Halliday/Resnick/Walker
Fundamentals of Physics 8th edition

Classroom Response System Questions

Chapter 12 Static Equilibrium and Elasticity

Reading Questions
12.2.1. A water skier is pulled by a boat traveling with a constant velocity. Which one of the following statements is false concerning this situation?

a) The water skier is in equilibrium.

b) The net acceleration of the skier is zero m/s$^2$.

c) The net force on the skier is zero newtons.

d) There is a net horizontal force on the skier in the direction the boat’s velocity.

e) The net vertical force on the skier is zero newtons.
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d) There is a net horizontal force on the skier in the direction the boat’s velocity.

e) The net vertical force on the skier is zero newtons.
12.2.2. Which one of the following descriptions indicates that the object is in translational equilibrium?

a) Translational equilibrium occurs only if the object is at rest.

b) Translational equilibrium occurs only if the object is moving with constant acceleration.

c) Translational equilibrium occurs only if the object is at moving with constant velocity.

d) Translational equilibrium occurs if the object is moving with constant velocity or with constant acceleration.

e) Translational equilibrium occurs if the object is at rest or moving with constant velocity.
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12.2.3. Which of the following actions will take place if an object in unstable equilibrium is slightly displaced?

a) The object will move in the direction opposite that of the displacement.

b) The object will stop moving as soon as it reaches a place of stable equilibrium.

c) The kinetic energy will decrease.

d) The potential energy will decrease.
12.2.3. Which of the following actions will take place if an object in unstable equilibrium is slightly displaced?

a) The object will move in the direction opposite that of the displacement.

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12.3.1. Complete the following statement: When determining the net torque on a rigid body, only the torques due to

a) internal forces are considered.

b) external forces are considered.

c) forces that are either parallel or perpendicular to the lever arms are considered.

d) forces that form action-reaction pairs as in applying Newton’s third law of motion are considered.

e) internal and external forces are considered.
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e) internal and external forces are considered.
12.3.2. An object, which is considered a rigid body, is in equilibrium. Which one of the following statements is false when determining the forces and torques acting on the object?

a) The linear acceleration or the angular acceleration of the object may not be equal to zero.

b) The location of the rotational axis is arbitrary. Therefore, it can be placed at any point on the object that is convenient.

c) In placing an x-y coordinate system on the object, the +x direction is arbitrary and it can be directed toward any direction that is convenient.

d) A free body diagram of the external forces acting on the object is useful in analyzing this situation.

e) The sum of the torques due to external forces must equal zero N·m.
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e) The sum of the torques due to external forces must equal zero N·m.
12.3.3. Which of the following is not a requirement of static equilibrium?

a) The angular momentum of the object must be zero.

b) The vector sum of all the external forces that act on the body must be zero.

c) The linear momentum of the object must be zero.

d) The vector sum of all the external torques acting on the body must be zero.

e) All of the above are requirements of static equilibrium.
12.3.3. Which of the following is not a requirement of static equilibrium?

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e) All of the above are requirements of static equilibrium.
12.4.1. Which one of the following statements most accurately describes the *center of gravity* of an object?

a) It is the point where gravity acts on the object.

b) It is the point on the object where all the weight is concentrated.

c) It is the point from which the torque produced by the weight of the object can be calculated.

d) It must be experimentally determined for all objects.

e) It is the point where all the mass is concentrated.
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12.5.1. Consider the drawing. A small disk with a radius $r$ shares an axis with a wheel of radius $4r$. An object of mass $M_1$ hangs from a rope that is attached and wrapped around the wheel as shown. Another object of mass $M_2$ hangs from a rope that is attached and wrapped around the disk as shown. Which one of the following conditions must be true if this system is in equilibrium?

a) $M_1 = M_2$

b) $M_1 < M_2$

c) $M_1 > M_2$
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b) $M_1 < M_2$

c) $M_1 > M_2$
12.5.2. A block is sliding down a ramp at a constant velocity. Which one of the following statements is true?

a) The block is not in equilibrium because the net forces on the block are not equal to zero newtons.

b) The block is in static equilibrium.

c) The block is not in equilibrium because the net torque on the block is not equal to zero N \cdot m.

