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Test Prep

Student's Guide

Revised May 2019

CONSTRUCTION AND SKILLED TRADES SELECTION SYSTEM – REVISED

Test Brochure

Construction and Skilled Trades Selection System – Revised (CAST-R)

CAST-R is a battery of aptitude and behavioral tests designed and validated to aid in the selection of candidates across a wide variety of construction and skilled trades occupations. CAST-R is the culmination of extensive research sponsored by the Edison Electric Institute (EEI), including a large-scale consortium project involving 34 investor-owned electric companies and thousands of employees and supervisors. This research resulted in a comprehensive battery of tests designed to predict candidates' probability of success in the following categories of construction and skilled trade jobs:

1. Transmission and Distribution
2. Facilities and Repair
3. Other Facilities (e.g., Equipment Operator)
4. Electrical Repair
5. Machining and Vehicle Repair
6. Meter Service and Repair

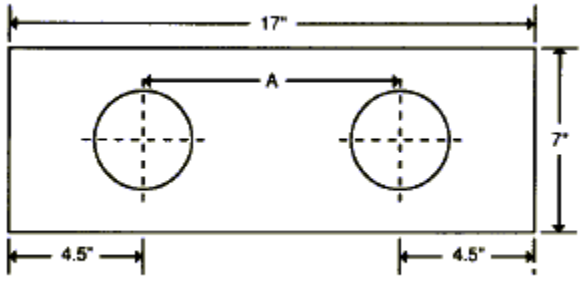
CAST-R can be administered in approximately two hours. The tests comprising the CAST-R battery include Graphic Arithmetic, Mechanical Concepts, Reading for Comprehension, and the Work Preferences Inventory.

A description of the aptitude and behavioral tests comprising the CAST-R battery is provided below:

Graphic Arithmetic. This test measures a candidate's ability to solve arithmetic problems by using information from prints or drawings. The test contains two drawings, each followed by several questions. The test has 16 questions and a 30-minute time limit. The use of a calculator is permitted during this test.

Examples of the **Graphic Arithmetic** test are:

Use the drawing below to answer the two example questions. (Please note that the dimensions shown on the drawing are not necessarily drawn exactly to scale.) Mark your answers to the questions in the "Examples" box on your answer sheet.



1) What is the distance "A" between the centers of the two holes?

a) 6.0 "

b) 7.0 "

c) 8.0 "

d) 12.5 "

e) N

2) What was the surface area of the side shown in the drawing before the holes were drilled?

a) 24.0 square inches

b) 79.0 square inches

c) 84.0 square inches

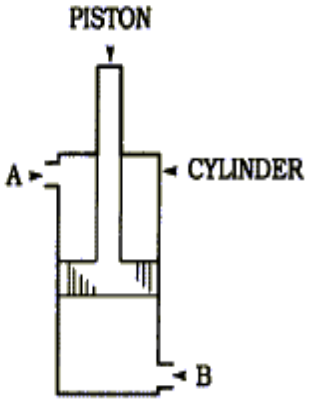
d) 109.0 square inches

e) N

Mechanical Concepts. This test measures the ability to understand mechanical principles. There are 44 multiple-choice items. Each item contains a pictorial description of a mechanical situation, a question, and three possible answers. This test has a 20-minute time limit.

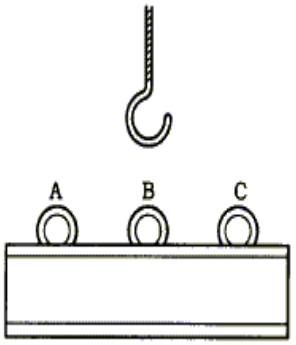
Examples of the **Mechanical Concepts Test** are:

1) In the figure below, at which point should pressurized air enter the cylinder to lower the piston? (If both, mark C.)



● **A**
○ **B**
○ **C** (Both A & B)

2) To keep the beam horizontal when lifted, at which point should you hook the cable?



○ **A**
● **B**
○ **C**

Reading for Comprehension. This test measures a candidate's ability to read and understand written materials. The test consists of four reading passages, each followed by several multiple-choice questions about the passage. There are 32 items and a 30-minute time limit on this test.

Work Preferences Inventory. The Work Preferences Inventory assesses an individual's preferred work style, behavior, and environment by assessing the extent to which they agree with various statements. The test has 105 multiple-choice items and a 30-minute time limit.

Examples of the types of items on the **Work Preferences Inventory** are:

1) **I can focus on several work tasks at the same time.**

   Strongly Agree
   Agree
   Neither Agree Nor Disagree
   Disagree
   Strongly Disagree

2) **I would prefer a job that does not involve a lot of customer interaction.**

   Strongly Agree
   Agree
   Neither Agree Nor Disagree
   Disagree
   Strongly Disagree

Scoring

The CAST-R test components are scored based on the number of questions a person answers successfully. There is no penalty for guessing or wrong answers. The component scores are then combined into an index score ranging in value from 1 to 10. The index score provides a prediction of overall effectiveness in a wide variety of construction and skilled trades occupations and is used to determine the probability of success or failure in these occupations. As such, it can differentiate between potentially effective candidates and those individuals less likely to succeed.

Test Prep Table of Contents

Student's Guide

Federal regulations mandate that employment tests must be job-related. Edison Electric Institutes' (EEI) employment test batteries are designed and validated for specific energy industry job
families, including power plant operators, maintenance and craft positions, power dispatching positions, customer service.

These tests are standardized and your success on the chosen test is important.

This course was designed to help you achieve your career goals by preparing you for the pre-employment test required to enter this rewarding career field.

