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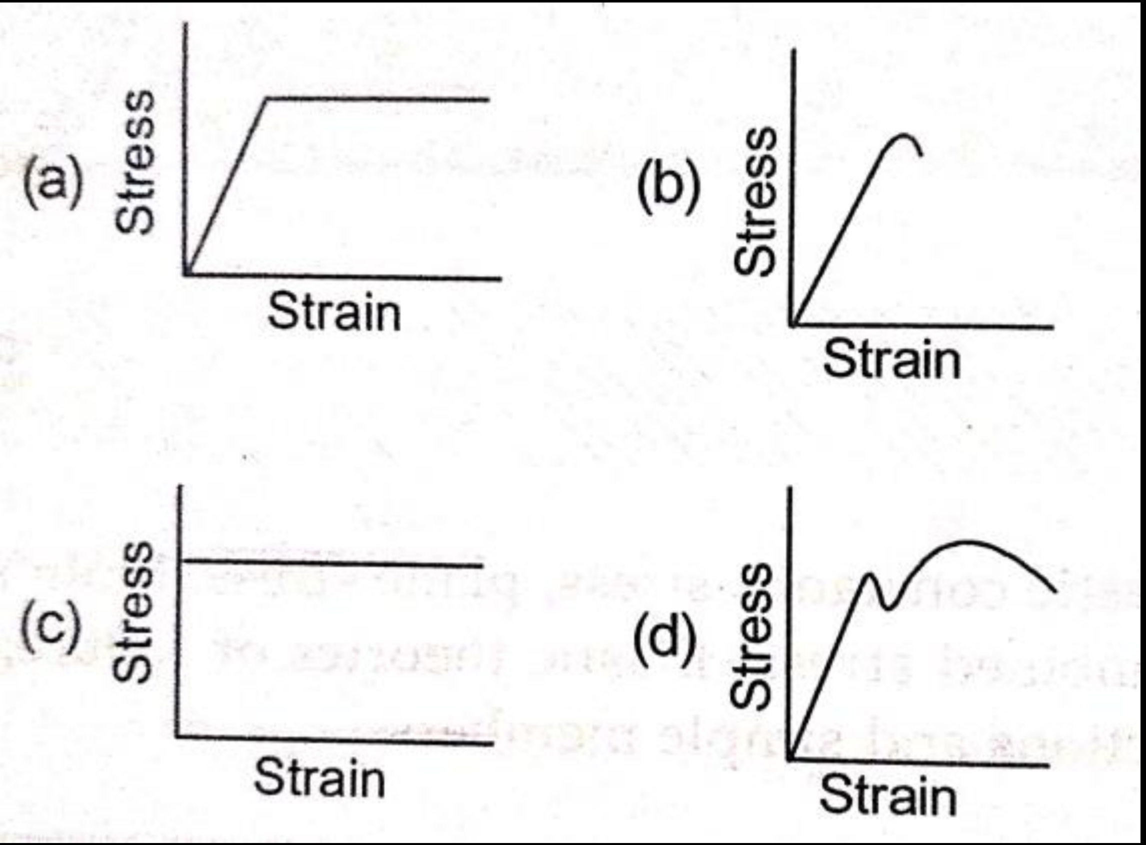
Q : 1) The stress-strain curve for an ideally plastic material is



Q : 2) In terms of bulk modulus (K) and modulus of rigidity (G), the Poisson's ratio can be expressed as

A : (3K-4G)/(6K+4G)

B : (3K+4G)/(6K-4G)

C : (3K-2G)/(6K+2G)

D : (3K+2g)/(6K-4G)

Q : 3) Two bars one of material A and the other of material B of same length are tightly secured between two unyielding walls. Coefficient of thermal expansion of bar A is more than that of B. When temperature rises the stresses induced are

