Edexcel IAL Physics A-Level

Topic 1.2 - Materials

Flashcards

Define:
Pressure
Density
Volume

Define: pressure,density and volume

Pressure: force per unit area (force / area) / Pa.

Density: mass per unit volume, mass/volume/kgm^{-3}.

Volume: quantity of three-dimensional space enclosed by a closed surface/m^3.

What is the rule of upthrust?

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The force of upthrust = weight of fluid displaced.

State Stokes' Law and the meanings of each term.

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$$F = 6\pi\eta rv$$

F = viscous drag/N, η = viscosity/m^2s^{-1}, r = radius of object/m, v = velocity of object/ms^{-1}.

What is the difference between laminar flow and turbulent flow?

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Laminar flow is when the layers flow parallel to each other and don’t interact. It is a smooth flow and there is a constant speed.

Turbulent flow is when the layers can cross over each other and turn at angles. Eddy currents are also formed, therefore there is not a constant speed.

Why does Stokes' Law only apply for small objects and laminar flow?

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If the object is not small, there may be friction with the sides of the tube it is going down, causing turbulent flow. When there is turbulent flow, the characteristics of the object's movement are unpredictable, therefore the velocity is not terminal/constant.

What is Hooke’s law?

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$$F = k\Delta x$$

F = force applied (N)

K = stiffness constant

Δx = extension (m)

Write the equations for stress,strain and young’s modulus then state the definition of Young’s Modulus.

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Stress = force / cross-sectional area (Nm^{-2} or Pa)

Strain = change in length / original length

Young's Modulus = stress / strain (Nm^{-2} or Pa)

Young's Modulus: measure of elasticity

Explain the terms:

limit of proportionality

elastic limit

yield point

elastic deformation

plastic deformation

Explain the terms: limit of proportionality, elastic limit, yield point, elastic deformation and plastic deformation

Limit of Proportionality: the point beyond which Hooke's law is no longer true when stretching a material.

Elastic Limit: the point beyond which the material you are stretching becomes permanently stretched so that the material does not return to its original length when the force is removed.

Yield Point: the stress at which a material begins to deform plastically.

Elastic Deformation: The object will return to its original shape after the force is removed.

Plastic Deformation: The object will permanently deform.

Give the equation that calculates elastic strain energy in terms of spring constant and extension.

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$$E = \frac{1}{2} k \Delta L^2$$

How do you work out elastic strain energy from which type of graph?

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The area under a force-extension graph is the equivalent to elastic strain energy:

$$\frac{1}{2}F\Delta x$$

Define:

Hard

Brittle

Ductile

Malleable

Strong

Tough

Stiff

Define hard, brittle, ductile, malleable, strong, tough, stiff.

- **Hard** - Can scratch or indent, and withstands being scratched.
- **Brittle** - Breaks without plastic deformation.
- **Ductile** - Can be drawn into a wire.
- **Malleable** - Can be reshaped.
- **Strong** - Withstands large static loads without breaking.
- **Tough** - Withstands large dynamic loads without breaking.
- **Stiff** - Resists deformation by tension or compression.

What are the stiffness equations if springs are in series/parallel?

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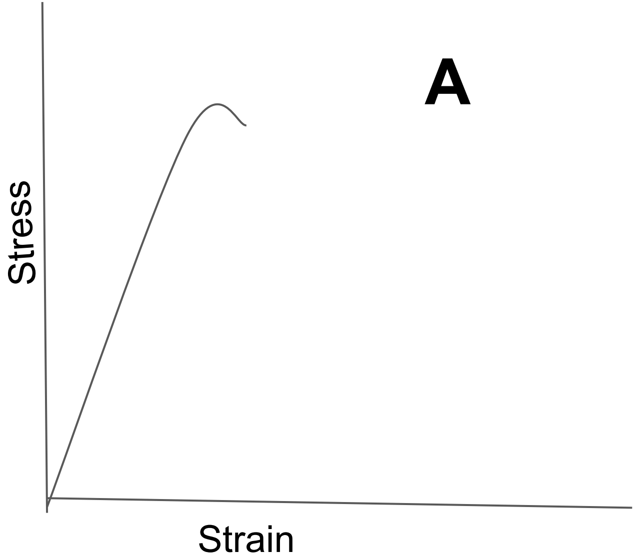
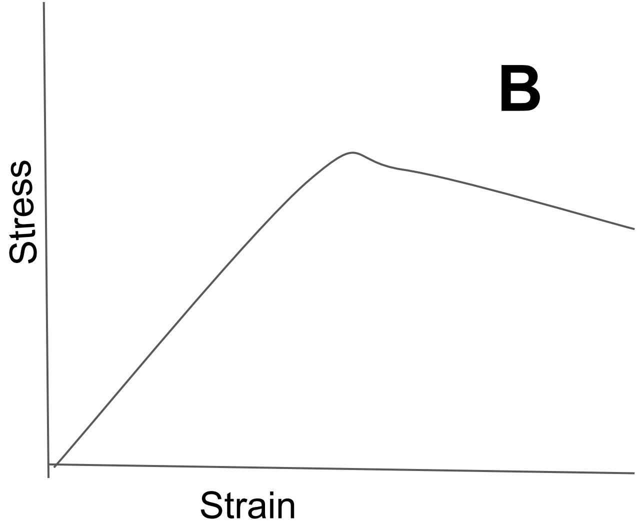
$$Series:\ k = 1 / ((1/k_1)+(1/k_2))$$

