Edexcel Physics A-Level
Topic 4 - Materials

Flashcards

What is the density of a material?

What is the density of a material?

The density of a material is its mass per unit volume.

State the equation used to calculate density.

State the equation used to calculate density.

$$\text{Density} = \frac{\text{Mass}}{\text{Volume}}$$

What is the unit of density?

What is the unit of density?

kgm^{-3}

When an object is submerged in a fluid, what determines the upthrust it experiences?

When an object is submerged in a fluid, what determines the upthrust it experiences?

The upthrust of a submerged object is equal to the weight of the fluid that it displaces.

What determines whether an object floats or sinks?

What determines whether an object floats or sinks?

The balance between the weight and upthrust of the object. If the weight exceeds the upthrust, the object will sink.

Why will a uniform object with a density greater than that of the liquid it is submerged in, always sink?

Why will a uniform object with a density greater than that of the liquid it is submerged in, always sink?

- The upthrust of the object will be equal to the weight of the liquid displaced
- Therefore, the maximum upthrust will be equal to the *density of the fluid x volume of object x gravitational field strength*
- The weight of the object is equal to the *density of the object x volume of object x gravitational field strength*
- If the object's density is greater, the weight will always be greater than the upthrust and the object will sink

What shaped objects does Stokes' Law apply to?

What shaped objects does Stokes' Law apply to?

Stokes' law only applies to small spherical objects.

What type of flow is required for Stokes' Law to apply?

What type of flow is required for Stokes' Law to apply?

Laminar Flow

What does Stokes' Law allow you to calculate?

The viscous drag force that a small spherical object experiences when falling at low speeds through a viscous fluid with laminar flow.

State the Stokes' Law equation.

State the Stokes' Law equation.

$$F = 6\pi\eta r v$$

η is the viscosity of the fluid

r is the radius of the sphere

v is the speed of the sphere

What is elastic deformation?

What is elastic deformation?

An object has undergone elastic deformation if it returns to its original shape once the deforming forces are removed.

What is plastic deformation?

What is plastic deformation?

An object has undergone plastic deformation if it no longer returns to its original shape once the deforming forces are removed. It will have permanent deformation.

Express Hooke's Law in words.

Express Hooke's Law in words.

The extension of an elastic object is directly proportional to the force that is applied to it, up to its limit of proportionality.

What is the limit of proportionality?

What is the limit of proportionality?

The point beyond which the force and extension will no longer be directly proportional to each other - Hooke's Law is no longer obeyed.

What is the elastic limit?

What is the elastic limit?

The point beyond which the object will no longer elastically deform, and will instead deform plastically.

State the defining equation of Hooke's Law.

State the defining equation of Hooke's Law.

$$F = k\Delta x$$

F = force applied (N)

K = stiffness constant

Δx = extension (m)

What is mechanical stress?

What is mechanical stress?

The force experienced by an object per unit area.

State the equation for stress.

State the equation for stress.

$$\text{Stress} = \frac{F}{A}$$

F is the force applied

A is the cross-sectional area

What is the unit of stress?

What is the unit of stress?

Nm^{-2}

State the equation for strain.

State the equation for strain.

$$\text{Strain} = \frac{\Delta L}{L}$$

ΔL is the change in length

L is the original length

What is the unit of strain?

Strain is a unitless quantity because it is the ratio of two lengths.

What does the Young Modulus of a material tell you?

What does the Young Modulus of a material tell you?

A material's Young Modulus is a measure of how much force is required for a given extension, regardless of the object's dimensions.

What equation is used to calculate a material's Young Modulus?

What equation is used to calculate a material's Young Modulus?

Young Modulus = Stress/Strain

What unit is used for a material's Young Modulus?

What unit is used for a material's Young Modulus?

Nm^{-2}

What is breaking stress?

Breaking stress is the the maximum stress that an object can withstand before fracturing.

What is the yield point?

What is the yield point?

The point beyond which the object will experience a large extension without substantial increase in the force applied.

What type of energy is stored in an object that has been stretched?

What type of energy is stored in an object that has been stretched?

Elastic Potential Energy

State two equations used to calculate the energy stored in a spring.

State two equations used to calculate the energy stored in a spring.

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

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

What does the gradient and area represent on a force-extension graph?

What does the gradient and area represent on a force-extension graph?

- The gradient of the linear region represents the elastic constant (k)
- The area is equal to the elastic potential energy stored in the spring

What does the gradient represent on a stress-strain graph?

What does the gradient represent on a stress-strain graph?

● The gradient of the linear region represents the Young Modulus of the material.