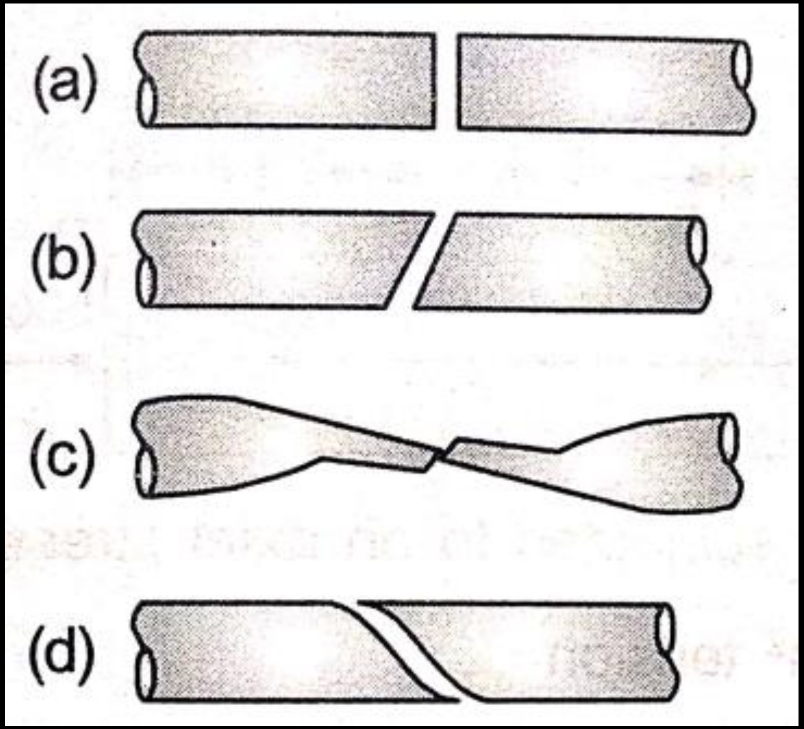
A : Tension in both materials

B : Tension in material A and compression in material B

C : Compression in material A and tension in material B

D : Compression in both materials

Q : 4) When a mild-steel specimen fails in a torsion test, the fracture looks like



Q : 5) A bar of circular cross-section varies uniformly from a cross-section 2D to D. If extension of the bar is calculated treating it as a bar of average diameter, then the percentage error will be

A : 10

B : 25

C : 33.33

D : 50

Q : 6) If the dimensions of prismatic bar of square cross-section suspended freely from the ceiling of a roof are doubled then the total elongation produced by its own weight will increase

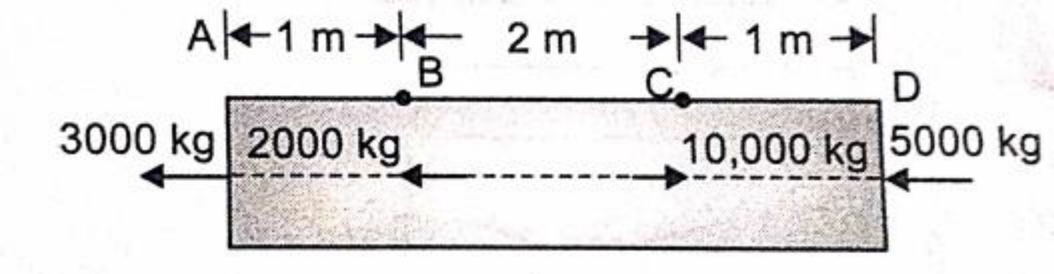
A : Eight times

B : Four times

C : Three times

D : Two times

Q : 7) A prismatic bar of uniform cross-sectional area of 5 cm^2 is subjected to axial loads as shown in the given figure.



Portion BC is subjected to an axial stress of

A : 400 kg/cm^2 tension

B : 2000 kg/cm^2 compression

C : 1000 kg/cm^2 tension

D : 600 kg/cm^2 tension

Q : 8) If ‘A’ be the area of cross-section of a bar, the gauge length for the measurement of ductility will be

A : $5.65 \times A^{1/2}$

B : $5.65 \times A$

C : $6.56 \times A^{1/2}$

D : $6.56 \times A$

Q : 9) Match List-I with List-II and select the correct answer

List I	List II
A. Ductility B. Brittleness C. Tenacity D. Toughness	1. Failure without warning 2. Drawn permanently over great changes of shape without rupture 3. Absorption of energy at high stress without rupture 4. High tensile strength