$$Parallel:\ k = k_1 + k_2$$

Which of these two graphs represents a brittle material?





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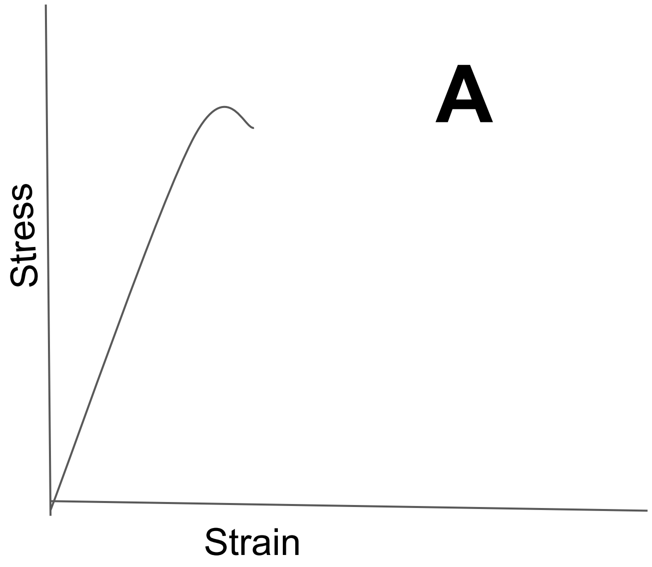
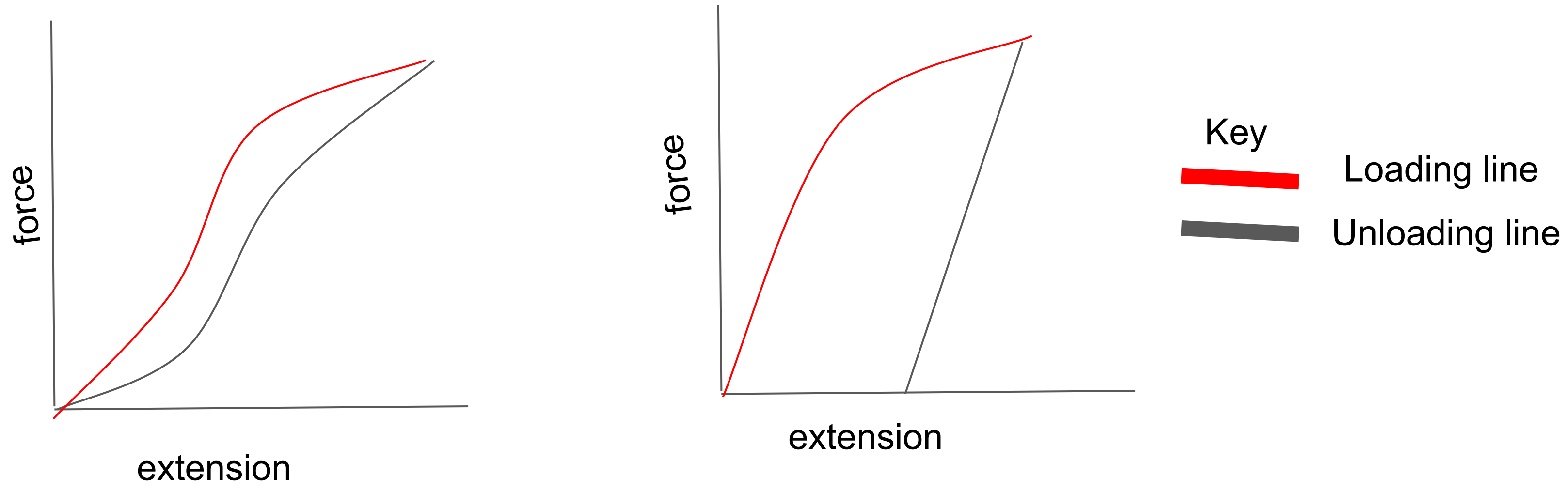


Which of these graphs would represent a wire which has plastically deformed?



