

NCAE Review W

**MECHANICAL
REASONING**

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Mechanical Reasoning

- refers to a student's ability to **understand basic physical and mechanical principles**—how things move, work, and interact—*without doing complex math*.
- **Mechanical Reasoning = understanding how machines and physical forces work**

What skills does it measure?

- Mechanical reasoning tests your ability to:
 - ❖ Understand cause and effect in physical systems
 - ❖ Predict what will happen when parts move or forces are applied
 - ❖ Visualize motion, balance, and direction

Common Topics

- You may see questions about:

- **Levers** (seesaws, crowbars)
- **Pulleys** (lifting objects)
- **Gears** (direction and speed of rotation)

- **Inclined planes** (ramps)
- **Gravity and motion**
- **Balance and center of mass**
- **Simple machines** (wheel and axle, screw, wedge)

Example idea (not the real question)

- **If one gear turns clockwise, which direction will the next gear turn?**

Why is Mechanical Reasoning important in the NCAE?

- It helps identify students who may do well in:
 - Engineering
 - Technical-Vocational (TVL) tracks
 - Mechanics, electronics, automotive, construction
 - Physics-related careers

Important to know

- ✓ You don't need advanced formulas
- ✓ Most questions rely on **logic, pictures, and everyday experiences**
- ✓ Understanding **basic physics concepts** is enough

Question:

- **1. Levers (seesaws, crowbars)**
- A child sits closer to the center of a seesaw, while an adult sits farther from the center on the other side. What will most likely happen?
 - A. The seesaw will not move
 - B. The child's side will go down
 - C. The adult's side will go down
 - D. Both sides will stay balanced

- **1. Levers (seesaws, crowbars)**

- A child sits closer to the center of a seesaw, while an adult sits farther from the center on the other side. What will most likely happen?

C. The adult's side will go down

- In a lever, **force \times distance from the pivot** matters. Even if the child is lighter, the adult sits **farther from the center**, creating a larger turning effect. This causes the adult's side to go down.

Question:

- **2. Pulleys (lifting objects)**
- A single fixed pulley is used to lift a box. What is the main advantage of using this pulley?
 - A. It reduces the weight of the box
 - B. It changes the direction of the force applied
 - C. It makes the box lighter
 - D. It increases gravity

- **2. Pulleys (lifting objects)**

- A single fixed pulley is used to lift a box. What is the main advantage of using this pulley?

B. It changes the direction of the force applied

A **single fixed pulley** does **not reduce the weight** of the object. Its advantage is that it allows you to **pull down instead of lifting up**, which is easier and more convenient.

Question:

- **3. Gears (direction and speed of rotation)**
- Two gears are touching each other. If the first gear turns clockwise, how will the second gear turn?
 - A. Clockwise
 - B. Counterclockwise
 - C. It will not move
 - D. It will move up and down

- **3. Gears (direction and speed of rotation)**
- Two gears are touching each other. If the first gear turns clockwise, how will the second gear turn?
 A. Clockwise
 B. Counterclockwise

When two gears touch, they always rotate in **opposite directions**. If one gear turns clockwise, the other must turn counterclockwise.

Question:

- **4. Inclined planes (ramps)**
- Why is it easier to push a heavy box up a ramp than to lift it straight up?
 - A. The box becomes lighter on the ramp
 - B. The ramp reduces gravity
 - C. The ramp allows the force to be applied over a longer distance
 - D. The ramp increases friction

- **4. Inclined planes (ramps)**
- Why is it easier to push a heavy box up a ramp than to lift it straight up?
 - C. The ramp allows the force to be applied over a longer distance

A ramp does not reduce gravity or weight. Instead, it spreads the effort over a **longer distance**, making the required force **smaller** and easier to apply.