The following are the tests that are covered by this course.

Construction and Skilled Trades (CAST):

Used to help select employees for a wide variety of construction and skilled trade occupations. CAST is used for jobs in three general areas: transmission and distribution; facilities and equipment; and meter reader service and repair.

Test		CAST
Mechanical Concepts		X
Reading for Comprehension		X
Graphic Arithmetic		X

Testing Topic: Understanding Mechanical Concepts

How to Solve Problems	The questions are based on a picture. The picture has all the information needed to choose the correct answer.

FORCE

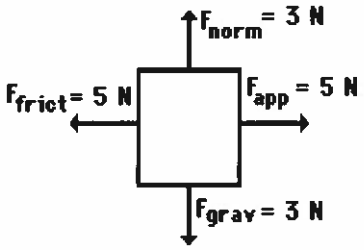
A FORCE can be defined as "A push or a pull on an object." The FORCE (push or pull) may result from a contact between two objects, or from an influence in which no contact takes place, such as magnetism or gravitation.

A FORCE can cause a change in motion of the object. If the object is not acted upon by other pushes and / or pulls which combine to form an equal and opposite counteracting action, then the FORCE will change the motion of the object to which it is applied.

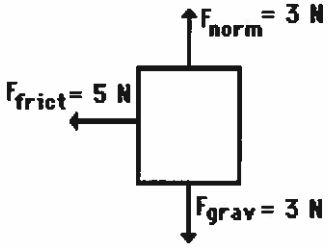
FORCE is a vector quantity, meaning that it has both magnitude and direction. FORCEs are sometimes described in terms of magnitude only, and in many of those cases, the direction is self-evident.

Sir Isaac Newton, the 17th-century English mathematician, formulated a series of observations about the basic behavior of forces on objects. Those observations have become known as "Newton's Laws of Motion."

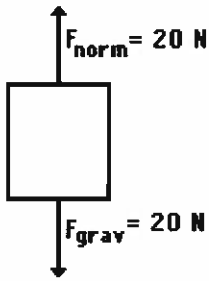
Situation A



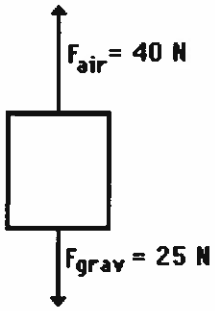
Situation B



Situation C



Situation D



First Law

An object at rest stays at rest and an object in motion stays in motion with the same speed and in the same direction unless acted upon by an unbalanced force.

Example:
Have you ever experienced the first law of motion in an automobile while it is braking to a stop?

The force of the road on the locked wheels provides the unbalanced force to change the car's state of motion.

But there is no unbalanced force to change your own state of motion so you keep sliding forward at the same speed.

Until what happens: you are acted upon by the unbalanced force of a seat belt.

Second Law

The change in motion of an object is proportional to the net magnitude of the combination of the applied forces, and takes place along the straight line in which the combination of the applied forces acts.

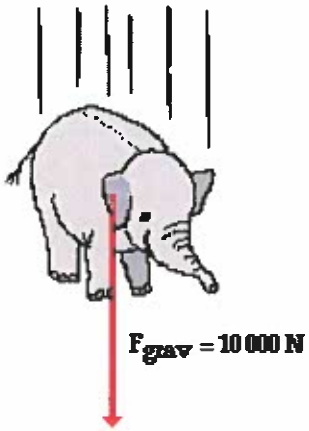
Free Fall Motion

Objects that are said to be undergoing free fall, are not encountering a significant force of air resistance; they are falling under the sole influence of gravity.

Under such conditions, all objects will fall with the same rate of acceleration, regardless of their mass.

WHY Consider the free-falling motion of a 1,000-kg baby elephant and a 1-kg overgrown mouse.

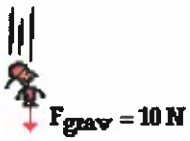
$m = 1000\ kg$



$$a = \frac{F_{net}}{m} = \frac{10\,000\ N}{1000\ kg}$$

$a = 10\ m/s/s$

$m = 1\ kg$



$$a = \frac{F_{net}}{m} = \frac{10\ N}{1\ kg}$$

$a = 10\ m/s/s$

Third Law

For every action, there is an equal and opposite reaction. In other words, when two objects exert forces on each other, the forces are equal in magnitude, opposite in direction, and collinear.

WORK

Suppose the engine of your car stalled while you were in line to exit from a flat, level parking lot. You try several times to restart it, but it just won't start.

Since you are a considerate person, you decide to push your car out of the way of the people behind you. You get out and go round back and begin to push on the car.

Suppose also that you are a fairly strong person, so you exert a horizontal force of 100 pounds on the rear of the car. The car doesn't move. But you are also a persistent person, so you continue to push on the car for two whole minutes, exerting the same 100 pounds of force. The car still won't move. Although you will probably be quite tired, you will have done NO WORK.

WHY? Because WORK is defined as a FORCE operating through a DISTANCE. The car didn't move, so although there was FORCE, there was no MOTION.

Now you get smart and release the parking brake, and, having recovered from your previous 2-minute exercise in futility, you again push the car with the same constant 100- pound force. This time the car moves, and you push it for another two minutes. It travels 165 feet during those two minutes of effort.

In that case, you will have produced 16,500 foot-pounds of WORK (100 pounds of force x 165 feet of distance = 16,500 foot-pounds).

FRICTION

FRICTION is an especially interesting example of a force. It is the resistance to motion which takes place when one body is moved upon another.

