanation of

the assertion, then mark (1).

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark (2).

C. If Assertion is true statement but Reason is false, then mark (3).

D. If both Assertion and Reason are false statements, then mark (4).

Answer: D

Watch Video Solution

4. A : A unitless physical quantity must be dimensionless.

R : A pure number is always dimensionless.

A. If both Assertion & Reason are true and the reason is the correct explanation of the assertion, then mark (1).

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark (2).

C. If Assertion is true statement but Reason is false, then mark (3).

D. If both Assertion and Reason are false statements, then mark (4).

Answer: B

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5. A : Absolut error is unitless and dimensionless.

R : All type of errors are unitless and dimensionless.

A. If both Assertion & Reason are true and the reason is the correct explanation of the assertion, then mark (1).

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark (2).

C. If Assertion is true statement but Reason is false, then mark (3).

D. If both Assertion and Reason are false statements, then mark (4).

Answer: D

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6. A : Higher is the accuracy of measurement, if instrument have smaller least count.

R : Smaller the percentage error, higher is the accuracy of measurement.

A. If both Assertion & Reason are true and the reason is the correct explanation of the assertion, then mark (1).

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark (2).

C. If Assertion is true statement but Reason is false, then mark (3).

D. If both Assertion and Reason are false statements, then mark (4).

Answer: B

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7. A : The maximum possible error in a reading is taken as least count of the measuring instrument.

R : Error in a measurement cannot be greater than least count of the measuring instrument.

A. If both Assertion & Reason are true and the reason is the correct explanation of

the assertion, then mark (1).

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark (2).

C. If Assertion is true statement but Reason is false, then mark (3).

D. If both Assertion and Reason are false statements, then mark (4).

Answer: C

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8. A : In a measurement, two readings obtained are 20.004 and 20.0004. The second measurement is more precise.

R : Measurement having more decimal places is more precise.

A. If both Assertion & Reason are true and the reason is the correct explanation of the assertion, then mark (1).

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark (2).

C. If Assertion is true statement but Reason is false, then mark (3).

D. If both Assertion and Reason are false statements, then mark (4).

Answer: A

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9. A : Out of the measurements A = 20.00 and B = 20.000, B is more accurate.

R : Percentage error in B is less than the percentage error in A.

A. If both Assertion & Reason are true and the reason is the correct explanation of the assertion, then mark (1).

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark (2).

C. If Assertion is true statement but Reason is false, then mark (3).

D. If both Assertion and Reason are false statements, then mark (4).

Answer: A

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10. 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.

A. If both Assertion & Reason are true and the reason is the correct explanation of the assertion, then mark (1).

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark (2).

C. If Assertion is true statement but Reason is false, then mark (3).

D. If both Assertion and Reason are false statements, then mark (4).

Answer: A

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11. A : All physically correct equations are dimensionally correct.

R : All dimensionally correct equations are physically correct.

A. If both Assertion & Reason are true and the reason is the correct explanation of the assertion, then mark (1).

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark (2).

C. If Assertion is true statement but Reason is false, then mark (3).

D. If both Assertion and Reason are false statements, then mark (4).

Answer: C

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12. A : Physical relations involving addition and subtraction cannot be derived by dimensional analysis.

R : Numerical constants cannot be deduced by the methos of dimensions.

A. If both Assertion & Reason are true and the reason is the correct explanation of

the assertion, then mark (1).

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark (2).

C. If Assertion is true statement but Reason is false, then mark (3).

D. If both Assertion and Reason are false statements, then mark (4).

Answer: B

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13. A : If displacement y of a particle executing simple harmonic motion depends upon amplitude a angular frequency ω and time t then the relation $y = a\sin\omega t$ cannot be dimensionally achieved.

R : An equation cannot be achieved by dimensional analysis, if it contains dimensionless expressions.

A. If both Assertion & Reason are true and the reason is the correct explanation of

the assertion, then mark (1).

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark (2).

C. If Assertion is true statement but Reason is false, then mark (3).

D. If both Assertion and Reason are false statements, then mark (4).

Answer: A

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14. A : An exact number has infinite number of significant digits.

R : A number, which is not a measured value has infinite number of significant digits.

A. If both Assertion & Reason are true and the reason is the correct explanation of the assertion, then mark (1).

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark (2).

C. If Assertion is true statement but Reason is false, then mark (3).

D. If both Assertion and Reason are false statements, then mark (4).

Answer: B

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15. A : A dimensionless quantity may have unit.

R : Two physical quantities having same dimensions, may have different units.

A. If both Assertion & Reason are true and the reason is the correct explanation of the assertion, then mark (1).

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark (2).

C. If Assertion is true statement but Reason is false, then mark (3).

D. If both Assertion and Reason are false statements, then mark (4).

Answer: B

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