QUESTION BANK

1. If Poisson's ratio of a material is 0.5, then the elastic modulus for the material is
(a) three times its shear modulus
(b) four times its shear modulus
(c) equal to its shear modulus
(d) indeterminate

2. Match List-I (Elastic properties of an isotropic elastic material) with List-II (Nature of strain produced) and select the correct answer using the codes given below the lists :

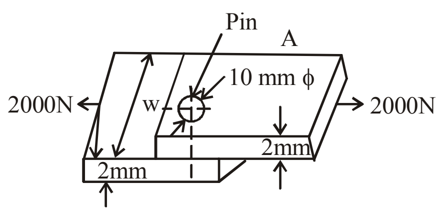
List-I
A. Young's modulus
B. Modulus of rigidity
C. Bulk modulus
D. Poisson's ratio

List-II
1. Shear strain
2. Normal strain
3. Transverse strain
4. Volumetric strain

Codes :

	A	B	C	D
(a)	1	2	3	4
(b)	2	1	3	4
(c)	2	1	4	3
(d)	1	2	4	3

3. If permissible stress in plates of joint through a pin as shown in the figure is 200 MPa, then the width w will be



(a) 15 mm (b) 20 mm
(c) 18 mm (d) 25 mm

4. The number of independent elastic constants required to express the stress-strain relationship for a linearly elastic isotropic material is
(a) one (b) two
(c) three (d) four

5. The number of elastic constants for a completely anisotropic elastic material is
(a) 3 (b) 4
(c) 21 (d) 25

6. The maximum value of Poisson's ratio for an elastic material is
(a) 0.25 (b) 0.5
(c) 0.75 (d) 1.0

7. The unit of elastic modulus is the same as those of
(a) Stress, shear modulus and pressure
(b) Strain, shear modulus and force
(c) Shear modulus, stress and force
(d) Stress, strain and pressure.

8. Young's modulus of elasticity and Poisson's ratio of a material are 1.25×10^5 MPa and 0.34 respectively. The modulus of rigidity of the material is
(a) 0.4025×10^5 MPa
(b) 0.4664×10^5 MPa
(c) 0.8375×10^5 MPa
(d) 0.9469×10^5 MPa

9. The independent elastic constants for a homogeneous and isotropic material are
(a) E, G, K, v (b) E, G, K
(c) E, G, v (d) E, G

10. In a homogeneous, isotropic elastic material, the modulus of elasticity E in terms of G and K is equal to
(a) $\frac{G+3K}{9KG}$ (b) $\frac{3G+K}{9KG}$
(c) $\frac{9KG}{G+3K}$ (d) $\frac{9KG}{K+3G}$

11. Match List I with List II and select the correct answer using the codes given below the lists

List I (Property)

A. Tensile strength
B. Impact strength
C. Bending strength
D. Fatigue strength

List II (Testing Machine)

1. Rotating Bending machine
2. Three-Point Loading Machine
3. Universal Testing Machine
4. Impact Testing Machine

Codes :

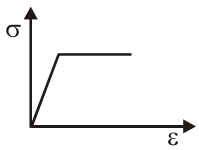
	A	B	C	D
(a)	4	3	2	1
(b)	3	2	1	4
(c)	2	1	4	3
(d)	3	4	2	1

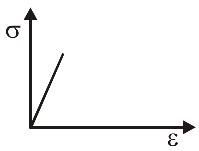
12. Match List-I with List-II and select the correct answer using the codes given below the list :

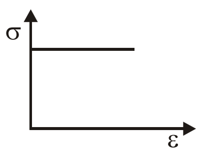
List-I

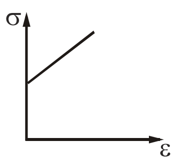
A. Rigid-Perfectly plastic
B. Elastic-Perfectly plastic
C. Rigid-Strain hardening
D. Linearly elastic

List-II

1.


2.


3.


4.