PRESSURE

A PRESSURE is the result of a FORCE being applied to a specific cross-sectional area, and is defined as FORCE per unit AREA, as in POUNDS per SQUARE INCH.

For example, if a downward FORCE of 1000 pounds is applied evenly to a square plate of steel which measures 2" by 2" (4 square inches of area), then the PRESSURE applied to that block (Force per unit AREA) is determined by dividing the FORCE (1000 pounds) by the AREA (4 square inches), which is 250 pounds per square inch *("psi")*.

If the **same** 1,000-pound FORCE was applied to a plate which measured 2" x 4" (8 square inches), then the PRESSURE would be reduced to 125 psi because the area of the plate doubled. The same force is being applied over a greater area, resulting in a LOWER force per unit area.

Taking it a step further, suppose you have a hydraulic cylinder with a 1/2" diameter piston. The area of that piston = diameter x diameter x 0.785, or in this case, 0.5 x 0.5 x 0.785 = 0.196 square inches.

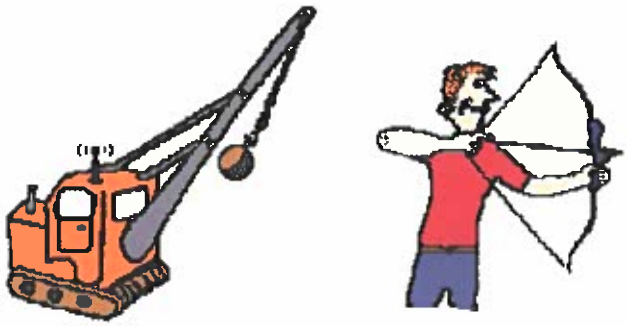
Now, if you apply 1,000 pounds to the rod of that cylinder, the 1,000-pound FORCE is applied by the rod to the piston, which acts against the oil in the cylinder to produce a pressure in the oil of 5102 (1000 / 0.196 = 5102) psi.

If that oil is routed through some tubing to another hydraulic cylinder which has a 2.5 inch diameter piston, then the 5,102 psi will be applied to the 4.91 square inch piston (2.5 x.2.5 x .785 = 4.91) and results in a 25, 050 pound force being available at the end of the rod on that cylinder.

Potential Energy

An object can store energy as the result of its position. For example, the heavy ball of a demolition machine is storing energy when it is held at an elevated position. This stored energy of position is referred to as potential energy.

Similarly, a drawn bow is able to store energy as the result of its position. When assuming its usual position (i.e., when not drawn), there is no energy stored in the bow. Yet when its position is altered from its usual equilibrium position, the bow is able to store energy by virtue of its position.

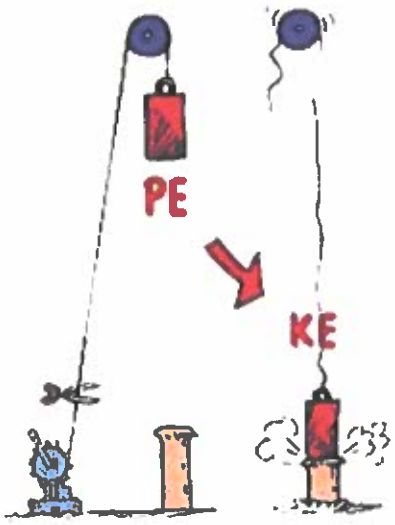


The massive ball of a demolition machine and the stretched bow possesses stored energy of position - potential energy.

Kinetic Energy

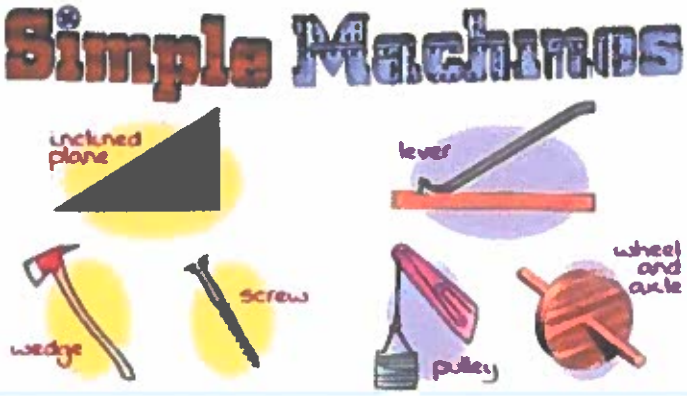
An object that has motion - whether it is vertical or horizontal motion - has kinetic energy.

The amount of kinetic energy that an object has depends upon two variables: the mass (m) of the object and the speed (v) of the object.



SIMPLE MACHINES

This topic discusses how to make work easier through use of simple machines.



Inclined Plane

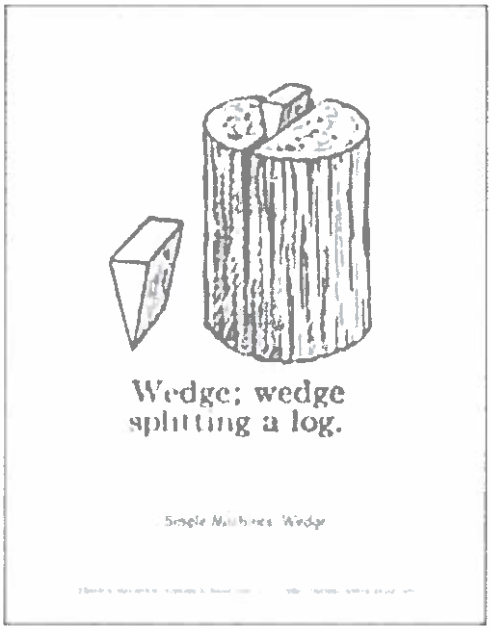
A plane is a flat surface. For example, a smooth board is a plane. Now, if the plane is lying flat on the ground, it isn't likely to help you do work. However, when that plane is inclined, or slanted, it can help you move objects across distances. And, that's work! A common inclined plane is a ramp. Rolling a wheel barrel onto a loading dock is much easier if you slide the wheel barrel up a ramp--a simple machine.