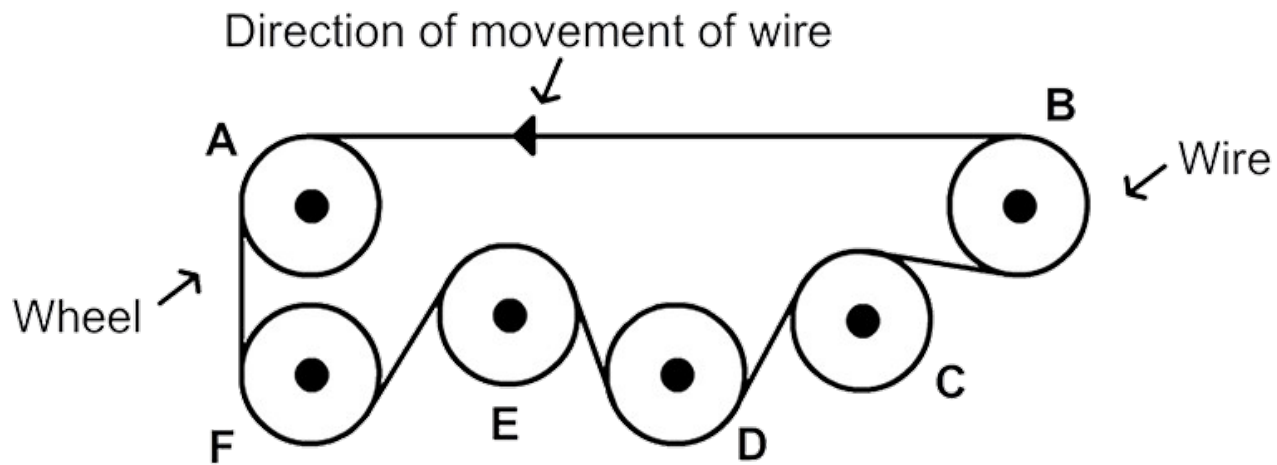
Question:

- **5. Balance and center of mass**
- A tightrope walker holds a long pole while walking on a rope. Why does the pole help?
 - A. It increases speed
 - B. It raises the center of mass
 - C. It lowers and spreads the center of mass
 - D. It reduces gravity

- **5. Balance and center of mass**
- A tightrope walker holds a long pole while walking on a rope. Why does the pole help?
 - C. It lowers and spreads the center of mass

The long pole increases balance by **lowering the center of mass** and spreading weight over a wider area, making it easier to stay stable on the rope.

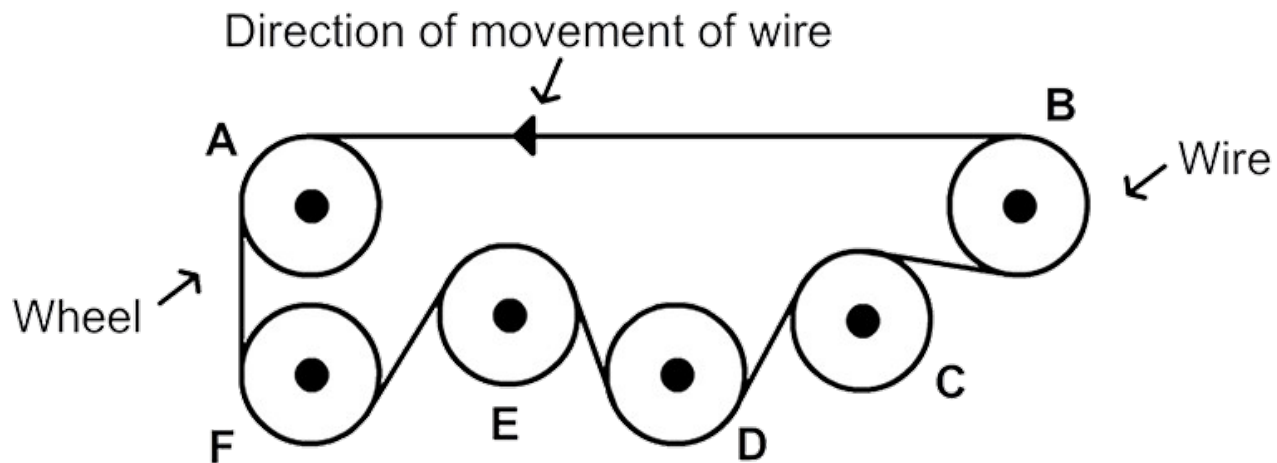
Question No: 6



Which wheels are turning counter-clockwise?

