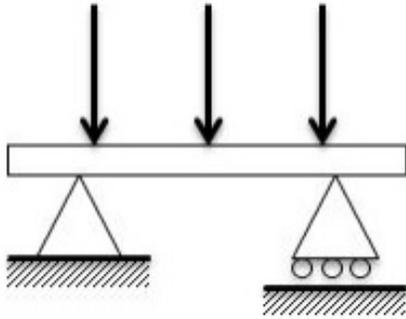


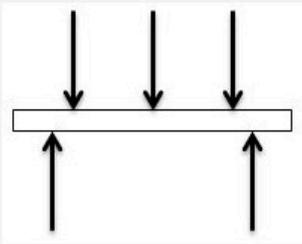
Placement Exam - Basic Principles of Mechanics Sample Questions

1. Consider the simply supported beam as shown:

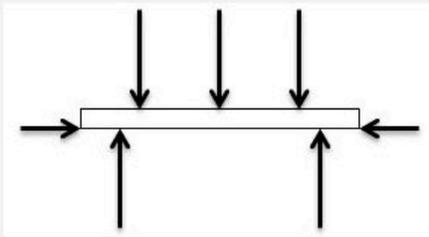


The correct free body diagram for the beam is:

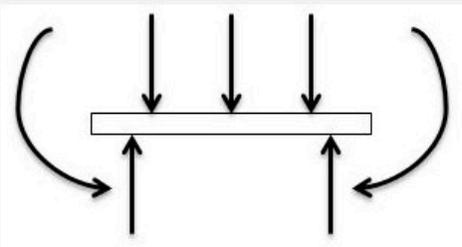
a.



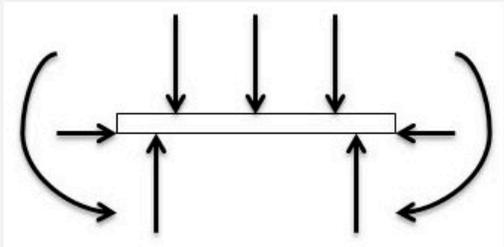
b.



c.

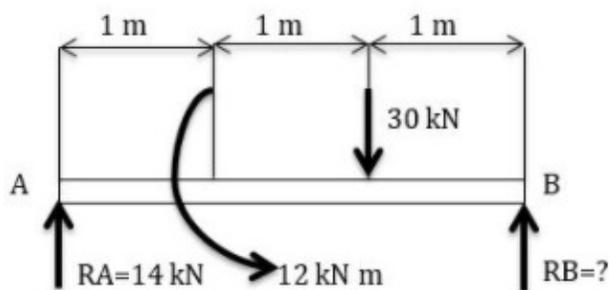


d.



2. Consider a symmetric beam subject to pure bending in the elastic range. The true statement is:
- Normal strain varies linearly with the distance from the neutral surface.
  - Normal stress varies linearly with the distance from the neutral surface.
  - The neutral axis passes through the centroid of the cross-section.
  - All of the above.

3. Consider the free diagram of a beam AB subject to the load shown:



If the beam AB is in equilibrium, the reaction at B

- Has intensity 0 kN
  - Has intensity 16 kN and direction as shown
  - Has intensity 16 kN but opposite direction
  - Has intensity 12 kN, horizontal, from right to left
4. According to the Parallel Axis Theorem, what is the moment of inertia (IP) of a section about an axis parallel to the axis through the centroid? Here, A is the area of the section, IG is the moment of inertia of the section about the axis through the centroid and h is the distance between the two axes.
- $IP = IG + A h^2$
  - $IP = IG - A h^2$
  - $IP = IG / (A h^2)$
  - $IC = IP / (A h^2)$

5. Assume that the transverse cross-section of a beam in pure bending remains plane and that there exists a state of uniaxial stress

$$\sigma_x \neq 0, \sigma_y = \sigma_z = 0$$

in which  $x$  is the axial direction, and  $y$  and  $z$  are the transverse directions. Then, the true statement is

- a) There is no deformation within the plane of the cross-section
- b) The strains  $\epsilon_y$  and  $\epsilon_z$  depend upon the Poisson's ratio  $\nu$  of the material and are expressed as

$$\epsilon_y = -\nu\epsilon_x$$

$$\epsilon_z = -\nu\epsilon_x$$

- c) The strains  $\epsilon_y$  and  $\epsilon_z$  depend upon the Poisson's ratio  $\nu$  of the material and are expressed as

$$\epsilon_y = \nu\epsilon_x$$

$$\epsilon_z = \nu\epsilon_x$$

- d) None of the above.

6. The Reynolds number represents:

- a) The relative importance of the inertia and viscous forces
- b) The relative importance of gravitational and viscous forces
- c) The ratio between the velocity and the speed of sounds
- d) The approximate number of turbulent eddies in the flow

7. In a viscous flow the velocity of a fluid at the boundary with a solid wall is

- a) Always orthogonal to the wall
- b) Forming an angle of 45 degree to the wall
- c) Always 0
- d) Equal to the velocity of the solid wall

8. During an immersion, as a diver goes deeper he will experience

- a) Increased hydrostatic pressure and increased buoyancy
- b) No change in buoyancy or pressure
- c) Lower hydrostatic pressure and lower buoyancy
- d) Higher hydrostatic pressure and constant buoyancy

9. Which of these statements about incompressible flows is true

- a) The pressure is constant anywhere
- b) The divergence of the velocity field is equal to 0
- c) The Mach number is  $\gg 1$  everywhere
- d) All of the above

10. Which of these statements about laminar flow in a horizontal tube is true

- a) The velocity has a parabolic profile with a maximum at the center
- b) There is no shear stress on the wall
- c) The velocity is uniform everywhere
- d) Can only exist for Reynolds numbers much larger than 2000

## Mechanics Sample Questions Key

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1. A
2. D
3. B
4. A
5. B
6. A
7. D
8. D
9. B
- 10.A