Man pushing a wheelbarrow up an inclined plank

Simple Machines: Inclined Plane

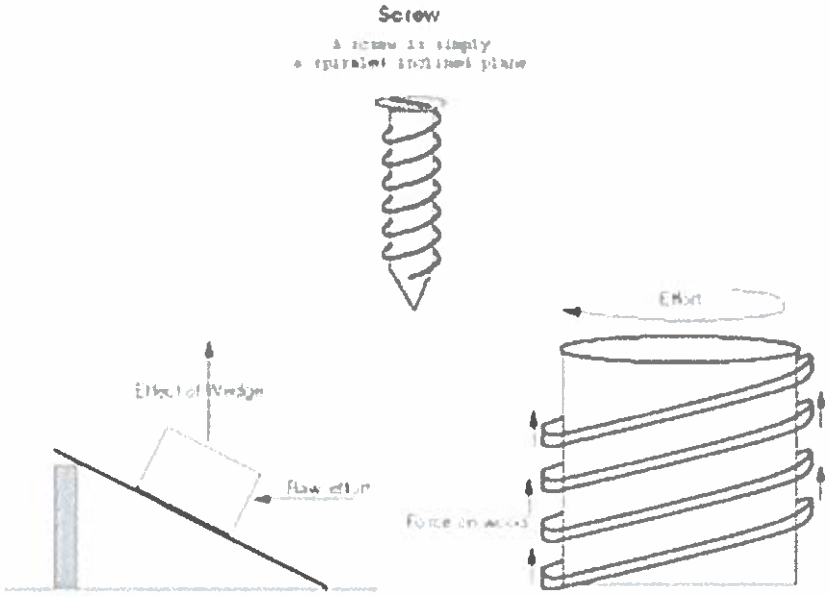
Wedge

Instead of using the smooth side of the inclined plane, you can also use the pointed edges to do other kinds of work. For example, you can use the edge to push things apart. Then, the inclined plane is a wedge. So, a wedge is actually a kind of inclined plane. An axeblade is a wedge. Think of the edge of the blade. It's the edge of a smooth slanted surface. That's a wedge!



Screw

Now, take an inclined plane and wrap it around a cylinder. Its sharp edge becomes another simple tool: the screw. Put a metal screw beside a ramp and it's kind of hard to see the similarities, but the screw is actually just another kind of inclined plane. Try this demonstration to help you visualize. How does the screw help you do work? Every turn of a metal screw helps you move a piece of metal through a wooden space. And, that's how we build things!

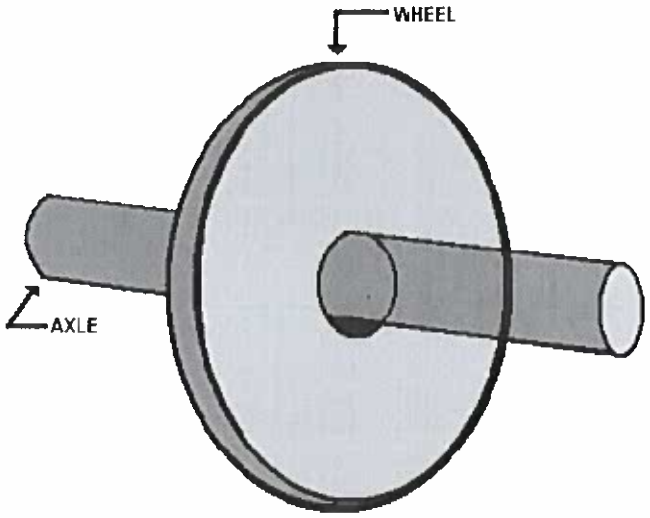


Wheel and Axle

The rotation of the lever against a point pries objects loose. That rotation motion can also do other kinds of work.

Another kind of lever, the wheel and axle, moves objects across distances. The wheel (the round end) turns the axle (the cylindrical post) causing movement.

On a wagon, for example, the bucket rests on top of the axle. As the wheel rotates the axle, the wagon moves. Now, place your pet dog in the bucket, and you can easily move him around the yard. On a truck, for example, the cargo hold rests on top of several axles. As the wheels rotate the axles, the truck moves.



Pulley

Instead of an axle, the wheel could also rotate a rope or cord.

This variation of the wheel and axle is the pulley. In a pulley, a cord wraps around a wheel. As the wheel rotates, the cord moves in either direction.

Now, attach a hook to the cord, and you can use the wheel's rotation to raise and lower objects.

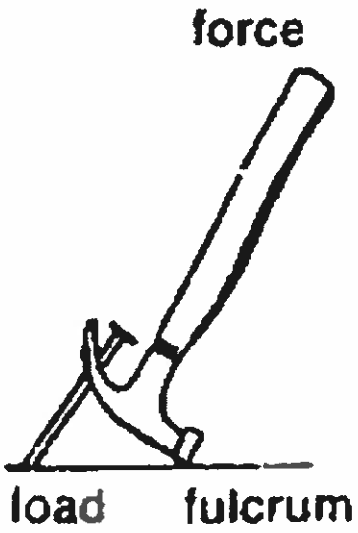
On a flagpole, for example, a rope is attached to a pulley. On the rope, there are usually two hooks. The cord rotates around the pulley and lowers the hooks where you can attach the flag. Then, rotate the cord and the flag raises high on the pole.

