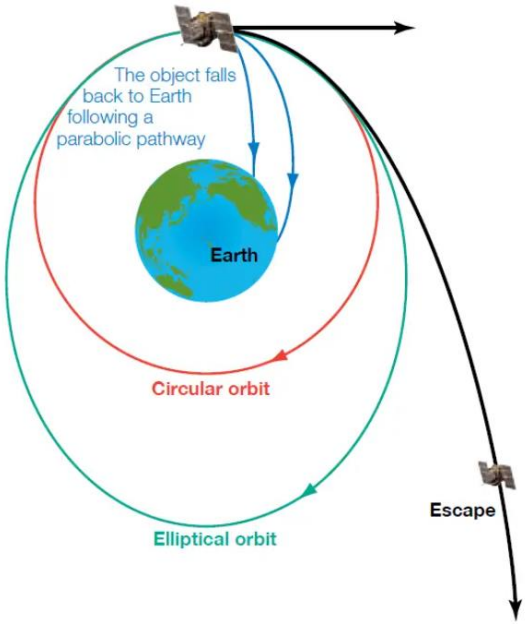
C.B.T. NOVEMBER-2023
CLASS-XI (PHYSICS)

SYLLABUS COVERED: 1. GRAVITATON
2. MECHANICAL PROPERTIES OF SOLIDS

CASE-STUDY-1

GRAVITATON

When we throw a body vertically upward from the surface of the earth it returns to the surface of the earth after sometime due to gravitational pull of the earth. The acceleration experience by a body due to gravitational force of the Earth is known as acceleration due to gravity. It depends on mass and size of the earth and rotation of the earth. It decreases as we go away from the surface of the earth and deceases with the depth from the surface of the earth.



If a body is thrown with escape speed it never returns to the surface of the earth. Escape speed only depends on the mass and size of the planet. It does not depend on the angle of projection from the surface of heavenly body. The motion of the satellite around the earth is a case of a freely falling body. A velocity is required to put a satellite into its orbit around the earth called orbital velocity. Escape velocity is $\sqrt{2}$ times the orbital velocity.

Q.1 Escape speed of a chalk of mass 2 g on the surface of the Earth is 11.2 km/ s, the escape speed of the ball of mass 50 g on the surface of the earth will be:

(i) 22.4 km/s (ii) 11.2km/s (iii) 280km/s (iv) 0.5 km/s

Ans: - (ii) we know that escape speed does not depend on the mass of the body. i.e. $v_e = \sqrt{2gR}$.

Q.2 The value of escape speed on a certain planet is 2 km/ s. Then the value of orbital speed for a satellite orbiting close to its surface is

(i) 12 km/s

(ii) 1 km/s

(iii) $\sqrt{2}$ km/s

(iv) 2 $\sqrt{2}$km/s

Answer: (iii) $\sqrt{2}$ km/s

Near surface of the earth , $v_o = v_e / \sqrt{2}$

Q.3 The percentage decrease in the weight of the body when it is taken 64 km below the surface of the earth having radius 6400 km:

(i) 5% (ii) 3% (iii) 1% (iv) 6%

Answer: -(iii) $g_d = g\left(1 - \frac{d}{R}\right)$

$g_d = g\left(1 - \frac{64}{6400}\right)$

$g_d = g\left(1 - \frac{1}{100}\right)$

$g_d - g = \left(\frac{g}{100}\right)$

decrease in weight = $mg - m g_d = m(g - g_d) = m\left(\frac{g}{100}\right)$

% decrease in weight = $m\left(\frac{g}{100}\right) / mg \times 100 = 1\%$

Q.4 What is not conserved in case of celestial bodies revolving around the sun?

(i) kinetic energy

(ii)mass

(iii) angular momentum

(iv) linear momentum

Answer: (i) kinetic energy

K.E. changes due to change in speed of celestial bodies from Kepler's law

Q.5 Directions: In the following questions, a statement of assertion is followed by a statement of reason.

Assertion: The value of acceleration due to gravity becomes zero at depth equal to half the diameter of the earth.
Reason: Acceleration due to gravity depends on rotation of the earth.
Mark the correct choice as:

(i) If both assertion and reason are true and reason is the correct explanation of assertion.
(ii) If both assertion and reason are true but reason is not the correct explanation of assertion.
(iii) If assertion is true but reason is false.
(iv) If both assertion and reason are false.