Codes :

	A	B	C	D
(a)	3	1	4	2
(b)	1	3	2	4
(c)	3	1	2	4
(d)	1	3	4	2

13. Which one of the following materials is highly elastic?

(a) Rubber (b) Brass
(c) Steel (d) Glass

14. The elastic Constants E and K are related as (μ is the Poisson's ratio).

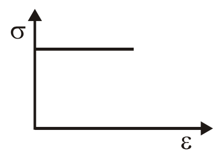
(a) $E = 2K(1 - 2\mu)$
(b) $E = 3K(1 - 2\mu)$
(c) $E = 3K(1 + \mu)$
(d) $E = 2K(1 + 2\mu)$

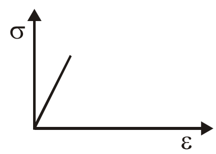
15. ***Assertion (A) :*** Stress-strain curves for brittle material do not exhibit yield point.

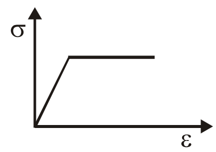
Reason (R) : Brittle materials fail without yielding.

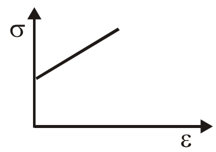
(a) Both A and R are individually true and R is the correct explanation of A
(b) Both A and R are individually true but R is NOT the correct explanation of A
(c) A is true but R is false
(d) A is false but R is true

16. An idealised stress-strain curve for a perfectly plastic material is given by

(a)


(b)


(c)


(d)


17. ***Assertion (A) :*** Poisson's ratio is a measure of the lateral strain in all direction perpendicular to the loading direction in terms of the linear strain.

Reason (R) : The nature of lateral strain in a uniaxially loaded bar is opposite to that of the linear strain in the direction of loading.

(a) Both A and R are individually true and R is the correct explanation of A
(b) Both A and R are individually true but R is not the correct explanation of A
(c) A is true but R is false
(d) A is false but R is true

18. A weight falls on a plunger fitted in a container filled with oil there by producing a pressure of 1.5 N/mm^2 in the oil. The Bulk Modulus of oil is 2800 N/mm^2. Given this situation, the volumetric compressive strain produced in the oil will be

(a) 400×10^{-6} (b) 800×10^{6}
(c) 268×10^{6} (d) 535×10^{-6}

19. The Young's modulus of elasticity of a material is 2.5 times of its modulus of rigidity. The Poisson's ratio for the material will be

(a) 0.25 (b) 0.33
(c) 0.50 (d) 0.75

20. Lueder lines on steel specimen under simple tension test is a direct indication of yielding of material due to slip along the plane

(a) Of maximum principal stress
(b) Of maximum shear stress
(c) Along the direction of loading
(d) Perpendicular to the direction of loading

21. A bar is having strain 0.0014. The elastic limit of that material is 250 N/mm^2. If the modulus of elasticity of the material of the bar is 205000 N/mm^2 then the residual component of the strain on unloading is very close to

(a) 0.0004 (b) 0.0002
(c) 0.0001 (d) 0.00005

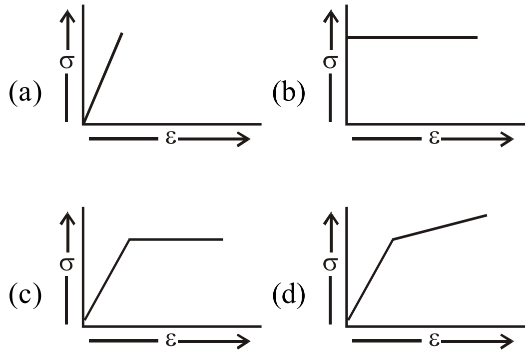
22. In a simple tension test, Hooke's law is valid upto the.

(a) Elastic limit (b) Limit of proportionality
(c) Ultimate stress (d) Breaking point

23. The percentage elongation of a material as obtained from static tension test depends upon the

(a) Diameter of the test specimen
(b) Gauge length of the specimen
(c) Nature of end-grips of the testing machine
(d) Geometry of the test specimen

24. The stress strain curve of an ideal elastic strain hardening material will be as



25. ***Assertion (A) :*** Poisson's ratio of a material is a measure of its ductility.