Lever

Any tool that pries something loose is a lever.

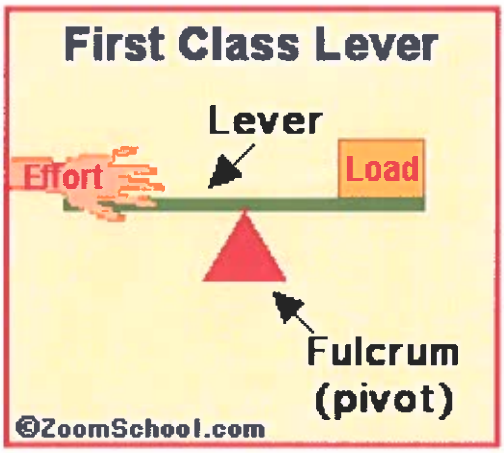
A lever is an arm that "pivots" (or turns) against a "fulcrum" (or point).

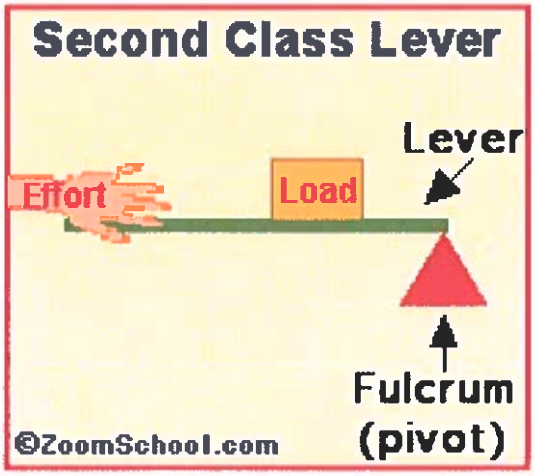
Think of the claw end of a hammer that you use to pry nails loose. It's a lever. It's a curved arm that rests against a point on a surface. As you rotate the curved arm, it pries the nail loose from the surface.



The lever is the most common kind of simple machine.

There are 3 classes of levers. The type of lever is determined by the relationship of the load the fulcrum and the effort.


First Class Lever
Lever
Effort
Load
Fulcrum
(pivot)
©ZoomSchool.com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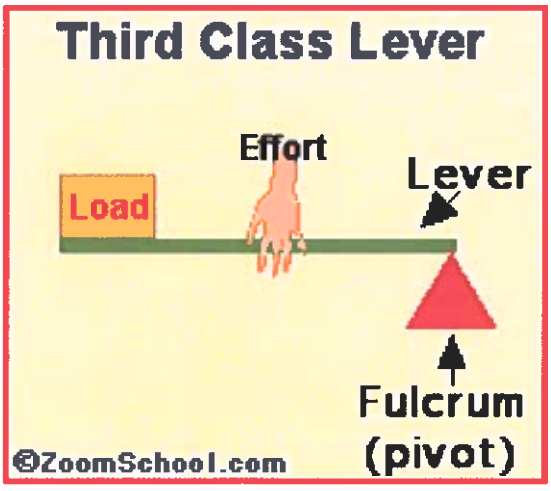
Third Class Lever
Effort
Lever
Load
Fulcrum
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Mechanical Advantage

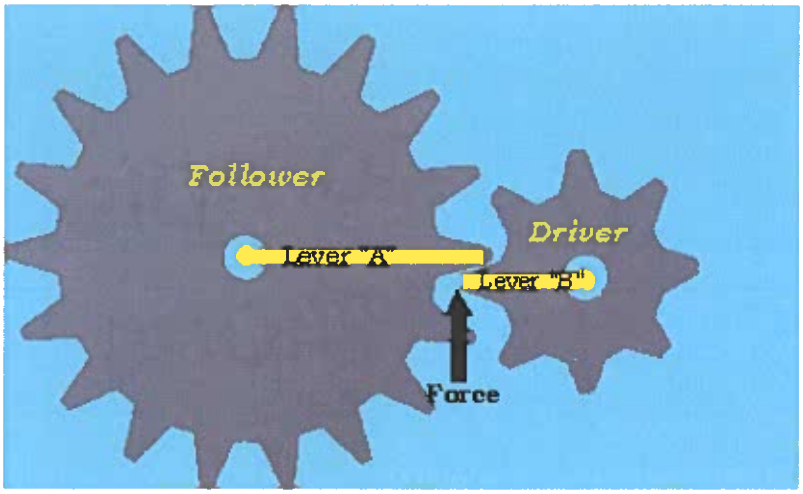
The specific amount of benefit gained through the use of a machine is called the mechanical advantage.

