1-10-2021

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مقاومة المواد
الصف الثاني / بناء وانشاءات

1

I

Stress & Strain

σ ε

الاجهاد الانفعال

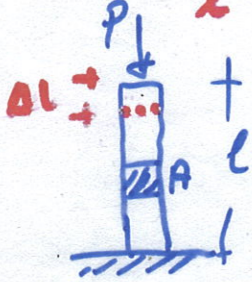
Stresses : Tension & Compression

stress: σ : force per unit Area القوة في وحدة المساحة

strain: ε : Elongation per unit length الاستطالة في وحدة الطول

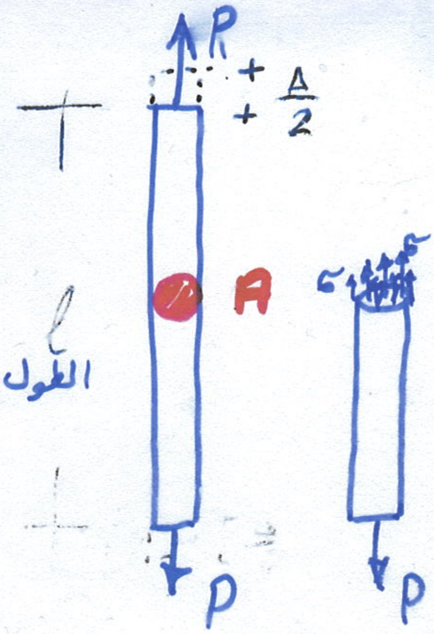
$$\sigma = \frac{P}{A} \quad [N/mm^2] \text{ الوحدات}$$

$$\varepsilon = \frac{\Delta l}{l} \quad [-] \text{ الوحدات}$$



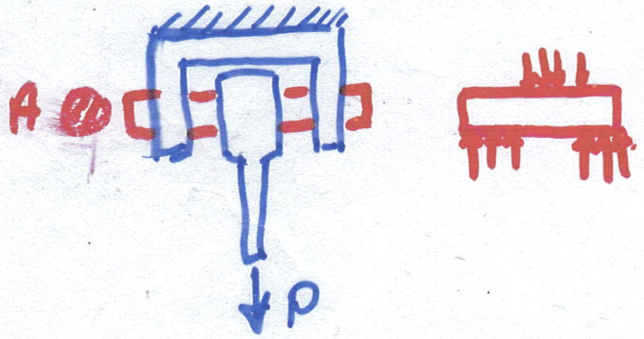
تقصر

Compression (Contraction)

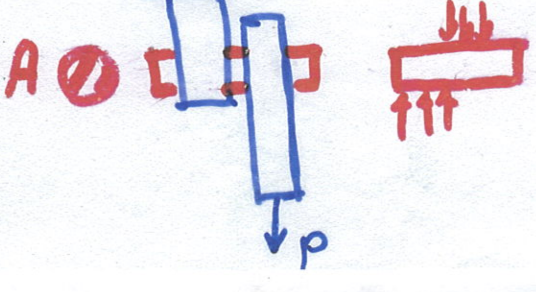


Tension (elongation)

Stresses Shearing stress (τ)



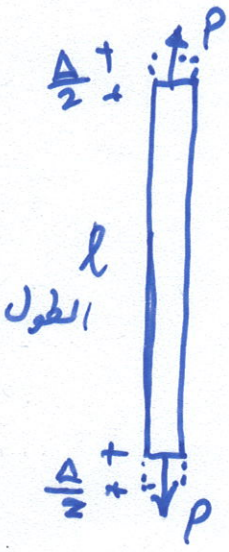
$$\tau = \frac{P}{2A} \quad \left[\frac{N}{mm^2}\right]$$



$$\tau = \frac{P}{A} \quad \left[\frac{N}{mm^2}\right]$$

Tensile Test فحص الشد

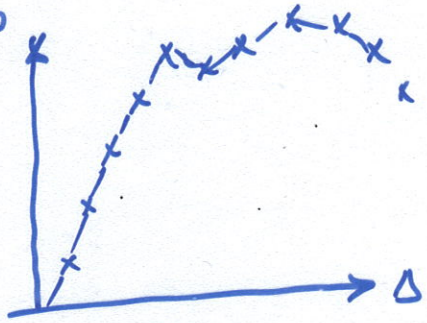
Tensile Machine



Step 1

P [N]	Δ [mm]
..	..
..	..
..	..
..	..
..	..
..	..
..	..

