SOLUTIONS TO MOCK TEST-3

Candidates name: TEST-2

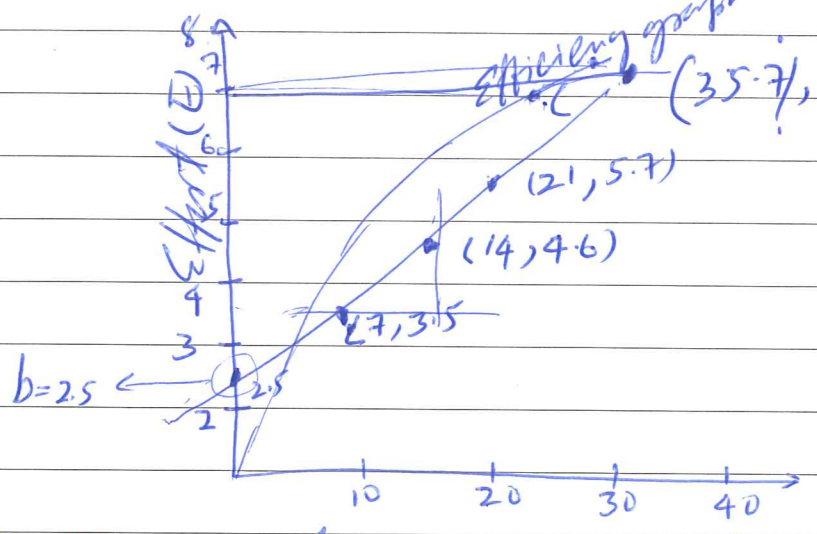
Question Number	Begin each answer on a new page	Do not write in this margin

Q. No. 1

$M.A = \frac{\text{load } (W)}{\text{Effort } (E)}$ $\quad VR = 12$ (given)

$\eta = \frac{M.A}{V.R} \times 100$

W	7	14	21	28	35	42
E	3.5	4.6	5.7	6.7	7.7	8.8
M.A	$\frac{7}{3.5} = 2$,	3.04	3.68	4.18	4.55	4.77
% η (Efficiency)	16.7	25.3	30.7	34.8	37.8	39.8



Graph is linear, equation of st. line

$y = mx + c$

y = Effort, x = load

m = slop, c is intercept on y-axis

Equation of machine is $E = aW + b$

a = slope = $\frac{\text{Rise}}{\text{Run}}$

$= \frac{4.6 - 3.5}{21 - 7} = 0.157$

$b = 2.5$

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$\Rightarrow$ $\boxed{E = 2.5 + 0.15W}$

When $E = 7N$

$\therefore W = \frac{7 - 2.5}{0.15} = 30$.

$\therefore M.A = \frac{30}{7} = 4.2$

$\therefore \eta = \frac{4.2}{12} \times 100 = \boxed{35.7\%}$

Q.No (2) Hg is 1.74 times heavier than steel so mercury density > steel density

Hence steel will float in Mercury.

Steel is 7.8 times heavier than water,

Therefore, steel will sink in water.

(a) Absolute Pressure = Atmpheric pr + Gauge pr.

(b) Downward force = upward force

$(2 \times 1 \times 0.5 \times 760 \times 1000) + m(man) = (2 \times 1 \times 0.5 \times 1000)$

$\boxed{m = 240 \text{ kg}}$

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Q.No 3. (i) load = 50,000 N, L = 3m

Diameter = 50×10^{-3} m

$$\text{Stress} = \frac{\text{load}}{\text{Area}} = \frac{50{,}000 \times 4}{\pi \times (50 \times 10^{-3})^2}$$

$A = \frac{\pi}{4} d^2$

$$\text{Stress} = 25.46 \text{ MPa}$$

(ii) $$\text{strain} = \frac{\text{Change in length}}{\text{Original length}} = \frac{\text{Stress}}{E}$$

$$\therefore \text{strain} = \frac{3.005 - 3}{3}$$

$$= \frac{0.005}{3}$$

$$\text{Strain} = 1.66 \times 10^{-3}$$

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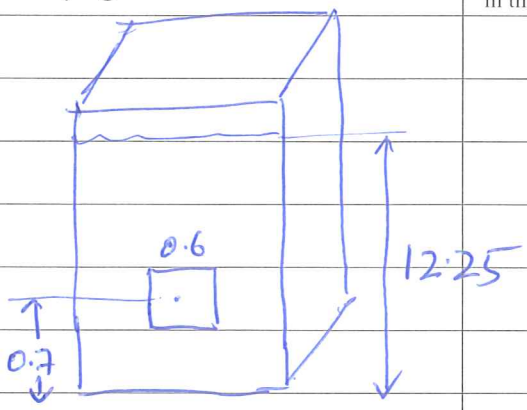
Q.No.4 Oil in T = 12.5 × 0.98

= 12.25 m.



Door area = 0.6 × 0.6

= 0.36 m²

h = 12.25 − 0.7

h = 11.55 m

MDO density ρ = 0.84 × 1000 = 840 kg/m³

Pressure at centroid of door = $\rho g \bar{h}$

p = 840 × 9.81 × 11.55

p = 95.176 kN/m²

load on door = 95.176 × 0.36

= 34.26 kN

Q.No.5 (i) $t = \frac{100 N}{60 \times 9.81} = 0.169$

(ii) $F = m \times a \Rightarrow a = \frac{F}{m}$

$a = \frac{110 - 100}{60} = 0.166 \text{ m/s}^2$

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Velocity after 4s = 0.166 × 4 = 2.66 m/s.

∴ Av. velocity = $\frac{1}{2}(0 + 2.66)$ = 1.33 m/s.

Distance = Av. vel. × time = 1.33 × 4

s = 5.32 m