Codes:

A : 1, 2, 4, 3

B : 1, 2, 3, 4

C : 2, 3, 4, 1

D : 2, 1, 4, 3

Q : 10) High yield deformed bars have a

A : Definite yield value

B : Chemical composition different from mild steel

C : Percentage elongation less than that of mild steel

D : Percentage elongation more than that of mild steel

Q : 11) If a member is subjected to tensile stress of σ_x, compressive stress of $\sigma_y$and tensile stress of σ_z along the x, y and z directions respectively, then the resultant strain 'e_x' along the 'x' direction would be (E young's modulus of elasticity, μ is Poisson's ration)

A : 1/E (σ_x + μσ_y- μσ_z)

B : 1/E (σ_x + μσ_y + μσ_z)

C : 1/E (σ_x - μσ_y + μσ_z)

D : 1/E (σ_x - μσ_y- μσ_z)

Q : 12) A square plate (a × a) rigidly held at three edges is free to move along the fourth edge. If temperature of the plate is raised by temperature ‘t’. Then the free expansion at the fourth edge will be (coefficient of thermal expansion of the material = α, modulus of elasticity of the material = E and its Poisson ratio = μ)

A : a α tμ

B : a $\alpha(1+\mu)$

C : a α t+$\left(\frac{\alpha t\mu}{E}\right)$

D : a α t(1 - μ)

List I	List II
A. Young's modulus B. Poisson's ratio C. Bulk modulus D. Rigidity modulus	1. Lateral strain to linear strain within elastic limit 2. Stress to strain within elastic limit 3. Shear stress to shear strain within elastic limit 4. Direct stress to corresponding volumetric strain

Q : 13) Match List-I (Elastic constant) with List-II (Definition) and select the correct answer:

Codes:

A : 3, 1, 4, 2

B : 2, 1, 4, 3

C : 2, 4, 1, 3

D : 3, 4, 1, 2

Q : 14) A member having length L, cross-sectional areas A and modulus of elasticity E is subjected to an axial load W. The strain energy stored in this member is

A : WL^2/AE

B : $WL^2/2AE$

C : $W^2L/2AE$

D : W^2L/AE

Q : 15) The principal strain at a point are + 800 × 10^{-6} cm/cm, + 400 × 10^{-6} cm/cm and -1200 × 10^{-6} cm/cm. The volumetric strain is equal to

A : + 1200 × 10^{-6}

B : + 800 × 10^{-6} cm/cm

C : -1200 × 10^{-6} cm/cm

D : Zero

Q : 16) The failure surface of a standard cast iron torsion specimen, subjected to a torque is along

A : The surface helicoidal at 45° to the axis of the specimen

B : The curved surface at the grips

C : The plane surface perpendicular to the axis of the specimen

D : The curved surface perpendicular to the axis of the specimen

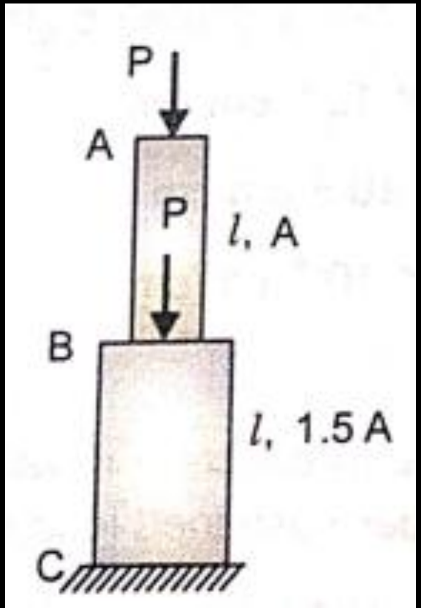
Q : 17) A stepped column carries loads as shown in the figure. What is the maximum normal stress in the column at B in the larger diameter column?

A : $\frac{P}{1.5A}$

B : $\frac{P}{A}$

C : $\frac{2P}{1.5A}$

D : $\frac{P}{1.5A}$



Q : 18) What is the nature of stress in a ceiling fan rod?