ε- Curve →

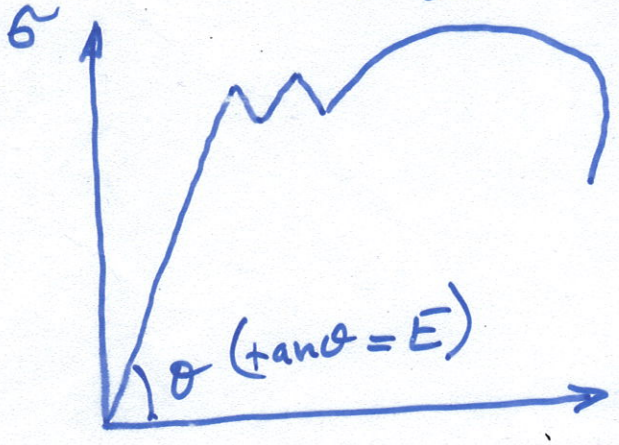


Step 2 نقسم على الثوابت A, l

P/A	Δ/l	σ (P/A)	ε (Δl/l)
.	.	.	.
.	.	.	.
.	.	.	.
.	.	.	.
.	.	.	.

→

Step 3 الرسم لقيم ε, σ واستخراج θ



$$\tan\theta = \frac{\sigma}{\varepsilon}$$

$$E = \frac{\sigma}{\varepsilon}$$

tanθ → E modulus of Elasticity معامل المرونة

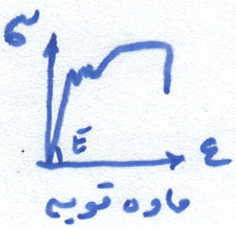
نعوض القيم

$$E = \frac{\frac{P}{A}}{\frac{\Delta l}{l}} \rightarrow \Delta l = \frac{Pl}{AE}$$

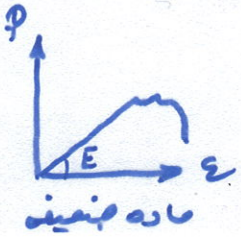
قانون هوك $\sigma = E\varepsilon$ التناسب الخطي

$$\boxed{\Delta l = \frac{Pl}{AE}}$$ الاستطالة

E = Constant for every Materi ثابت لكل مادة



مادة قوية



مادة ضعيفة

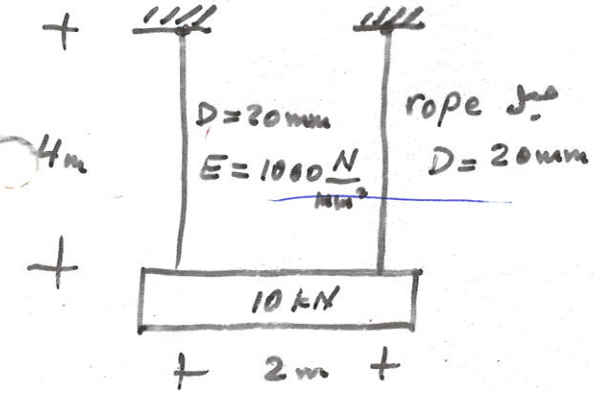
Exercises تمارين

stress & strain

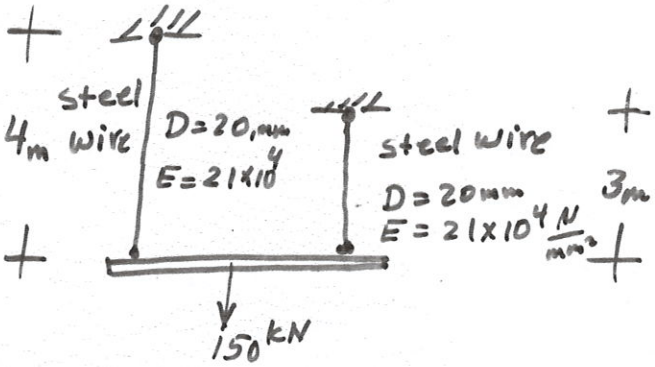
1. A steel Bar of dimension 1 x 6mm and length $l = 30m$ Calculate the stress and Elongation for a Force 50N knowing that $E = 200 \times 10^3 \frac{N}{mm^2}$

Ans.: $\sigma = 8.3 \frac{N}{mm^2}$, $\Delta = 1.25 mm$

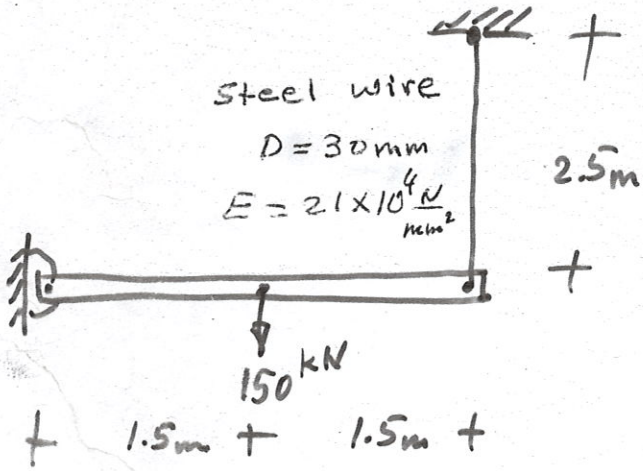
2. Find the stresses and Elongation



[A]