d) The block is in equilibrium, but it is not in static equilibrium.

e) The block is not in equilibrium because the linear momentum of the block is not equal to zero kg \cdot m/s.
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12.5.3. Consider the four situations shown below. A cube-shaped object is on a plank that is supported by one or more fulcrums, represented as triangles. An upward force, represented by the arrow, is applied at the locations shown. In which of these situations is the cube-shaped object most likely to be in static equilibrium?
12.5.3. Consider the four situations shown below. A cube-shaped object is on a plank that is supported by one or more fulcrums, represented as triangles. An upward force, represented by the arrow, is applied at the locations shown. In which of these situations is the cube-shaped object most likely to be in static equilibrium?
12.5.4. Consider the four situations shown below. One or two cube-shaped objects are sitting on a plank that is supported by one or more fulcrums, represented as triangles. An upward force, represented by the arrow, is applied at the locations shown. In which of these situations is the cube-shaped object most likely to be in static equilibrium?
12.5.4. Consider the four situations shown below. One or two cube-shaped objects are sitting on a plank that is supported by one or more fulcrums, represented as triangles. An upward force, represented by the arrow, is applied at the locations shown. In which of these situations is the cube-shaped object most likely to be in static equilibrium?
12.6.1. Which one of the following choices does not represent an example of an indeterminate structure?

a) an elephant standing on the ground

b) a three legged stool

c) a four legged coffee table

d) an unevenly loaded car

e) all of the above are indeterminate structures
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a) an elephant standing on the ground

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e) all of the above are indeterminate structures
12.7.1. What are the SI units of the shear modulus?

a) N/m²

b) N • m²

c) N/m

d) N • m

e) N/m³
12.7.1. What are the SI units of the shear modulus?

a) $\text{N/m}^2$

b) $\text{N} \cdot \text{m}^2$

c) $\text{N/m}$

d) $\text{N} \cdot \text{m}$

e) $\text{N/m}^3$
12.7.2. Complete the following statement: Young's modulus cannot be applied to

a) a bending beam.

b) a compressed liquid.

c) a stretched wire.

d) a compressed rod.

e) a stretched rubber band.
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12.7.3. A box that is submerged below the surface of a liquid is observed to have a volume $V_2$, which is smaller than the initial volume $V_1$ when the box was in air above the surface. If we wish to determine the “stress” on the box, what additional information is needed?

a) bulk modulus of the material from which the box is made

b) mass of the box

c) bulk modulus of the liquid

d) shear modulus of the material from which the box is made

e) Young's modulus of the material from which the box is made
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e) Young's modulus of the material from which the box is made
12.7.4. Complete the following statement: In general, the term stress refers to

a) a change in length.

b) a change in volume.

c) a fractional change in length.

d) a force per unit length.

e) a force per unit area.
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a) a change in length.

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e) a force per unit area.
12.7.5. Stress is the product of which two factors?

a) modulus and strain

b) force and strain

c) torque and elasticity

d) mass and acceleration

e) momentum and modulus
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12.7.6. Complete the following statement: The shear modulus for a fluid is

a) usually larger than the shear modulus for a solid.

b) larger than Young’s modulus for a fluid.

c) zero.

d) dependent on the fluid pressure.

e) dependent on the fluid density.
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a) usually larger than the shear modulus for a solid.

b) larger than Young’s modulus for a fluid.

c) zero.

d) dependent on the fluid pressure.

e) dependent on the fluid density.
12.7.7. Complete the following statement: The difference between strain and stress is that

a) stress deals with tensile and compressive forces while strain deals with shearing forces.

b) stress relates to the amount of deformation and strain is the deforming force per unit area.

c) stress is the deforming force per unit area and strain is the shearing force per unit area.

d) strain measures the amount of deformation and stress is related to force applied to an area of the object.

e) there is no difference.
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a) stress deals with tensile and compressive forces while strain deals with shearing forces.

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d) strain measures the amount of deformation and stress is related to force applied to an area of the object.

e) there is no difference.
12.7.8. Which pair of quantities listed below have the same units?

a) yield strength and strain
b) shear modulus and stress
c) strain and stress
d) tension and yield strength
e) All of the above pairs have the same units.
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c) strain and stress

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