A : Bending

B : Tensile

C : Compressive

D : Shear

Q : 19) For a material having modulus of elasticity equal to 208 GPa and Poisson's ratio equal to 0.3, what is the modulus of rigidity?

A : 74.0 GPa

B : 80.0 GPa

C : 100.0 GPa

D : 128.5 GPa

Q : 20) Given E as the Young's modulus of elasticity of a material, what can be the minimum value of its bulk modulus of elasticity?

A : E/2

B : E/3

C : E/4

D : E/5

Q : 21) Poisson's ratio is defined as the ratio of

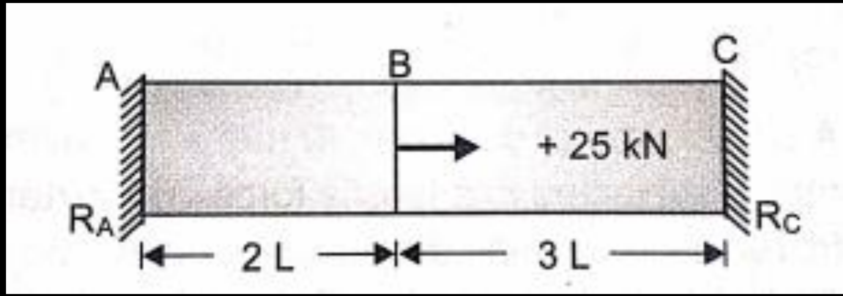
A : Longitudinal strain and longitudinal strain

B : Lateral strain and longitudinal strain

C : Longitudinal stress and lateral stress

D : Lateral stress and longitudinal stress

Q : 22) A prismatic bar ABC is subjected to an axial load of 25 kN; the reactions R_A and R_C will be



A : R_A = - 10 KN and R_C = - 15 kN

B : R_A = 10 KN and R_C = - 35 kN

C : R_A = - 15 KN and R_C = - 10 kN

D : R_A = 15 KN and R_C = - 40 kN

Q : 23) Consider the following salient points in a stress-strain curve of a mild steel bar:

1. Yield point
2. Braking point
3. Yield plateau
4. Proportionality limit
5. Ultimate point

The correct sequence in which they occur while testing the mild steel bar in tension from initial zero strain to failure is

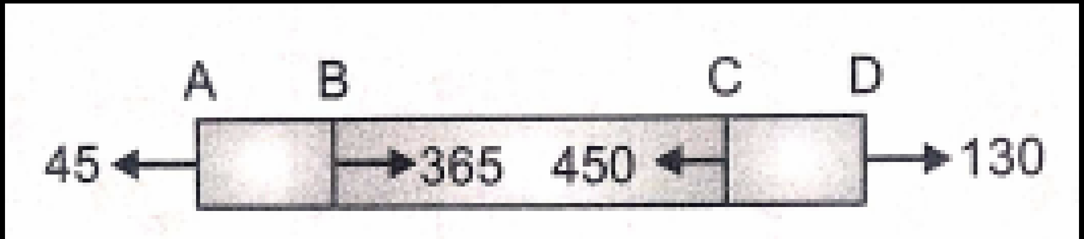
A : 4, 1, 2, 3 and 5

B : 1, 4, 3, 5 and 2

C : 4, 1, 3, 5 and 2

D : 1, 4, 2, 3 and 5

Q : 24) A member ABCD is subjected to a force system as shown in the figure



The resistive force in the part BC is

A : 365 (compressive)

B : 450 (tensile)

C : 85 (Compressive)

D : 320 (Compressive)

Q : 25) The symmetry of the stress tensor at a point in a body when at equilibrium is obtained from

A : Conservation of mass

B : Force equilibrium equations

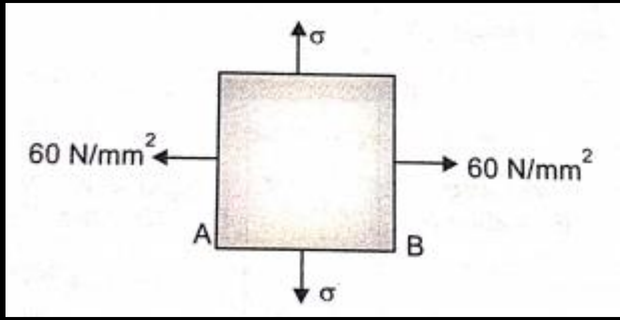
C : Moment equilibrium equations

D : Conservation of energy

Q : 26) Statement (I): There are two independent elastic constants for an isotropic material.