- A. A, B D, F
- B. C & E
- C. F & D
- D. ALL

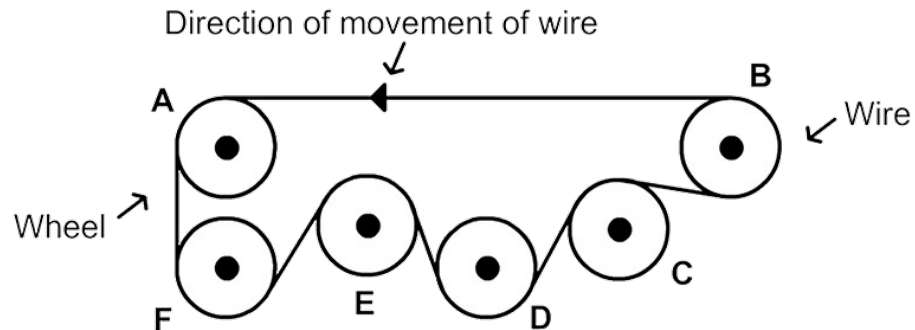
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Question No: 6



Which wheels are turning counter-clockwise?

O

A. A, B, D, F

Wheel A, B, D and F are turning counterclockwise.

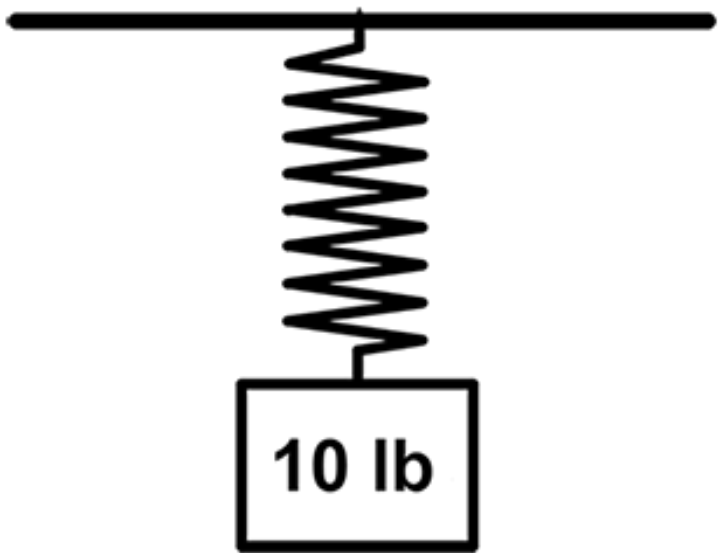
The wheels in contact with the wire will turn depending on which direction around the wheel the wire goes.

Follow the wire as it passes around all the wheels. Try to mentally turn the wheels while following the direction of the wire.

Question No: 7

A spring bearing a 10-pound weight has stretched 0.5 inches.

If you were to increase the weight to 15 pounds, how many inches would the spring stretch?



A. 1.0 inch

B. 1.25 inches

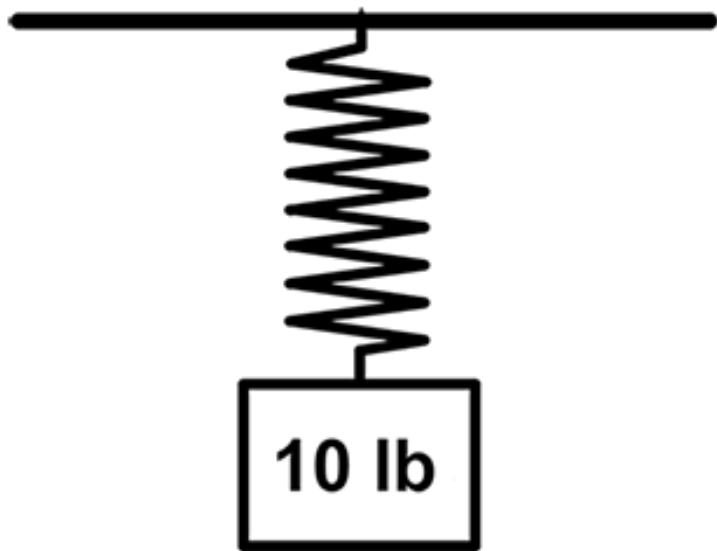
C. 0.75 inch

D. 0.5 inch

Question No: 7

A spring bearing a 10-pound weight has stretched 0.5 inches.