GEARS

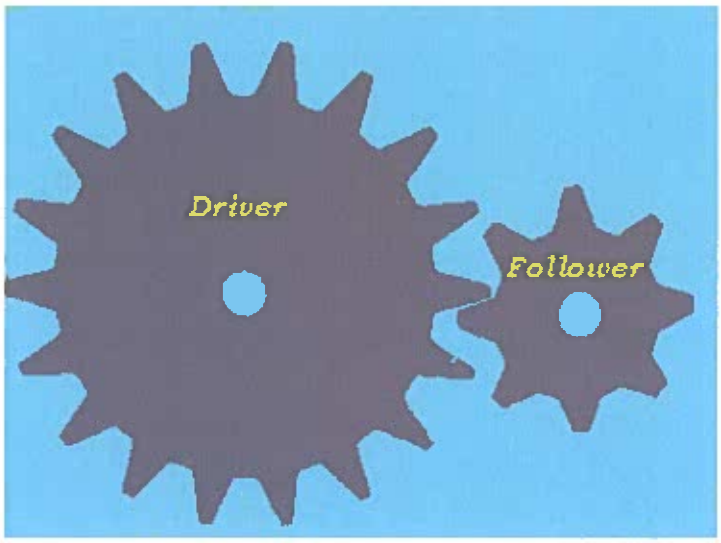
When two gears are meshed, they act in a similar fashion to levers.

Each gear tooth can be regarded as the end of a lever with the fulcrum placed at the center of the gear.

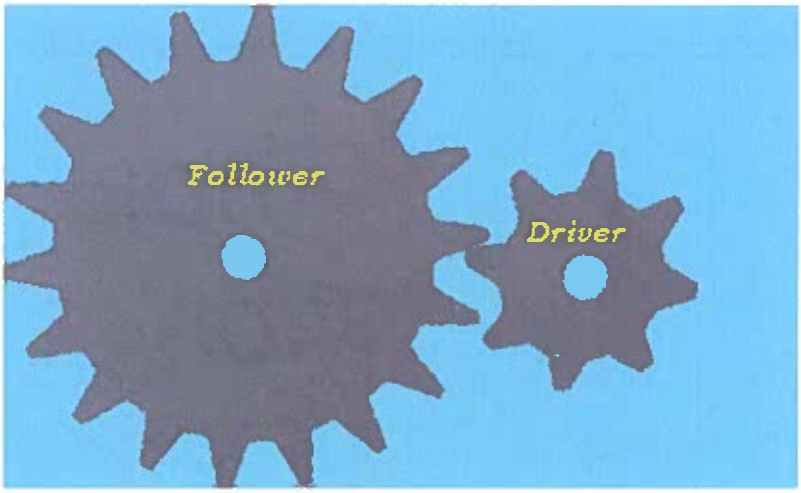
The longer lever "A" is, the greater the force that is applied to the shaft of the follower.



The gear train has a gear ratio of 8/18. If a force of 180N was applied to the driver the follower would exert a force of (8/18) X 180 = 80N.



The gear train has a gear ratio of 18/8. If a force of 180N was applied to the driver the follower would exert a force of (18/8) X 180 = 405N.



PRACTICE TEST #1

FOR

MECHANICAL CONCEPTS

PRACTICE FOR MECHANICAL CONCEPTS

Mechanical concepts are seen in everyday life, can be quite simple, and yet are actually founded on the principles of physics, material properties, and basic electrical properties. This test gages your ability to draw appropriate conclusions regarding mechanical principles.

To help you prepare, a practice test follows with 26 different scenarios. Each scenario gives you a picture to illustrate a particular situation. For each situation, there will be one correct answer out of the three possible answers shown. This practice test helps you to practice determining the appropriate outcome for each situation, and within a suggested time limit.

The questions you answer will be multiple-choice, A, B or C. The correct answer depends upon your accurate determination of the outcome posed by the situation. Carefully consider each situational problem for the outcome that will occur. Select the appropriate answer on the answer sheet by completely filling in the circle of your choice of A, B, or C.

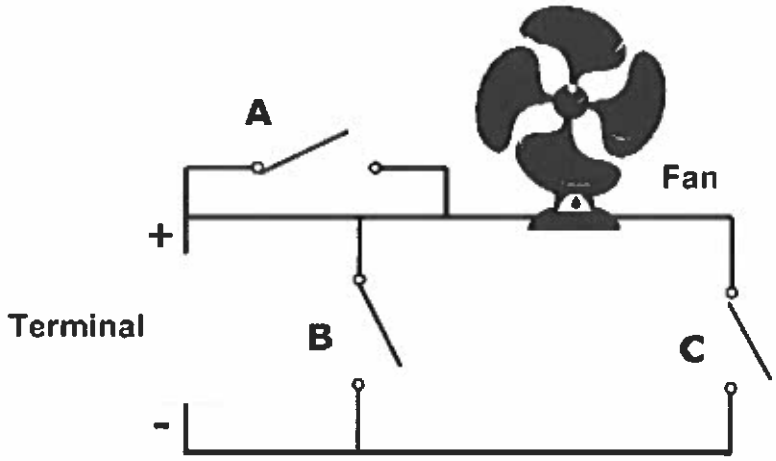
Practicing by taking this test will familiarize you with the style of the real selection test.

MECHANICAL CONCEPTS PRACTICE TEST

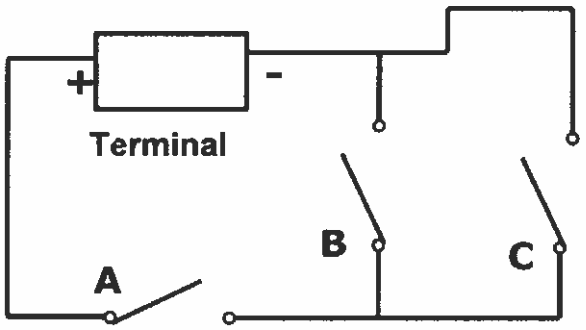
1. If the vehicle's brakes fail simultaneously, which vehicle will hit the brick wall with greater force? (If equal, mark C.)