Statement (II): All metals at micro-level are isotropic.

Q : 27) For a block with Young’s modulus of its material being 210 GPa and its Poisson’s Ratio being 0.25, when subjected to a stress system as shown in the figure, what is the magnitude of the stress σ for no strain along AB?



A : 30 N/mm²

B : 60 N/mm²

C : 120 N/mm²

D : 240 N/mm²

Q : 28) Consider the following statements:

1. In the infinitesimal strain theory, dilatation is taken as an invariant.
2. Dilatation is not proportional to the algebraic sum of all normal stresses.
3. The shearing modulus is always less than the elastic modulus.

Which of the above statements is/are correct?

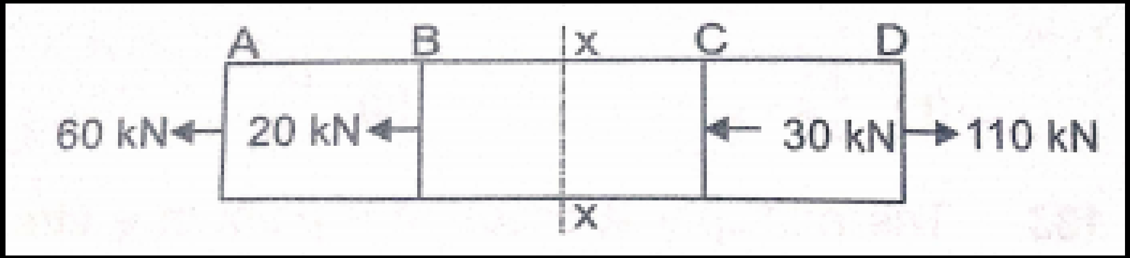
A : 1 only

B : 1 and 2 only

C : 2 only

D : 1, 2 and 3

Q : 29) What is the stress at the section x – x for the bar ABCD with uniform cross-section 1000 mm^2?



A : 20 N/mm^2 (Tensile)

B : 30 N/mm^2 (Compressive)

C : 80 N/mm^2 (tensile)

D : 50 N/mm^2 (Compressive)

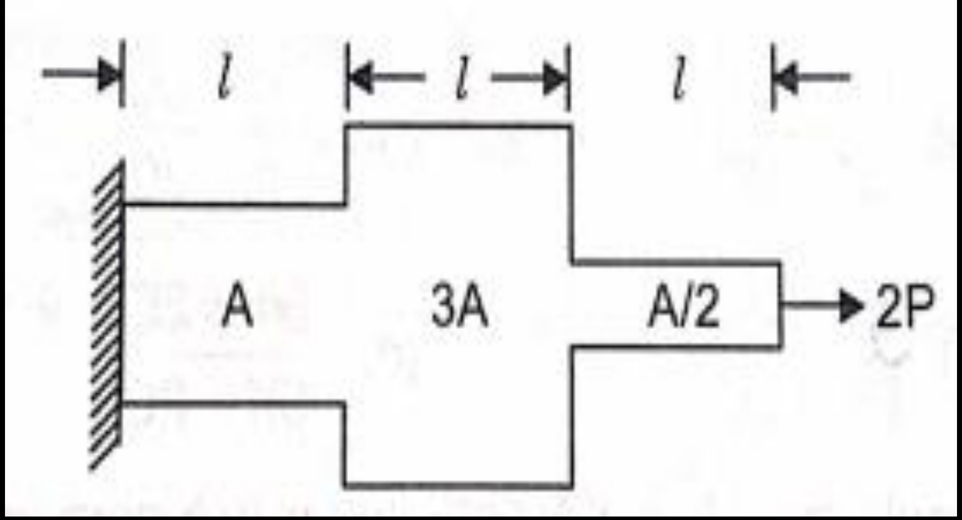
Q : 30) The total elongation of the structural element (fixed at one end, free at the other end, and of varying cross-section) as shown in the figure, when subjected to load 2P at the free end is