Answer: (ii) If both assertion and reason are true but reason is not the correct explanation of assertion

$g_d = g\left(1 - \frac{d}{R}\right)$, when d=Diameter/2, $g_d = 0$

CASE-STUDY-2
MECHANICAL PROPERTIES OF SOLIDS

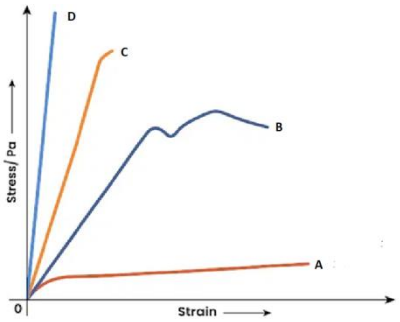
The knowledge of mechanical properties of solids like elasticity, plasticity, tensile strength , hardness, ductility, toughness, fatigue resistance plays an important role in selecting the right materials and designing structures and components that meet specific performance and safety criteria in engineering and manufacturing. They define how materials respond to external forces and loads.

If a body regains it's original size and shape after the removal of the deforming force it is called elastic body. Stress is the restoring force per unit area and strain is the fractional change in dimension .Stress may be tensile, shearing or hydraulic. For small deformations, and within elastic limit stress is proportional to strain. The constant of proportionality is called modulus of elasticity. Three types of modulus of elasticity: Young's modulus , bulk modulus and shear modulus, describe the elastic behaviour of objects as they respond to deforming forces which act on them.

The materials which have large plastic range of extension are called ductile materials and having small range of plastic extensions are called brittle materials.

When a solid is compressed after elastic limit for compression solid behaves like a plastic body. After this stage metals are said to be malleable.

Q.6 Stress –strain curve for different materials is shown in the graph. Choose the correct answer if 1- a plastic material, 2- a ductile material, 3- a strong material which is not ductile, 4- a brittle material.



(i) A-2, B-4, C-3, D-1
(ii) A-3, B-2, C-2, D-4
(iii) A-1, B-2, C-3, D-4
(iv) A-1, B-2, C-4, D-3

Answer: (iii) A-1 Plastic material, B-2 ductile material because it has large elastic range of extension , C-3 strong material which is not ductile , D-4 brittle material because its breaking point lies just close to elastic limit.

Q.7 Young's moduli of some materials are given below.

Substance	Young's modulus 'Y'(10^9 Nm^{-2})
iron	190
copper	110
steel	200
Aluminium	70

Which of the above materials will be preferred for making heavy duty machines and structural designs:
(i) iron
(ii) copper
(iii) steel
(iv) Aluminium

Answer: - (iii) **Steel** will be preferred for making heavy duty machines and structural designs because its modulus of elasticity is highest amongst given materials. It require large forces to produce small changes in length i.e. it is highly elastic.

Q.8 There are two wires of same material and same length while the diameter of second wire is two times that diameter of first wire, then the ratio of extension produced in the wire by applying same load will be

(i) 1:1 (ii) 2:1

(iii) 1:2 (iv) 4:1

Answer: - (iv) For the two wires F,l and Y are same, so $\Delta l_1 / \Delta l_2 = r_2^2 / r_1^2 = 4:1$.

Q.9 Within elastic limit ,the ratio of lateral strain to the longitudinal strain is called

(i) Modulus of rigidity

(ii) Poisson's ratio

(iii) Compressibilty

(iv)Bulk modulus

Answer: (ii) Poisson's ratio

Q.10 Directions: In the following questions, a statement of assertion is followed by a statement of reason.

Assertion: The Young's modulus of a wire of length L and radius R is Y Nm^{-2}. If the length is reduced to $\frac{L}{2}$ and radius $\frac{R}{2}$, there is no change in its Young's modulus .

Reason: Young's modulus of material depends on the dimensions of the wire.

Mark the correct choice as:

(i) If both assertion and reason are true and reason is the correct explanation of assertion.

(ii) If both assertion and reason are true but reason is not the correct explanation of assertion.

(iii) If assertion is true but reason is false.

(iv) If both assertion and reason are false.

Answer (iii) assertion is true but reason is false. Young's modulus depends on nature of the material

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