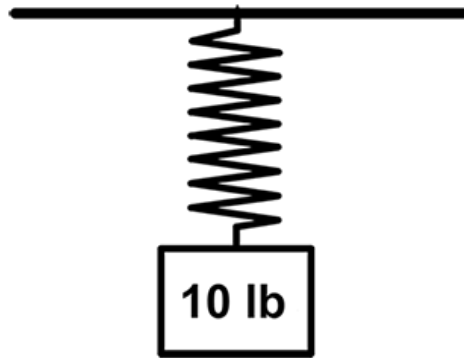
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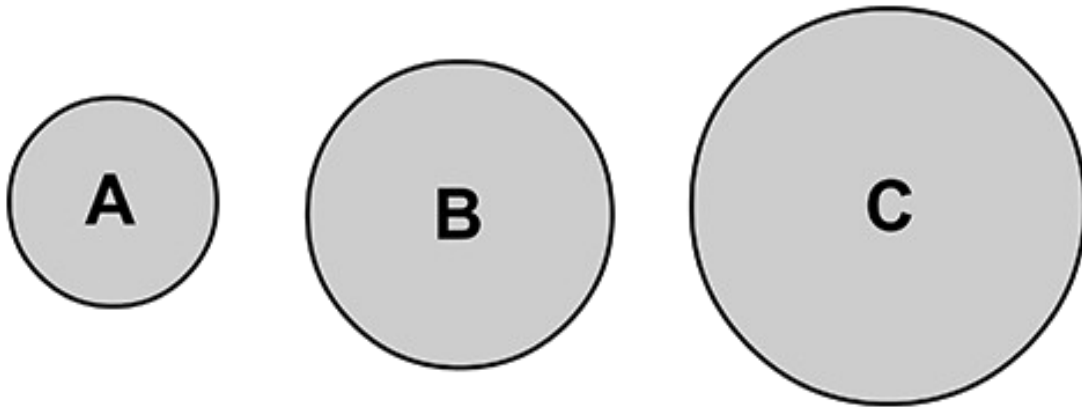


O c. 0.75 inch

We know that the spring stretches 0.5 inches under a pull of 10 pounds. We also know that springs behave linearly. Therefore, adding another 5 pounds, which is half of the 10-pound pull, the spring will stretch another 0.25 inches, which is half the distance it stretched under a pull of 10 pounds. Simply add: $0.5 + 0.25 = 0.75$. So the spring would stretch 0.75 inches.

Question No: 8

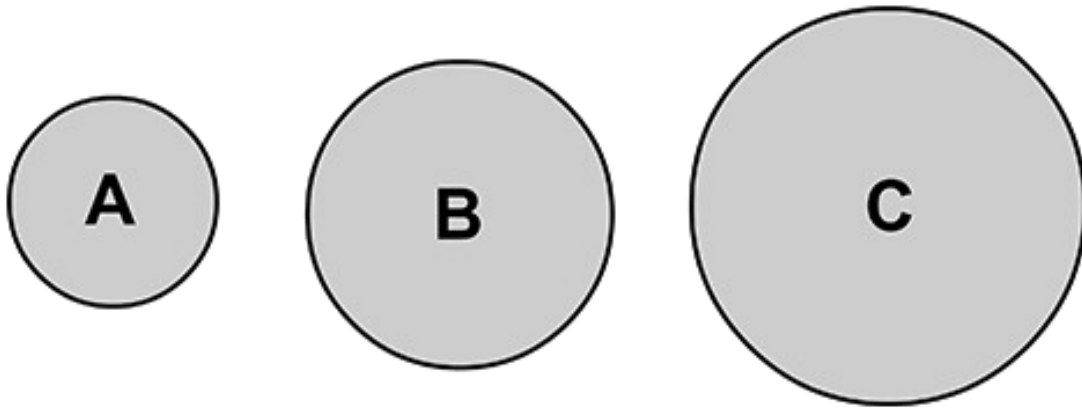
Which ball is the heaviest?