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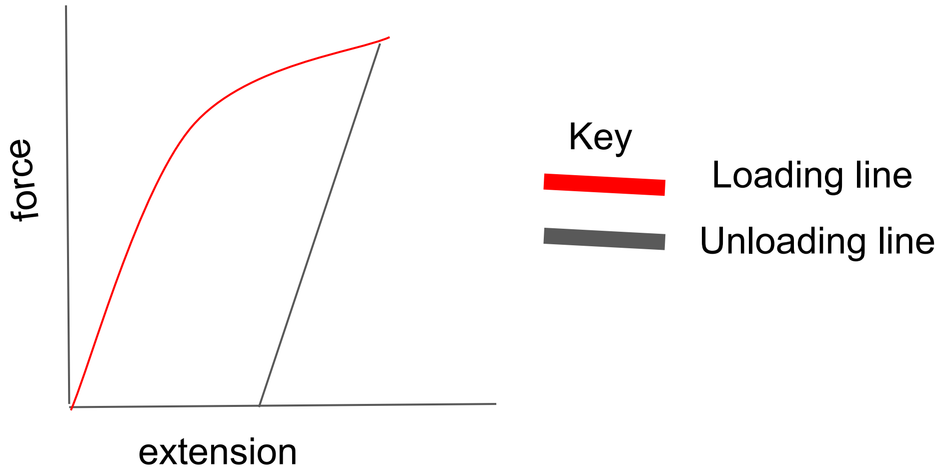
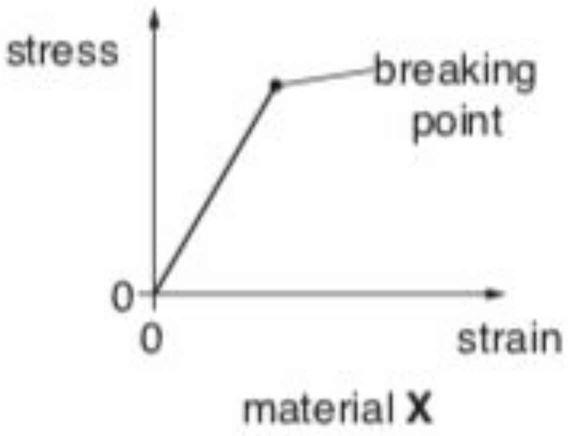


The diagram shows the stress against strain graph for material X. Describe the properties of X.

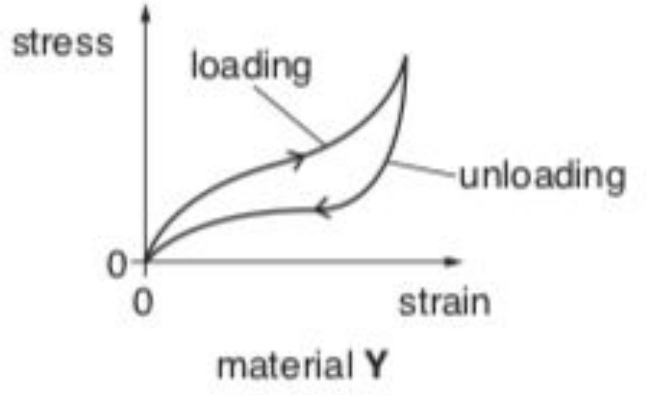


The diagram shows the stress against strain graph for material X. Describe the properties of X.

Material X is brittle. There is no plastic deformation (it is elastic) and returns to the same length when the stress is removed.

It obeys Hooke's law.

The diagram shows the stress against strain graph for material Y. Describe the properties of Y.



The diagram shows the stress against strain graph for material Y. Describe the properties of Y.

Material Y is a polymer. It is elastic and returns to the same length when the stress is removed.

It does not obey Hooke's law.

What is the Ultimate Tensile Strength?

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The maximum stress that the material can withstand. At this point, breaking stress occurs and the atoms of the material separate completely, causing it to break.