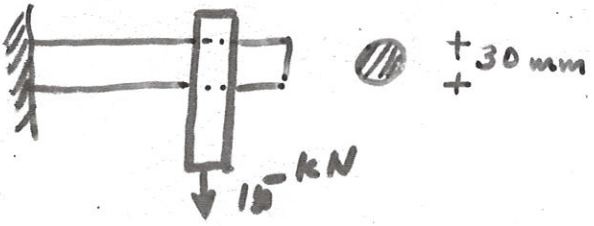


[B]

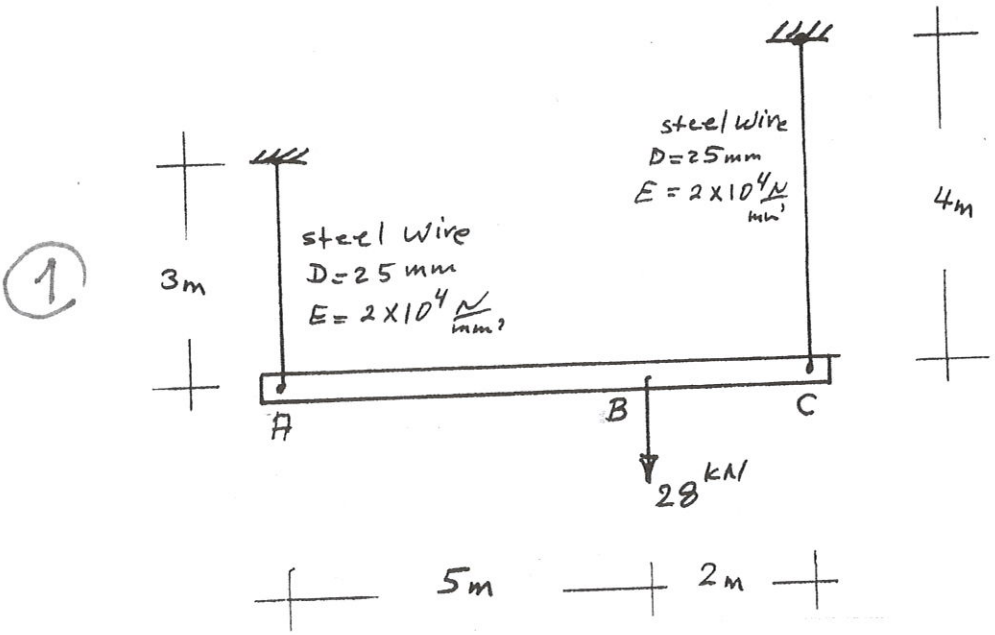


[C]

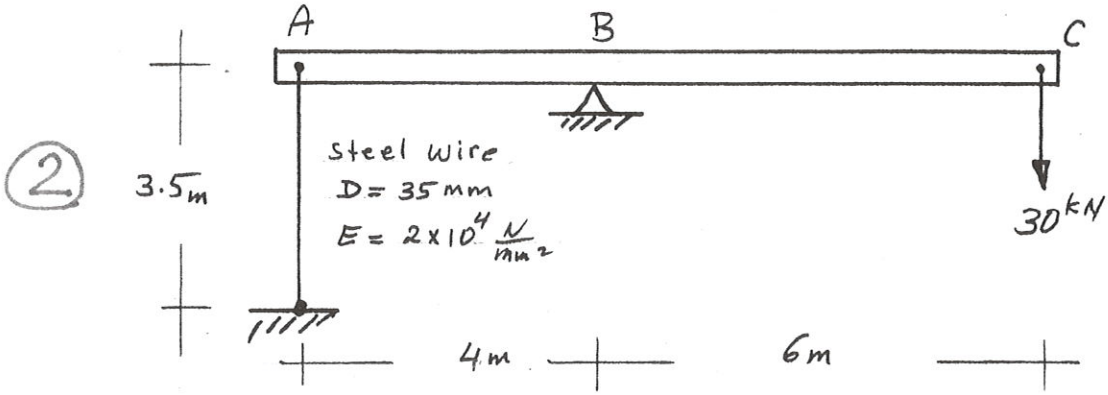
3. Calculate the shearing stresses in the Circular bar



Q_1 – Calculate the vertical movement of points A, B and C



Q_2- Calculate the vertical movement for points A, B and C



Q_3- Calculate the vertical movement of points A, B and C