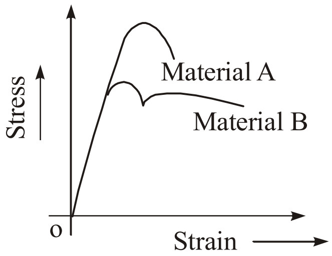
Reason (R) : For every linear strain in the direction of force, Poisson's ratio of the material gives the lateral strain in directions perpendicular to the direction of force.

(a) Both A and R are individually true and R is the correct explanation of A
(b) Both A and R are individually true but R is not the correct explanation of A
(c) A is true but R is false
(d) A is false but R is true

26. Which one of the following pairs is NOT correctly matched?

(a) Uniformly distributed stress .... Force passed through the centroid of the cross-section
(b) Elastic deformation .... Work done by external forces during deformation is dissipated fully as heat
(c) Potential energy of strain .... Body is in a state of elastic deformation
(d) Hooke's law .... Relation between stress and strain

27. 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

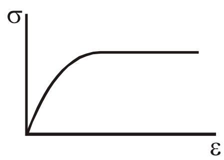
(c) (i) is true but (ii) is false

(d) (i) is false but (ii) is true

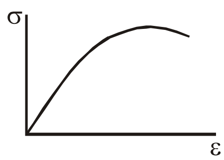
28. Match list I (Materials) with List II (Stress-strain curves) and select the correct answer using the codes given below the Lists

List-I **List-II**

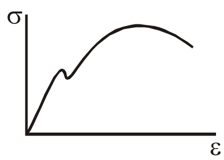
A. Mild Steel **1.**



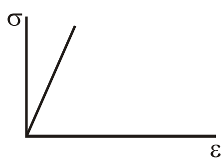
B. Pure copper **2.**



C. Cast iron **3.**



D. Pure aluminium **4.**



Codes :

	A	B	C	D
(a)	3	1	4	1
(b)	3	2	4	2
(c)	2	4	3	1
(d)	4	1	3	2

29. Match List I with List II and select the correct answer using the codes given below the Lists:

List-I

A. Ultimate strength

B. Natural strain

C. Conventional strain

D. Stress

List-II

1. Internal structure

2. Change of length per unit instantaneous length

3. Change of length per unit gauge length

4. Load per unit area

Codes :

	A	B	C	D
(a)	1	2	3	4
(b)	4	3	2	1
(c)	1	3	2	4
(d)	4	2	3	1

30. ***Assertion (A) :*** Hooke's law is the constitutive law for a linear elastic material.

Reason (R): Formulation of the theory of elasticity requires the hypothesis that there exists a unique unstressed state of the body, to which the body returns whenever all the forces are removed.

(a) Both A and R are individually true and R is the correct explanation of A

(b) Both A and R are individually true but R is not the correct explanation of A

(c) A is true but R is false

(d) A is false but R is true

31. Consider the following statements

1. There are only two independent elastic constants.
2. Elastic constants are different in orthogonal directions.
3. Material properties are same everywhere.
4. Elastic constants are same in all directions.
5. The material has ability to withstand shock loading.

Which of the above statements are true for a linearly elastic, homogeneous and isotropic material?

(a) 1, 3, 4 and 5 (b) 2, 3, and 4
(c) 1, 3, and 4 (d) 2 and 5

32. ***Assertion (A):*** For a ductile material stress-strain curve is a straight line up to the yield point.

Reason (R): The material follows Hooke's law up to the point of proportionality.

(a) Both A and R are individually true and R is the correct explanation of A
(b) Both A and R are individually true but R is not the correct explanation of A
(c) A is true but R is false
(d) A is false but R is true

33. Match List-I (Types of Tests and Materials) with List-II (Types of Fractures) and select the correct answer using the codes given below the lists:

List-I (Types of Tests and Materials)

A. Tensile test on CI
B. Torsion test on MS
C. Tensile test on MS
D. Torsion test on CI

List-II (Types of Fractures)

1. Plain fracture on a transverse plane
2. Granular helicoidal fracture
3. Plain granular at 45° to the axis
4. Cup and Cone
5. Granular fracture on a transverse plane

Codes :

	A	B	C	D
(a)	4	2	3	1
(b)	4	1	3	2
(c)	5	1	4	2
(d)	5	2	4	1

34. The moduli of elasticity and rigidity of a material are 200 GPa and 80 GPa, respectively. What is the value of the Poisson's ratio of the material?