A : 6.66 $\frac{Pl}{AE}$

B : 5.55 $\frac{Pl}{AE}$

C : 4.44 $\frac{Pl}{AE}$

D : 3.33 $\frac{Pl}{AE}$



Q : 31) In mild steel specimens subjected to tensile test cycle, the elastic limit in tension is raised and the elastic limit in compression is lowered, this is called

A : Annealing effect

B : Bauschinger effect

C : Strain rate effect

D : Fatigue effect

Q : 32) A solid uniform metal bar of diameter D mm and length l mm hangs vertically from its upper end.

The density of the material is $\rho N/\text{mm}^3$ and its modulus of elastic is E N/mm². The total extension of the rod due to its own weight would be

A : $\frac{\rho l^2}{2E}$

B : $\frac{\rho l}{2E}$

C : $\frac{\rho l}{4E}$

D : $\frac{\rho l^2}{4E}$

Q : 33) A bar of uniform rectangular section of area A is subjected to an axial tensile load P; its Young's modulus is E and its Poisson's ratio is $\frac{1}{m}$. Its volumetric strain, $\in_v$ is

A : $\frac{P}{AE}\left(1+\frac{3}{m}\right)$

B : $\frac{P}{AE}\left(1+\frac{2}{m}\right)$

C : $\frac{P}{AE}\left(1-\frac{2}{m}\right)$

D : $\frac{P}{AE}\left(1-\frac{1}{2m}\right)$

Q : 34) A steel bar 2 m long, 20 mm wide and 15 mm thick is subjected to a tensile load of 30 kN. If Poisson's ratio is 0.25 and Young's modulus is 200 GPa, an increase in volume will be

A : 160 mm^3

B : 150 mm^3

C : 140 mm^3

D : 130 mm^3

Q : 35) A tie bar 50 mm × 8 mm is to carry a load of 80 kN. A specimen of same quality steel of cross-sectional area is 250 mm^2. If the maximum load carried by the specimen is 125 kN, the gauge length will be

A : 133 mm

B : 126 mm

C : 113 mm

D : 106 mm

Q : 36) The number of independent elastic constant for a linear elastic isotropic and homogeneous material is

A : 4

B : 3

C : 2

D : 1

Q : 37) For an isotropic material, he relationship between the young's modulus (E), shear modulus (G) and Poisson's ratio (μ) is given by

A : G = $\frac{E}{(1+\mu)}$

B : G = $\frac{E}{2(1+\mu)}$

C : G = $\frac{E}{(1+2\mu)}$

D : G = $\frac{E}{2(1+2\mu)}$

Q : 38) The necessary and sufficient condition for a surface to be called as a free surface is

A : No stress should be acting on it

B : tensile stress acting on it must be zero

C : Shear stress acting on it must be zero

D : No point on it should be under any stress

Q : 39) The components of strain tensor at a point in the plane strain case can be obtained by measuring longitudinal strain in following directions:

A : Along any two arbitrary directions

B : Along any three arbitrary directions

C : Along two mutually orthogonal directions

D : Along any arbitrary direction

Q : 40) The stress-strain diagram for two materials A and B is shown below:

The following statements are made based on this diagram

(i) Material A is more brittle than material B

(ii) The ultimate strength of material B is more than that of A

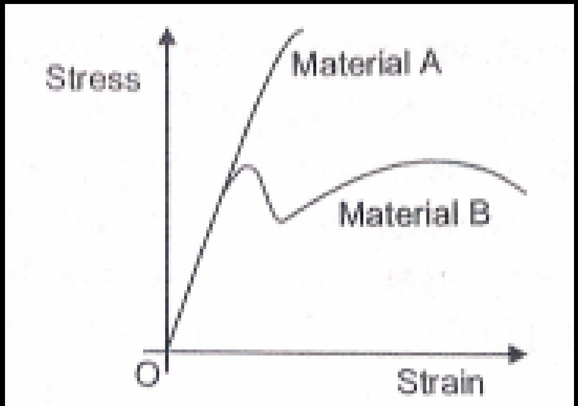
With reference to the above statements, which of the following applies?