A B

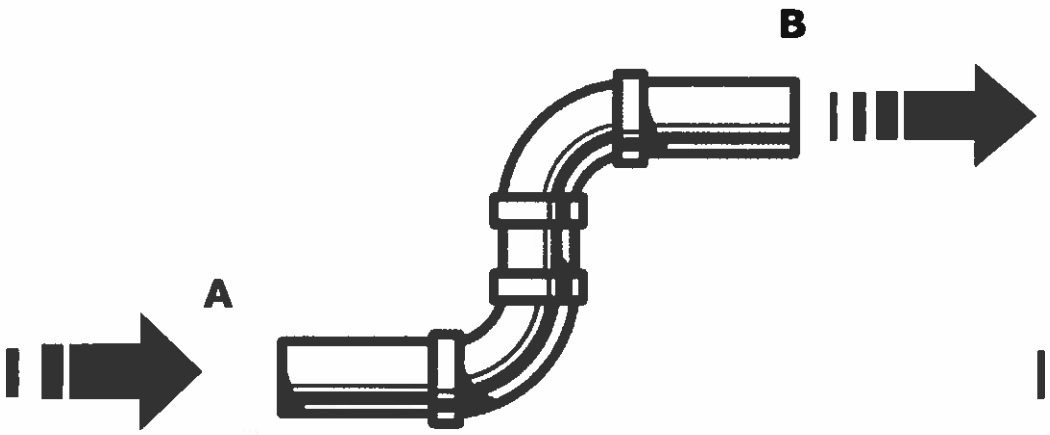
2. Which switch (A, B, or C) should be closed for the fan to operate?



3. Which of the three switches (A, B, or C), if broken and cannot be closed, will prevent the flow of electricity in the terminal?



4. Water enters the pipe at A and exits the pipe at B. At which location is the water moving at greater velocity? (If equal, mark C.)

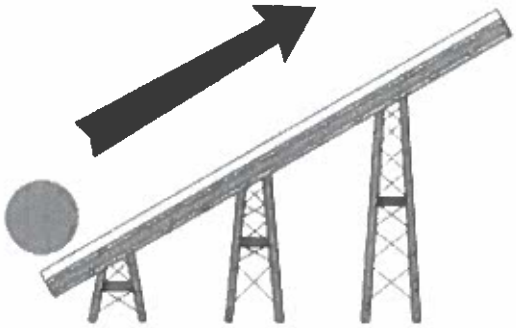


5. Two trucks of equal length carry equal weight loads. The load on Truck B is three feet higher than the load on Truck A. Which truck will require a greater turning radius to ensure it does not tip over during the turn? (If equal, mark C.)

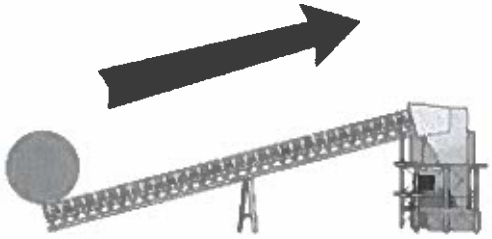
A

B

6. Each conveyor belt moves the same load from bottom to top for a total distance of 50 feet. If each conveyor begins at the same time and its load arrives at the top at the same time, then which conveyor belt requires the bigger motor? (If equal, mark C.)

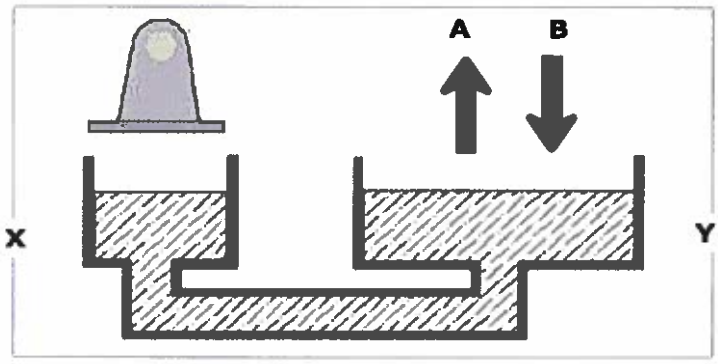


A

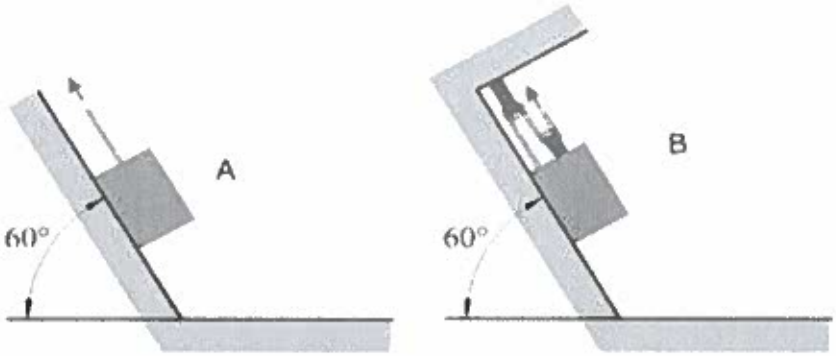


B

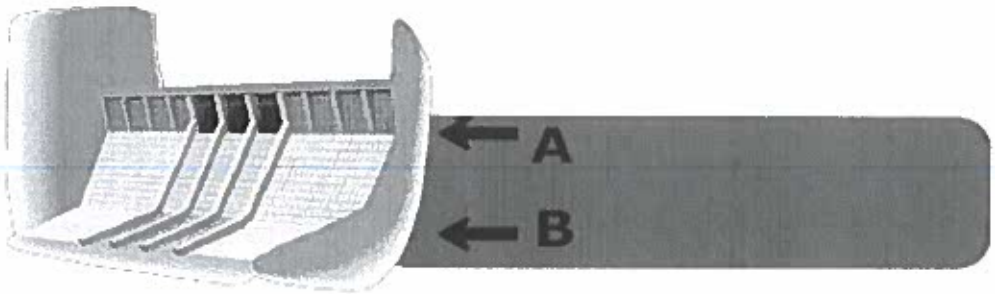
7. As the weight compresses on the surface of the fluid on the left (at X), will the level of the fluid in the right tank (Y) move up (A) or down (B) or stay constant level (C)?



