Sharjah Indian School, Sharjah.

Std : XI
Sub : Physical World and Measurement.

① Check the correctness of the relation * (i) $v^2 = u^2 + 2as$
✓ (ii) $V = \frac{\pi P r^4}{8\eta l}$

where V - volume per unit time, P - Pressure, r - radius, η - coefficient of viscosity ($ML^{-1}T^{-1}$) & l - length.

② The frequency of vibration (n) of a string may depend on length (l), tension (T) and mass per unit length (m) of the string. Using dimensions establish the formula for n.

3. The velocity of a body (v) which has fallen freely under gravity varies as $g^p h^q$ where g is acceleration due to gravity at a place and h is the height through which the body has fallen. Determine the values of p and q.

④ Given that the period T of oscillation of a gas bubble from an explosion under water depends on P^a, d and E where P is the pressure, d is density of water and E is total energy of explosion. Find dimensionally a relation for T.

⑤ Convert :
✓ (i) $1 N/m^2$ into $dyne/cm^2$ * (ii) $1 g/cm^3$ into kg/m^3
(iii) 10 ergs into joule. (iv) $3600 km/h^2$ into m/s^2.

⑥ Find the dimensions of constants a & b in the following :
(i) $(P + a/V^2)(V - b) = RT$ where P is pressure, V is volume, T is absolute temperature.
✓ (ii) $F = a\sqrt{x} + bt^2$ where F is force, x is distance & t is time.
* (iii) $E = \frac{b - x^2}{at}$ where E is energy.

8. 1 calorie = 4.18 J where J has the dimensions of energy. Now system of units is so chosen that, the unit of mass is α kg, unit of length is β m and unit of time is γ s, then prove that 1 calorie = $4.18\,\alpha^{-1}\beta^{-2}\gamma^{2}$ in terms of new units.

9. Assuming that the mass m of the largest stone that can be moved by a flowing water depends on the velocity (v), density of water (ρ) and acceleration due to gravity (g). Show that m varies as the sixth power of velocity of flow

10. Write the dimensions of the following quantities

✓1) Stress σ (force per unit area)
* 2) Torque τ (force x perpendicular distance)
✓3) Power P (work per unit time)
4) Kinetic energy K
5) Momentum p (mass x velocity)
6) Surface tension σ (force per unit length)
* 7) Planck's constant h (energy per frequency)
8) frequency ν (frequency = 1/time period)
9) pressure P
✓10) force constant k (force per unit extension)
11) Amplitude A
* 12) Gravitational constant G ($G = \frac{Fr^2}{m_1 m_2}$)