A : Both the statements are false

B : Both the statements are true

C: I is true but II is false

D : I is false but II is true



Q : 41) The maximum value of Poisson's ratio for an elastic material is

A : 0.25

B : 0.5

C : 0.75

D : 1.0

Q : 42) The principle of super position is made use of in structural computations when:

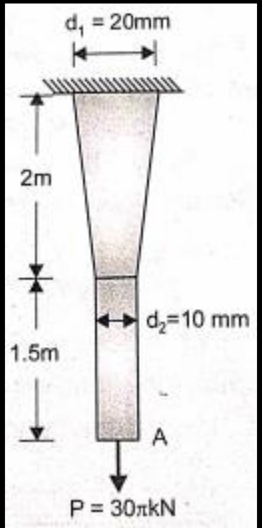
A : The geometry of the structure changes by a finite amount during the application of the loads

B : The changes in the geometry of the structure during the application of the loads is too small and the strains in the structure are directly proportional to the corresponding stresses.

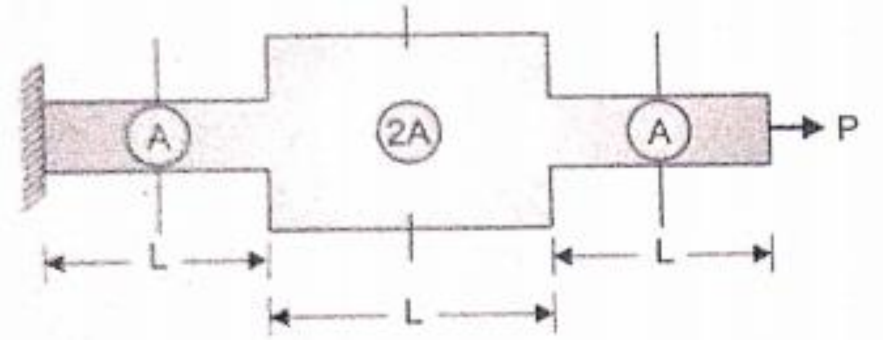
C : The strain in the structure are not directly proportional to the corresponding stresses, even the effect of changes in geometry can be neglected.

D : None of the above conditions are met.

Q : 43) A tapered circular rod of diameter varying from 20 mm to 10 mm is connected to another uniform circular rod of diameter 10 mm as shown in the following figure. Both bars are made of same material with the modulus of elasticity, E = 2 × 10^5 Mpa. When subjected to a laod P = 30π kN, the deflection at poinbt A is __________ mm.

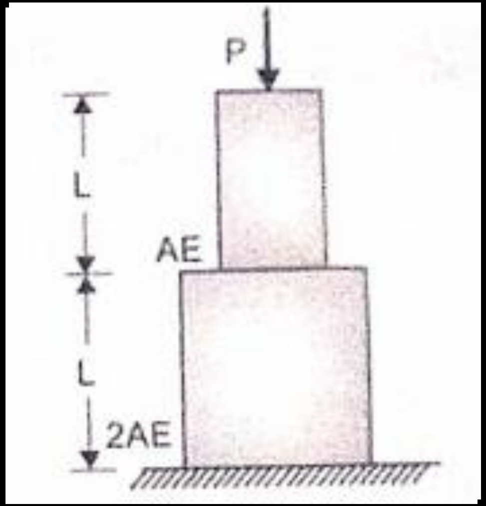


Q : 44) The total elongation of the structural element fixed, at one end, free at the other end, and of varying cross-section as shown in the figure when subjected to a force P at free end is given by



A : PL/AE
B : 3 PL/AE
C : 2.5 PL/AE
D : 2 PL/AE

Q : 45) The axial movement of top surface of stepped column as shown in figure is



A : 2.5 PL/AE
B : 3 PL/AE
C : 1.5 PL/AE
D : 2 PL/AE

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