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IIT-JAM BIOTECHNOLOGY

UNITS, MEASUREMENTS, DIMENSIONAL & ERROR ANALYSIS

PART-A: IIT-JAM PREVIOUS YEARS QUESTION

1. The dimensional formula of surface tension in terms of the dimensions of mass (M), length (L) and time (T) is **[JAM-2006]**

   (a) MT^{-2} (b) MLT^{-2} (c) MT^{-1} (d) $ML^{-1}T^{-2}$

2. The dimensions ML^2T^{-2} *do not* correspond to **[JAM-2010]**

   (a) work (b) torque (c) heat (d) angular momentum

3. The dimensions of the ratio $\frac{\text{Stress}}{\text{Strain}}$ are **[JAM-2011]**

   (a) $ML^{-4}T^{-2}$ (b) $ML^{-1}T^{-2}$ (c) $ML^{-2}T^{-1}$ (d) $ML^{-2}T^{-2}$

4. Dimension of viscosity is **[JAM-2013]**

   (a) $ML^{-2}T^{-1}$ (b) $ML^{-1}T^{-1}$ (c) $ML^{-1}T^{-2}$ (d) $ML^{-1}T$

5. The dimensions of shear strain are **[JAM-2014]**

   (a) $M^0L^1T^{-2}$ (b) $M^1L^1T^{-2}$ (c) $M^0L^1T^0$ (d) $M^0L^0T^0$

6. The position of a particle along the *y*-axis is $y = Pt^4 + Q$. For the equation to be dimensionally consistent, the dimension of P in terms of length [L] and time [T] is **[JAM-2017]**

   (a) LT^{-1} (b) LT^{-2} (c) LT^{-3} (d) LT^{-4}

7. The dimensions of coefficient of viscosity are _____. **[JAM-2019]**

   (a) $ML^{-1}T^{-1}$ (b) $ML^{-1}T^{-2}$ (c) $ML^{-2}T^{-2}$ (d) $ML^{-2}T^{-1}$

8. Consider a spherical particle of mass *m* and radius *r* moving in a medium. Its velocity at any time *t* is given by $v = v_0 \exp\left(\frac{-6\pi X r t}{m}\right)$, where v_0 is initial velocity of the particle. The dimensions of *X* are

   (a) MLT^{-1} (b) $M^{-1}LT$ (c) $ML^{-1}T^{-1}$ (d) Dimensionless **[JAM-2020]**

9. The moment of force in terms of fundamental dimensions is **[JAM-2021]**

   (a) $ML^{-1}T^{-1}$ (b) MLT^{-2} (c) MLT^{-1} (d) ML^2T^{-2}

PART-B: JNU BIOTECHNOLOGY PREVIOUS YEARS QUESTION

1. Which one of the following do not have the same dimension? **[JNU Biotech-2006]**

   (a) Planck's constant and energy (b) Work and energy

   (c) Angle and strain (d) Relative density and refractive index

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2. In arithmetic $17.8 \times 3.1143 = 55.4354$. But as a result or experimental measurements the best way to express the product is **[JNU Biotech-2007]**
(a) 55.4354 (b) 55.4 (c) 55.44 (d) 55.435

3. An experiment measures quantities *a, b, c* and *x* is calculated from $x = ab / c^3$. If the maximum percentage of error in *a, b* and *c* are 1%, 1% and 2% respectively, the maximum percentage of error in *x* will be
(a) 8% (b) 4% **[JNU Biotech-2007]**
(c) –4% (d) None of these

4. Which of the following is not a dimensionless quantity? **[JNU Biotech-2011]**
(a) Strain (b) Solid angle (c) Dielectric constant (d) Planck's constant

5. The following quantity has the dimension of action **[JNU Biotech-2011]**
(a) Energy (b) Planck's constant (c) Angular momentum (d) Torque

PART-C: JNU LIFE SCIENCES PREVIOUS YEARS QUESTION

1. One Angstrom (Å) is **[JNU Life Sc.-2004]**
(a) 10^{-10} meters (b) 10 cm (c) 10^{-5} meters (d) 10^{-2} cm

2. The unit of pressure in Sl system is **[JNU Life Sc.-2009]**
(a) atmosphere (b) mm of mercury (c) pascal (d) dyne × cm^2

3. The dimension of energy is **[JNU Life Sc.-2011]**
(a) $ML^{-1}T^{-2}$ (b) ML^2T^{-2} (c) $M^2L^2T^{-2}$ (d) MLT^{-2}

PART-D: TIFR PREVIOUS YEARS QUESTION

1. The dimensional representation of Planck's constant is same as that of: **[TIFR-2014]**
(a) Angular momentum (b) Momentum
(c) Torque (d) Energy

2. Which of the following correctly expresses the Planck length (I) in terms of other fundamental constants (the gravitational constant G, velocity of light c and Planck's constant $\hbar$) ? **[TIFR-2015]**

(A) $\sqrt{\frac{\hbar G}{c^3}}$ (B) $\sqrt{\frac{c^3}{\hbar G}}$ (C) $\sqrt{\frac{c}{\hbar^2 G}}$ (D) $\sqrt{\frac{\hbar G^2}{c^2}}$

(a) A (b) B (c) C (d) D

3. The drag force on a particle moving at a speed *v* in a medium is of the form $F = \zeta v$, where the drag coefficient ζ depends on the particle's shape and size and on properties of the medium. If length is measured in cm, mass in g, and time in s, then ζ has units: **[TIFR-2018]**
(a) g (b) g/(cm s)
(c) g/s (d) g cm^2/s

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4. Heat and water loss in animals is proportional to the ratio of their surface area to volume. Imagine a spherical cow. When the radius of the cow doubles, its surface area-to-volume ratio
   (a) Reduces by 3/*r* (b) Remains unchanged **[TIFR-2022]**
   (c) Becomes half (d) Doubles

5. A solid cylindrical glass rod has length 20.0 ± 0.1 cm and diameter 5.00 ± 0.01 mm. What is the percentage uncertainty in the calculated volume of this rod? **[TIFR-2022]**
   (a) 0.1% (b) 0.2% (c) 0.7% (d) 0.9%

ANSWER KEY

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1. (a)	**2.** (d)	**3.** (b)	**4.** (b)	**5.** (d)
6. (d)	**7.** (a)	**8.** (c)	**9.** (d)	

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1. (a)	**2.** (b)	**3.** (a)	**4.** (d)	**5.** (b, c)

JNU LIFE SCIENCES

1. (a)	**2.** (c)	**3.** (b)

TIFR

1. (a)	**2.** (a)	**3.** (c)	**4.** (_)	**5.** (_)

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