(a) 0.30 (b) 0.26
(c) 0.25 (d) 0.24

35. A mild steel specimen is tested in tension up to fracture in a Universal Testing Machine. Which of the following mechanical properties of the material can be evaluated from such a test?

1. Modulus of elasticity
2. Yield stress
3. Ductility
4. Tensile strength
5. Modulus of rigidity

Select the correct answer using the code given below

(a) 1, 3 and 5 (b) 2, 3 and 4
(c) 1, 2 and 5 (d) 1, 2, 3 and 4

36. What is the cause of failure of a short MS strut under an axial load?

(a) Fracture stress (b) Shear stress
(c) Buckling (d) Yielding

37. A steel cube of volume 8000 cc is subjected to all around stress of 1330 kg/cm^2. The bulk modulus of the material is 1.33×10^6 kg/cm^2. The volumetric change is

(a) 8 cc (b) 6 cc
(c) 0.8 cc (d) 10^{-3} cc

38. In terms of bulk modulus (K) and modulus of rigidity (G), Poisson's ratio can be expressed as

(a) $\frac{3K-4G}{6K+4G}$ (b) $\frac{3K+4G}{6K-4G}$

(c) $\frac{3K-2G}{6K+2G}$ (d) $\frac{3K+2G}{6K-2G}$

39. 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 the materials

(b) Tension in material A and compression in material B

(c) Compression in material A and tension in material B

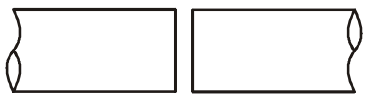
(d) Compression in both the materials

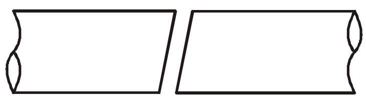
40. A bar of diameter 30 mm is subjected to a tensile load such that the measured extension on a gauge length of 200 mm is 0.09 mm and the change in diameter is 0.0045 mm. The poisson's ratio will be

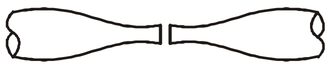
(a) 1/4 (b) 1/3

(c) 1/5 (d) 1/6

41. When a mild-steel specimen fails in a torsion test fracture looks like

(a) 

(b) 

(c) 

(d) 

42. A 2 m long bar of uniform section extends 2 mm under limiting axial stress of 200 N/mm^2. What is the modulus of resilience for the bar?

(a) 0.10 units (b) 0.20 units

(c) 10000 units (d) 200000 units

43. The stress level, below which a material has a high probability of not failing under reversal of stress, is known as

(a) elastic limit (b) endurance limit

(c) proportional limit (d) tolerance limit

44. If $E = 2.06 \times 10^5$ N/mm^2, an axial pull of 60 kN suddenly applied to a steel rod of 50 mm in diameter and 4 m long. It causes an instantaneous elongation of the order of

(a) 1.19 mm (b) 2.19 mm

(c) 3.19 mm (d) 11.9 mm

45. ***Assertion (A):*** Strain is a fundamental behaviour of the material, while the stress is a derived concept.

Reason (R): Strain does not have a unit while the stress has a unit.

(a) Both A and R are true and R is the correct explanation of A

(b) Both A and R are true but R is not a correct explanation of A

(c) A is true but R is false

(d) A is false but R is true

46. ***Assertion (A):*** A mild steel tension specimen has a cup and cone fracture at failure.

Reason (R): Mild steel is weak in shear and failure of the specimen in shear takes place at 45° to the direction of the applied tensile force.