- A. C
- B. A
- C. B
- D. Cannot Say

Question No: 8

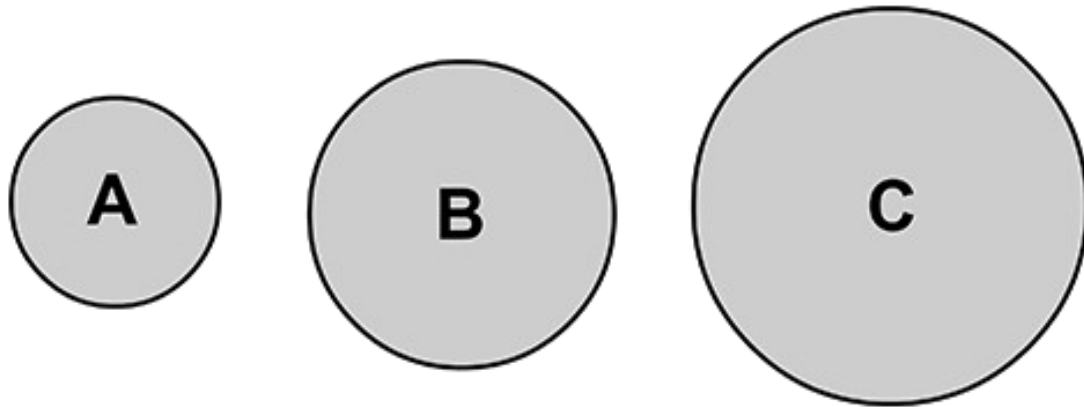
Which ball is the heaviest?



- A. C
- B. A
- C. B
- D. **Cannot Say**

Question No: 8

Which ball is the heaviest?



D. Cannot Say

We have insufficient information to tell which ball is the heaviest. The small ball may be made of metal while the largest ball may be made of rubber.

Question No: 9

Which of these objects will not float in water?

A. Empty soda bottle

(plastic)

B. Banana

C. Scissors

D. Wooden pencil

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Scissors will not float because they are partly made with metal.

Question No: 9

Which of the following might directly affect the rate of acceleration of a vehicle?

- A. Total weight of the vehicle, including occupants and luggage
- B. Power output from the vehicle's engine
- C. Drag coefficient of the vehicle
- D. All of are correct

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A. Total weight of the vehicle, including occupants and

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B. Power output from the vehicle's engine

C. Drag coefficient of the vehicle

D. **All of are correct**

All three things may affect the acceleration of a vehicle.

Question No: 10

The formation of frost on cooling coils in a refrigerator. . .

- A. Increases heat transfer
- B. Improves overall performance
- C. Reduces power consumption
- D. Increases power consumption

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- A. Increases heat transfer
- B. Improves overall performance
- C. Reduces power consumption
- D. **Increases power consumption**

Build up frost on the cooling reduces the heat transfer and thereby increase power consumption.

Question No: 11

What does LED stand for?

- A. Light Emitting Diode
- B. Light Emitting Display
- C. Low Energy Display
- D. Light Emitting Detector

Question No: 11

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- A. Light Emitting Diode**
- B. Light Emitting Display
- C. Low Energy Display
- D. Light Emitting Detector

A light-emitting diode (LED) is a two-lead semiconductor light source.

Question No: 12



- A. **A**
- B. **B**
- C. **C**
- D. Where A and B meet

Where is the temperature change the highest throughout the day?
(If no difference, choose C)

Question No: 12



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(If no difference, choose C)

