Physics Assignment (Dimensional Analysis)

Q1. Write two physical quantities having (a) same dimensions (b) no dimensions.

Q2. Can a physical quantity have (give example wherever possible)

(i) Units but no dimensions

(ii) Dimensions but no units

(iii) Neither dimensions nor units

Q3. Convert a power of 1 megawatt on a system whose fundamental units are 10kg, 1dm and 1 minute.

Q4. A gas bubble from an explosion under water oscillates with a period T proportional to $p^a d^b E^c$ where p is the static pressure, d is the density of water and E is the total energy of the explosion. Find the value of a, b and c.

Q5. Assuming that the mass m of the largest stone that can be moved by a flowing river depends on velocity v, density ρ and acceleration due to gravity g, show that m varies with the sixth power of velocity of flow.

Q6. Find the value of x in the following equation:

$(\text{Velocity})^x = (\text{pressure difference})^{3/2}(\text{density})^{-3/2}$

Q7. Check the correctness of the formula

$\vartheta = \frac{1}{2\pi}\left(\frac{mgl}{I}\right)^{\frac{1}{2}}$ where ϑ is the frequency and I is the moment of inertia.

Q8. If the units, energy and velocity are 10N, 100J and 5 m/s, find the units of mass, length and time.

Q9. Find the dimensions of a/b in the following relation:

$F = a\sqrt{x} + bt^2$ where F is the force, x is distance and t is the time.

Q10. The number of particles given by $n = -D\left[\frac{n_2 - n_1}{x_2 - x_1}\right]$ are crossing a unit area perpendicular to x axis in unit time. n_1 and n_2 are the number of particles per unit volume for the values of x meant to be x_1 and x_2. Find the dimensional formula of D?

Q11. Calculate the dimensions of Force and Impulse in terms of velocity v, density ρ and frequency ϑ as the fundamental units.

Q12. Construct a new physical quantity having dimensions of length in terms of G, c and h where G is universal gravitational constant, c is speed of light and h is Planck's constant.