(a) Both A and R are true and R is the correct explanation of A

(b) Both A and R are true but R is not a correct explanation of A

(c) A is true but R is false

(d) A is false but R is true

47. 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) $6.56 \times A$

48. Match List-I with List-II and select the correct answer using the codes given below the lists

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

Codes :

	A	B	C	D
(a)	1	2	4	3
(b)	1	2	3	4
(c)	2	3	4	1
(d)	2	1	4	3

49. Which one of the following pairs is NOT correctly matched?

(a) Visco-elastic : Small plastic zone material

(b) Strain hardening material : Stiffening effect felt at some stage

(c) Orthotropic material : Different properties in three perpendicular directions

(d) Isotropic material : Same physical property in all directions at a point

50. In an experiment it found that the bulk modulus of a material is equal to its shear modulus. The poisson's ratio is

(a) 0.125 (b) 0.250

(c) 0.375 (d) 0.500

51. Match List-I (Material) with List-II (Characteristic) and select the correct answer using the codes given below the lists :

List-I

A. Inelastic material

B. Rigid plastic material

C. Ductile material

D. Brittle material

List-II

1. No plastic zone

2. Large plastic zone

3. Strain is not recovered after unloading

4. Strain is zero upto a stress level and then stress remains constant.

Codes :

	A	B	C	D
(a)	3	4	2	1
(b)	3	4	1	2
(c)	4	3	2	1
(d)	4	3	1	2

52. Match List-I (Property) with List-II (Characteristic) and select the correct answer using the codes given below the lists

List-I

A. Fatigue

B. Creep

C. Plasticity

D. Endurance limit

List-II

1. Material continues to deform with time under sustained loading

2. Decreased resistance of material to repeated reversal of stress

3. Material has a high probability of not failing under reversal of stress of magnitude below this level

4. Material continues to deform without any further increases in stress

Codes :

	A	B	C	D
(a)	2	1	4	3
(b)	2	1	3	4
(c)	1	2	4	3
(d)	1	2	3	4

53. A cylindrical bar of 20 mm diameter and 1 m length is subjected to a tensile test. Its longitudinal strain is 4 times that of its lateral strain. If the modulus of elasticity is 2×10^5 N/mm^2, then its modulus of rigidity will be

(a) 8×10^6 N/mm^2

(b) 8×10^5 N/mm^2

(c) 0.8×10^4 N/mm^2

(d) 0.8×10^5 N/mm^2

54. ***Assertion (A) :*** In a tensile test on a specimen, true stress in the specimen is more than the nominal stress.

Reason (R) : Grip of universal testing machine introduces stress concentrations.

(a) Both A and R are true and R is the correct explanation of A

(b) Both A and R are true but R is not a correct explanation of A

(c) A is true but R is false

(d) A is false but R is true

55. ***Assertion (A) :*** A mild steel tension specimen subjected to an axial load failed along a surface at 45° to its axis.

Reason (R): Mild steel is weaker in shear than in tension and the plane of maximum shear is at 45° to its axis.

(a) Both A and R are true and R is the correct explanation of A

(b) Both A and R are true but R is not a correct explanation of A

(c) A is true but R is false

(d) A is false but R is true

56. Match List-I with List-II and select the correct answer using the codes given below the lists

List-I

A. Tenacity

B. Plasticity

C. Ductility

D. Malleability

List-II

1. Continues to deform without much increase of stress

2. Ultimate strength in tension

3. Ability to be converted into a thin sheet without rupture

4. Ability to be drawn out by tension to a small section without rupture

Codes :

	A	B	C	D
(a)	2	1	4	3
(b)	2	1	3	4
(c)	1	2	4	3
(d)	1	2	3	4

57. A bar of uniform section is subjected to axial tensile loads such that the normal strain in the direction of loading is 1.25 mm per m. If the poisson's ratio of the material of the bar is 0.3, the volumetric strain would be

(a) 2×10^{-4} (b) 3×10^{-4}

(c) 4×10^{-4} (d) 5×10^{-4}

58. Match List-I (Elastic constant) with List-II (Definition) and select the correct answer using the codes given below the lists

List-I

A. Young's modulus

B. Poisson's ratio

C. Bulk modulus

D. Rigidity modulus

List-II

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

Codes :