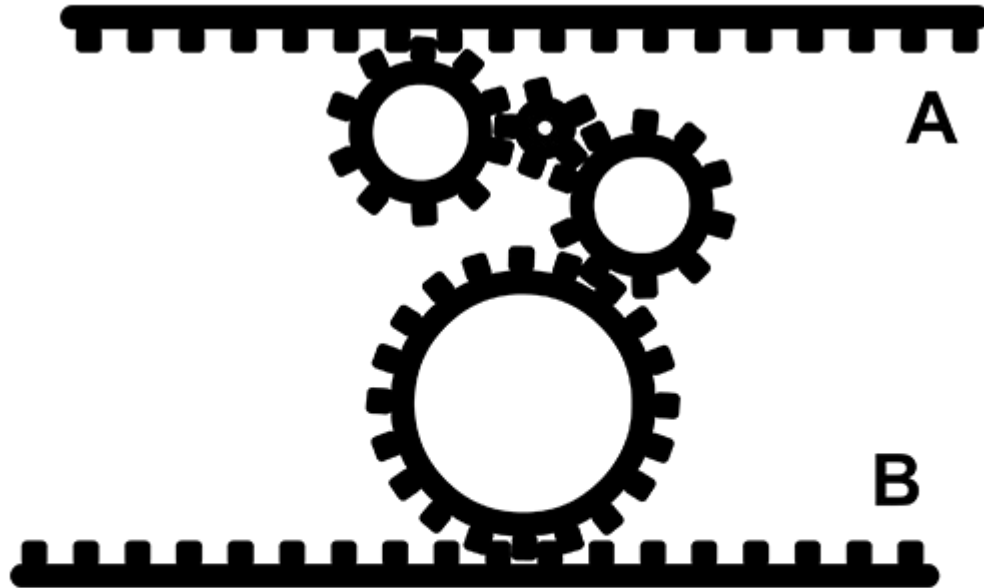
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- A. **A**
- B. **B**
- C. **C**
- D. Where A and B meet

Sand is a better thermal conductor than water, therefore sand is heated much faster. On the other hand, water has a better thermal capacity than sand, therefore water retains the heat for much longer.

This is why a sandy beach can be very hot at noon but cold at night, while the water temperature stays almost the same.

Question No: 13

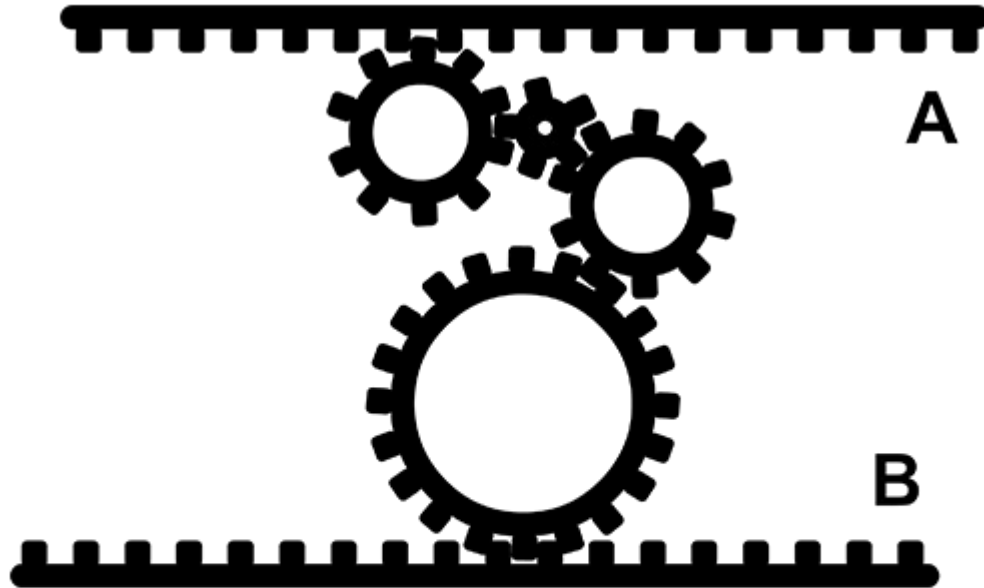


If bar A moves right at a speed of X ,
how does bar B move?

0
0
0
0

- A. Left, slower than X
- B. Right, slower than x
- C. Right, same speed
- D. Left, same speed

