## **Mechanical Properties of Solids**

## **Assertion Reason Questions**

Two statements are given one labelled Assertion

(A) and the other labelled Reason (R). Select the correct answer to these questions from the codes

(a), (b), (c) and (d) as given below:

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

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

(c) A is true but R is false.

(d) A is false and R is also false.

Assertion (A): Elastic restoring forces may be conservative.
Reason (R): The value of strain for the same stress is different while increasing the load and while decreasing the load.

**Ans.** (b) Both A and R are true and R is not the correct explanation of A. **Explanation:** Elastic force is the force formed on a deformed object itself to return to its initial shape. When an elastic material is subjected to an external force, it may undergo deformation till the force is released from the object. Whenever the external force is released, the elastic force within the body of that particular material tends its body to come back to the initial position. Conservative forces are the force which does not depend upon the path, but on the work done. As work done is a point function, the path is not considered in these types of forces.

**2. Assertion (A):** A lead is more elastic than rubber.

**Reason (R):** If the same load is applied on the lead and rubber wire of the same crosssectional area, the strain of lead is very much less than that of rubber.

**Ans.** (a) Both A and R are true and R is the correct explanation of A. **Explanation:** More elastic the material higher the Young's Modulus. Young's Modulus of rubber is 0.01-0.1 Gpa whereas for Lead it is 16 Gpa.

Also, 
$$Y = \frac{\left(\frac{F}{A}\right)}{\frac{1}{L}}$$

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Where

F = Applied Force A = Cross Section Area I = Elongation/Decrease in Length L = Actual Length

**3. Assertion (A):** Identical springs of steel and copper are equally stretched. More work will be done on the steel spring.

Reason (R): Steel is more elastic than copper.

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

**Explanation:** Work done =  $\frac{1}{2}$  × stress × strain Work done =  $\frac{1}{2}$  × Y × (strain)<sup>2</sup>

As steel is more elastic than copper, more work has to be done in order to stretch the steel.

**4. Assertion (A):** The bridges were declared unsafe after long use. **Reason (R):** Elastic strength of bridges losses with time.

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

**Explanation:** A bridge during its use undergoes alternating strains a large number of times each day, depending upon the movement of vehicles on it when a bridge is used for a long time, it loses its elastic strength. Due to this, the amount of strain on the bridge for a given stress will become large and ultimately, the bridge may collapse. This may not happen, if the bridges are declared unsafe after long use.

**5. Assertion (A):** Transverse sound waves do not occur in gases. **Reason (R):** Gases cannot sustain shearing strain.

**Ans.** (a) Both A and R are true and R is the correct explanation of A. **Explanation:** Shear strain cannot be tolerated by liquids or gases. Transverse waves, which move in the form of crests and troughs and include a change in shape, cannot thus propagate through a fluid. Because fluids have volume elasticity, compressions and rarefactions that entail volume changes can propagate through them.



**6. Assertion (A):** Two identical solid balls, one of ivory and the other of wetclay, are dropped from the same height on the floor. Both balls will rise to the same height after bouncing.

Reason (R): Ivory and wetclay have the same elasticity.

**Ans.** (d) A is false and R is also false.

**Explanation:** lvory is more elastic than wetclay. Hence, the ball of ivory will rise to a greater height. In fact, the ball of wetclay will not rise at all, it will be somewhat flattened permanently.

**7. Assertion (A):** Work is required to be done to stretch a wire. This work is stored in the wire in the form of elastic potential energy

**Reason (R):** Work is required to be done against the intermolecular forces of attraction.

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

**Explanation:** When we exert tensile stress on a wire, it will get stretched and the work done in stretching the wire will be equal and opposite to the work done by interatomic restoring force. This work is stored in the wire in the form of elastic potential energy. Whereas work done can be derived as W = JF.dl. Where F is a force applied on the wire and dl is changed in length.