	A	B	C	D
(a)	3	1	4	2
(b)	2	1	4	3
(c)	2	4	1	3
(d)	3	4	1	2

❍❍❍

Answer Sheet

1. ***Ans. (a)***

$$E = 2G(1+\mu)$$

Put $\mu = 0.5$

$\therefore$ $E = 3G$

2. ***Ans. (c)***

$$\text{Young's modulus (E)} = \frac{\text{Normal stress}}{\text{Normal strain}}$$

$$\text{Modulus of rigidity (G)} = \frac{\text{Shear stress}}{\text{Shear strain}}$$

$$\text{Bulk modulus} = \left|-\frac{\text{Change in pressure}}{\text{Volumetric strain}}\right|$$

$$\text{Poisson's ratio} = -\frac{\text{Lateral strain}}{\text{Longitudinal strain}}$$

3. ***Ans. (a)***

$$A \times \sigma = F$$

$$(w - 10) \times 2 \times 200 = 2000$$

$\therefore$ $w - 10 = 5$

$\therefore$ $w = 15$ mm

4. ***Ans. (b)***

5. ***Ans. (c)***

	Types of Material	Number of independent elastic constant
1.	Isotropic and homogeneous	2
2.	Orthotropic	9
3.	Anisotropic	21

6. ***Ans. (b)***

The range of Poisson's ratio of engineering material is from 0 to 0.5.

7. ***Ans. (a)***

8. ***Ans. (b)***

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

$$= \frac{1.25\times10^5}{2(1+0.34)}$$

$$= 0.4664 \times 10^5 \text{ MPa}$$

9. ***Ans. (d)***

10. ***Ans. (c)***

11. ***Ans. (d)***

12. ***Ans. (a)***

13. ***Ans. (c)***

14. ***Ans. (b)***

$$E = 2G(1+\mu)$$

$$= 3K(1-2\mu)$$

15. ***Ans. (a)***

16. ***Ans. (a)***

17. ***Ans. (b)***

18. ***Ans. (d)***

$$\text{Bulk modulus of elasticity (K)} = \frac{P}{\epsilon_v}$$

or $$\epsilon_v = \frac{P}{K} = \frac{1.5}{2800}$$

$$= 535 \times 10^{-6}$$

19. ***Ans. (a)***

$$E = 2G(1+\mu)$$

$$\Rightarrow \quad 1+\mu = \frac{E}{2G}$$

$$\Rightarrow \quad \mu = \left(\frac{E}{2G}-1\right)$$

$$= \left(\frac{2.5}{2}-1\right) = 0.25$$

20. ***Ans. (b)***

21. ***Ans. (b)***

22. ***Ans. (b)***

23. ***Ans. (b)***

24. ***Ans. (d)***

25. ***Ans. (d)***

26. ***Ans. (b)***

27. ***Ans. (c)***

28. ***Ans. (b)***

29. ***Ans. (a)***

30. ***Ans. (b)***

31. ***Ans. (a)***

32. ***Ans. (d)***

33. ***Ans. (c)***

34. ***Ans. (c)***

$$E = 2G(1+\mu)$$

or $$\mu = \frac{E}{2G} - 1$$

$$= \frac{200}{2\times 80} - 1 = 0.25$$

35. ***Ans. (d)***

36. ***Ans. (d)***

In compression test of ductile materials fractures is seldom obtained. Compression is accompanied by lateral expansion and a compressed cylinder ultimately assumes the shape of a flat disc due to yielding in compression.

37. ***Ans. (a)***

Bulk modulus, $K = \dfrac{P}{\frac{\Delta V}{V}}$

$$\therefore \quad \Delta V = \frac{1330\times 8000}{1.33\times 10^6} = 8\,\text{cc}$$

38. ***Ans. (c)***

There are four elastic constants

E = Young's modulus of elasticity

G = Modulus of rigidity

K = Bulk modulus

μ = Poisson's ratio

The relations between these constants are

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

$$K = \frac{E}{3(1-2\mu)}$$

$$E = \frac{9KG}{G+3K}$$

$$\mu = \frac{3K-2G}{6K+2G}$$

39. ***Ans. (d)***

As the temperature rises, both the bars will have tendency to expand but they are fixed between two unyielding walls so they will not be allowed to expand. Hence in both the bars compressive stress will develop.