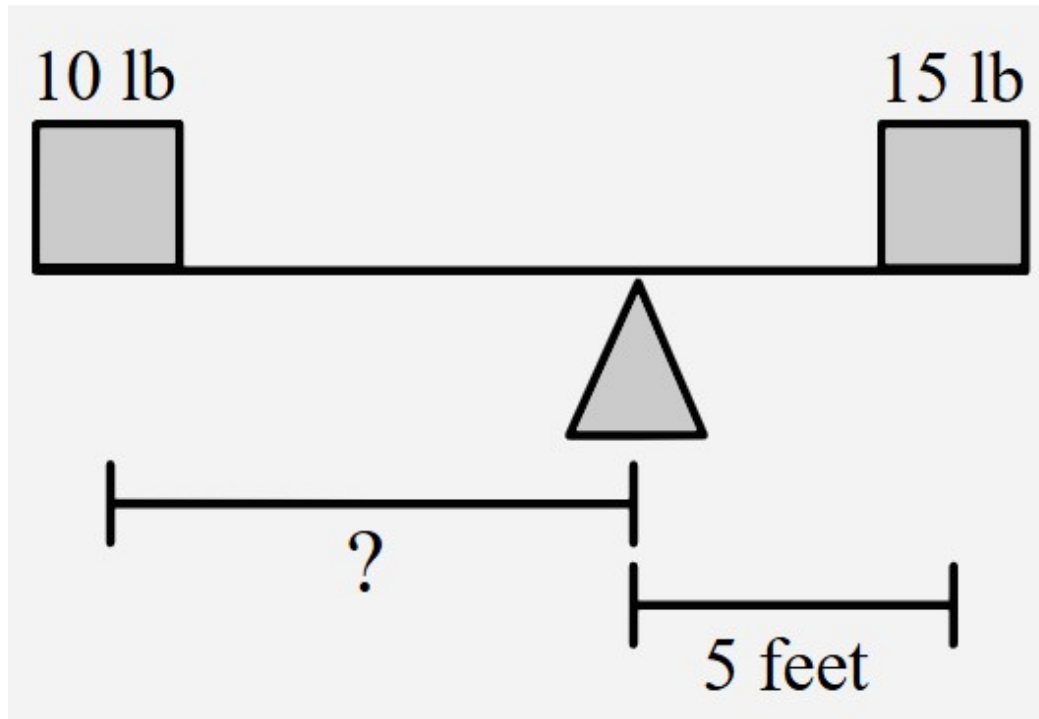
Question No: 13



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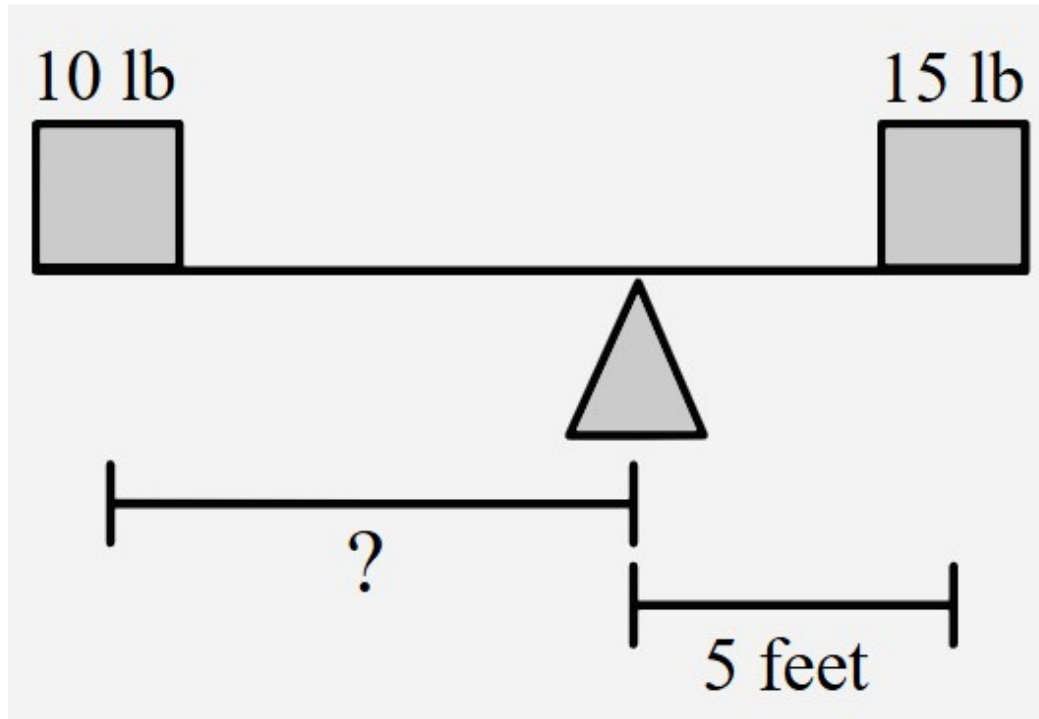
Question No: 14



How far from the fulcrum should the 10 lb. weight be placed on the left side?

