B.K. BIRLA CENTRE FOR EDUCATION

SARALA BIRLA GROUP OF SCHOOLS
A CBSE DAY-CUM-BOYS' RESIDENTIAL SCHOOL

PRE MID-TERM EXAMINATION

PHYSICS (042)

MARKING SCHEME

Class: XI **Time: 1hr**
Date: 08.11.25 **Max Marks: 25**

General Instructions:

i. *There are three sections A, B, and C with 13 questions in total, Section A has 5 Multiple Choice Questions of one mark each, Section B has 4 questions of two marks each and Section C has 4 questions of three marks each.*
ii. *All questions are compulsory.*

Section A

1. (d) Proportional limit 1
2. (a) L 1
3. (a) ρgh 1
4. (b) Hydraulic lift 1
5. (c) Assertion is correct, reason is incorrect. 1

Section-B

6. Ratio of lateral strain to longitudinal strain. 1
   $\nu = -$Longitudinal strain/Lateral strain. 1
   Dimension less.
7. $\Delta L = 2\times10^{-3}$ m, $r = 10^{-3}$ m, $A = \pi r^2 = 3.14\times10^{-6}$ m^2
   Strain = $\Delta L/L = 2\times10^{-3}/2 = 10^{-3}$.
   Stress = Y× strain $= 2\times10^{11}\times10^{-3} = 2\times10^{8}$ Pa 2
8. (a) Nature of fluid (intermolecular forces)
   (b)Temperature (viscosity of liquids ↓ with ↑ temp, gases ↑ with ↑ temp)
   (c)Impurities present. 2
9. A liquid drop tries to have minimum surface area due to surface tension. For a given volume, the sphere has the least surface area, hence drops are spherical. 2

Section-C

10. Force increases linearly with extension.
    Work done = average force × extension = ½ FΔL.

Per unit volume = ½ σε 3

11. **Yield point:** Stress where material begins permanent deformation. 1
Ultimate stress: Maximum stress material can bear. 1
Breaking stress: Stress at which material finally breaks. 1

12. Formula:

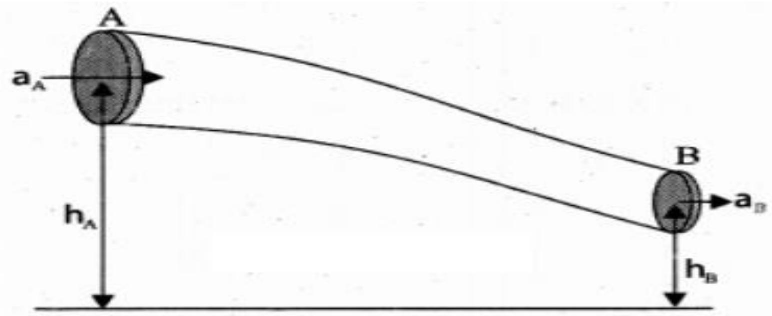
$F = \eta A v/d$

$2 = 0.1 \times A \times 1/0.0005$

$A = 2 \times 0.0005/ 0.1 = 0.01\ m^2$

13. (a)

Bernoulli's theorem: According to Bernoulli's theorem, the sum of pressure energy, kinetic energy, and potential energy per unit mass of an incompressible, non-viscous fluid in a streamlined flow remains a constant. Mathematically,



Flow of liquid through a pipe AB

$$\frac{P}{\rho} + \frac{1}{2}v^2 + gh = \text{constant}$$

This is known as Bernoulli's equation. Proof: Let us consider a flow of liquid through a Flow of liquid through a pipe AB pipe AB. Let V be the volume of the liquid when it enters A in a time t which is equal to the volume of the liquid leaving B in the same time. Let a_A , v_A and P_A be the area of cross section of the tube, velocity of the liquid and pressure exerted by the liquid at A respectively. Let the force exerted by the liquid at A is

$F_A = P_A \times a_A$ Distance travelled by the liquid in time t is $d = v_A t$

Therefore, the work done is $W = F_A d = P_A a_A v_A t$

But $a_A v_A t = a_A d = V$, **volume of the liquid entering at A.**

Thus, the work done is the pressure energy (at A), $W = F_A d = P_A V$

Pressure energy per unit volume at A $= \frac{\text{Pressure energy}}{\text{Volume}} = \frac{P_A V}{V} = P_A$

Pressure energy per unit mass at A $= \frac{\text{Pressure energy}}{\text{Mass}} = \frac{P_A V}{m} = \frac{P_A}{\frac{m}{V}} = \frac{P_A}{\rho}$

Since m is the mass of the liquid entering at A in a given time, therefore, pressure energy of the liquid at A is liquid at A is

$$E_{PA} = P_A V = P_A V \times \left(\frac{m}{m}\right) = m\frac{P_A}{\rho}$$

Potential energy of the liquid at A,

$$PE_A = mg\,h_A$$

Due to the flow of liquid, the kinetic energy of the liquid at A,

$$KE_A = \frac{1}{2}m\,v_A^2$$

Therefore, the total energy due to the flow of liquid at A,

$$E_A = E_{PA} + KE_A + PE_A$$

$$E_A = m\frac{P_A}{\rho} + \frac{1}{2}mv_A^2 + mg\,h_A$$

Similarly, let a_B, v_B and P_B be the area of cross section of the tube, velocity of the liquid and pressure exerted by the liquid at B. Calculating the total energy at E_B

$$E_B = m\frac{P_B}{\rho} + \frac{1}{2}mv_B^2 + mg\,h_B$$

From the law of conservation of energy, $E_A = E_B$

$$m\frac{P_A}{\rho} + \frac{1}{2}mv_A^2 + mgh_A = m\frac{P_B}{\rho} + \frac{1}{2}mv_B^2 + mg\,h_B$$

$$\frac{P_A}{\rho} + \frac{1}{2}v_A^2 + gh_A = \frac{P_B}{\rho} + \frac{1}{2}v_B^2 + gh_B = \text{constant}$$

Thus, the above equation can be written as

$$\frac{P}{\rho g} + \frac{1}{2}\frac{v^2}{g} + h = \text{constant}$$

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