40. ***Ans. (b)***

Longitudinal strain, $\epsilon_L = \dfrac{\Delta L}{L} = \dfrac{0.09}{200}$

Lateral strain, $\epsilon_D = \dfrac{\Delta D}{D} = -\dfrac{0.0045}{30}$

Poisson's ratio $= -\dfrac{\epsilon_D}{\epsilon_L} = \dfrac{0.0045}{30}\times\dfrac{200}{0.09} = \dfrac{1}{3}$

41. ***Ans. (a)***

42. ***Ans. (a)***

Modulus of resilience, $u = \dfrac{\sigma^2}{2E}$

Where, $E = \dfrac{\sigma L}{\Delta L}$

$$\therefore \quad u = \frac{\sigma \Delta L}{2L}$$

$$= \frac{200\times 2}{2\times 2000} = 0.10 \text{ units}$$

43. ***Ans. (b)***

The stress level upto which material can withstand for an infinite number of cycles, without failure is called endurance limit.

44. ***Ans. (a)***

Instantaneous elongation, $\Delta = \dfrac{2PL}{EA}$

$$= \frac{2\times 60\times 10^3\times 4000}{2.06\times 10^5\times\left(\frac{\pi\times 50^2}{4}\right)}$$

$$= 1.19 \text{ mm}$$

45. ***Ans. (b)***

46. ***Ans. (a)***

Mild steel is equally strong in tension and compression but it is weak in shear. Hence, the failure of the specimen takes place due to shear.

47. ***Ans. (a)***

48. ***Ans. (d)***

Tenacity : Property of material to resist fracture under the action of tensile load.

49. ***Ans. (a)***

Viscoelastic material have the characteristics of viscous and elastic material both. Because of viscosity factor they have strain rate dependent on time.

50. ***Ans. (a)***

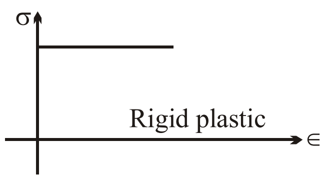
We know that $\mu = \dfrac{3K - 2G}{6K + 2G}$

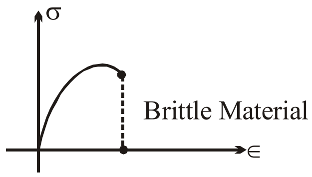
But here K = G

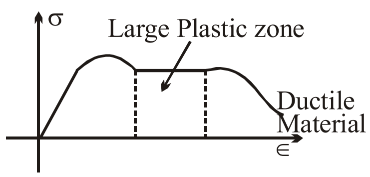
$\therefore \quad \mu = \dfrac{3-2}{6+2} = 0.125$

51. ***Ans. (a)***

Inelastic material does not have strain recovery on unloading.







52. ***Ans. (a)***

53. ***Ans. (d)***

$$\text{Poisson's ratio} = -\frac{\text{Lateral strain}}{\text{Longitudinal strain}}$$

$$= 0.25$$

$$G = \frac{E}{2(1+\mu)} = \frac{2 \times 10^5}{2.5}$$

$$= 0.8 \times 10^5 \text{ N/mm}^2$$

54. ***Ans. (b)***

For true stress, the actual area at any time is used. The actual area is less than original area, therefore true stress is more than nominal stress.

55. ***Ans. (a)***

56. ***Ans. (a)***

Tenacity is the property of the material to resist fracture under the action of a tensile force.

57. ***Ans. (d)***

$$\in_N = 1.25 \text{ mm per m}$$

Lateral strain,

$\in_L = -$ Poisson's ratio × Longitudinal strain

$= -0.3 \times 1.25$ mm per m

Volumetric strain,

$$\in_V = \in_N + \in_L + \in_L$$

$= 1.25 - 0.3 \times 1.25 - 0.3 \times 1.25$

$= 0.4 \times 1.25$

$= 0.5$ mm per m

$= 5 \times 10^{-4}$

58. ***Ans. (b)***

$$\text{Young's modulus} = \frac{\text{Stress}}{\text{Strain}}$$

$$\text{Poisson's ratio} = -\frac{\text{Lateral strain}}{\text{Longitudinal strain}}$$

$$\text{Bulk modulus} = \left| -\frac{P}{\Delta V / V} \right|$$

$$\text{Shear modulus} = \frac{\text{Shear stress}}{\text{Shear strain}}$$

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