- A. 10 feet
- B. 2.5 feet
- C. 12.5 feet
- D. 7.5 feet

Question No: 14



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- C. 12.5 feet
- D. 7.5 feet

Using the Principle of Moment
Moment = Force x Distance

Question No: 15

Which of the following statements is true?

- A. Engine oil lubricates the engine
- B. Engine oil absorbs heat and allows the moving parts of the engine to work properly with one another.
- C. Neither A nor B is correct
- D. Both A and B are correct.

Question No: 15

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- A. Engine oil lubricates the engine
- B. Engine oil absorbs heat and allows the moving parts of the engine to work properly with one another.
- C. Neither A nor B is correct
- D. **Both A and B are correct.**

The main purpose of engine oil is to lubricate, protect, clean and cool the engine.

Question No: 16

What is the principle behind the operation of a microwave oven?

- A. It uses convection currents generated by heating the air inside the oven.
- B. It uses infrared radiation to increase the temperature of food.
- C. It uses microwaves to cause water molecules in food to vibrate, producing heat.
- D. It uses ultraviolet radiation to sterilize and cook the food simultaneously

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Question No: 16

What is the principle behind the operation of a microwave oven?

O C. It uses microwaves to cause water molecules in food to vibrate, producing heat.

The principle behind the operation of a microwave oven is the use of microwaves to cause water molecules in the food to vibrate, which produces heat and cooks the food. Microwaves are a form of electromagnetic radiation, and when they penetrate the food, they cause the water molecules to move rapidly. This movement generates thermal energy (heat), which cooks the food from the inside out.

Question No: 17



This symbol indicates:

- A. Danger of pollution
- B. Enter this area at your own risk
- C. That this is a conservation area
- D. Danger of radio activity

Question No: 17



This symbol indicates:

- A. Danger of pollution
- B. Enter this area at your own risk
- C. That this is a conservation area
- D. **Danger of radio activity**

Question No: 18

What is the concept of the object of a rotation?

- A. Will draw towards the center of rotation
- B. Is the center of rotation
- C. Will draw away from the center of rotation
- D. All the answers above can be true depending on the situation.

Question No: 18

What is the concept of the object of a rotation?

- A. Will draw towards the center of rotation
- B. Is the center of rotation
- C. **Will draw away from the center of rotation**
- D. All the answers above can be true depending on the situation.

In rotation, the object of the rotation will draw away from the center. This is described as the centrifugal force. For instance, when a washing machine centrifuges, the clothes are pushed to the sides

Question No: 19

How is the size of a **TV** measured?

- A. Diagonal
- B. Vertical
- C. In square inches
- D. Horizontal

Question No: 19

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- A. Diagonal**
- B. Vertical
- C. In square inches
- D. Horizontal

Tv's are measured diagonally in inches

Question No: 20

Connecting a lead from the negative to the positive of a battery will produce:

- A. An open circuit
- B. A high-resistance circuit
- C. A low-current path
- D. A short circuit

Question No: 20

Connecting a lead from the negative to the positive of a battery will produce:

OD. A short circuit

A short circuit is an electrical circuit that allows a current to travel along an unintended path, often where essentially no (or a very low) electrical impedance is encountered, which is the case in this question. The electrical opposite of a short circuit is an “open circuit”, which is an infinite resistance between two nodes. It is common to misuse “short circuit” to describe any electrical malfunction, regardless of the actual problem

Question No: 21

The function of a fuse is to::

- A. Reduce the use of electricity in any device
- B. Produce electricity by wind power
- C. Provide overcurrent protection
- D. None of the above.

Question No: 21

The function of a fuse is to::

O C. Provide overcurrent protection

A fuse is a safety device to prevent excess current flowing in an electric circuit. It consist of a thin metal wire of low resistance and low melting point. When an electrical appliance or some other piece of electrical equipment becomes faulty, therefore allowing an excess electrical current to flow through its circuit, this causes the wire inside the fuse to melt and thus break the flow of current.