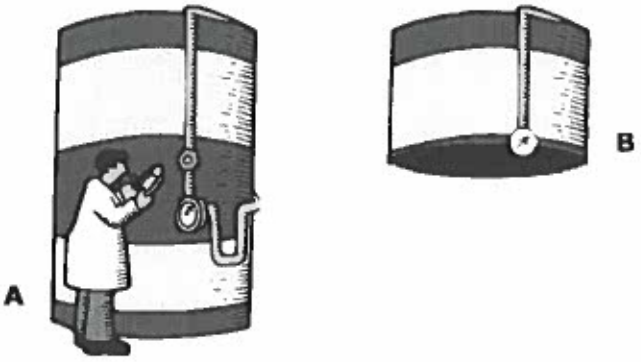
8. Which 25-pound load (A or B) has the greatest force applied to the rope to keep the load in its current position? (If equal, mark C.)



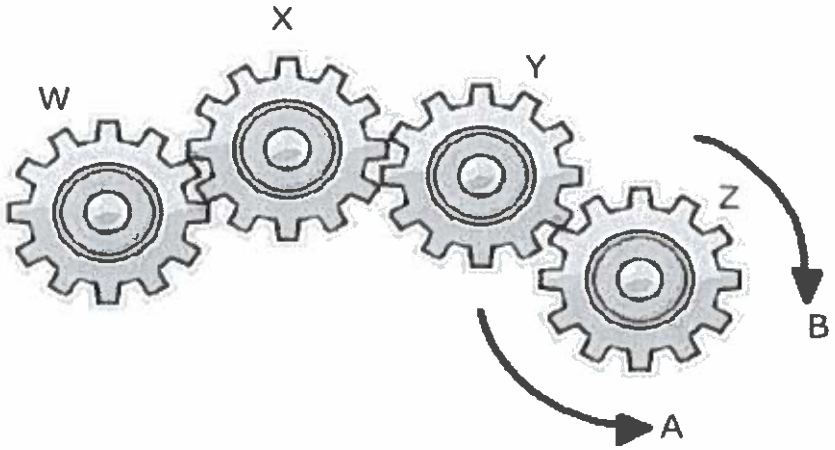
9. In the picture of the dam shown below, will the force of the water on the dam be greater at A or B? (If equal, mark C.)



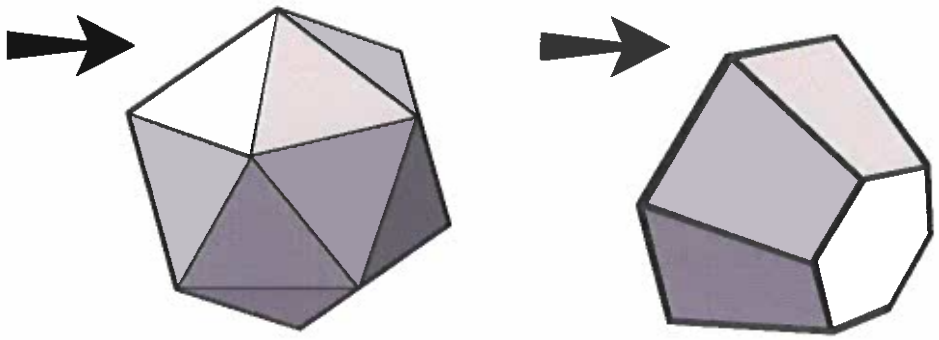
10. Both tanks contain the same gas that is under pressure. Tank A has approximately twice the volume of Tank B. If both tanks show the same pressure reading, which tank contains a greater quantity of the gas?



11. When the gear W moves clockwise, will gear Z move in direction A or B? (If no movement, mark C.)

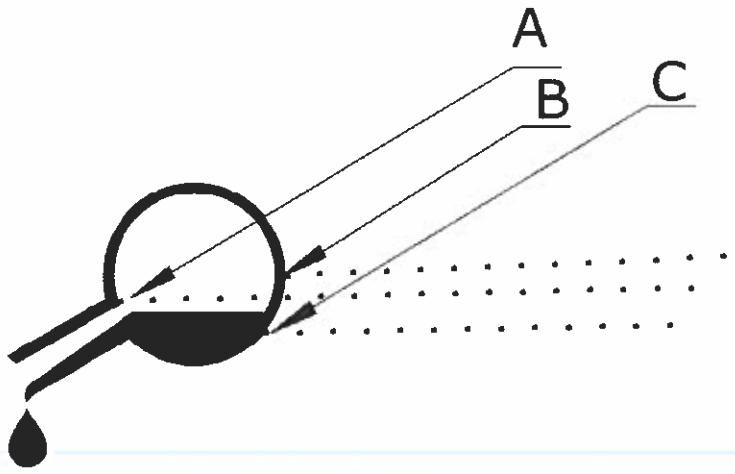


12. Object A and Object B are both given a push measuring the same force. Which object is more likely to travel further (A or B) along a flat surface? (If equal, mark C)

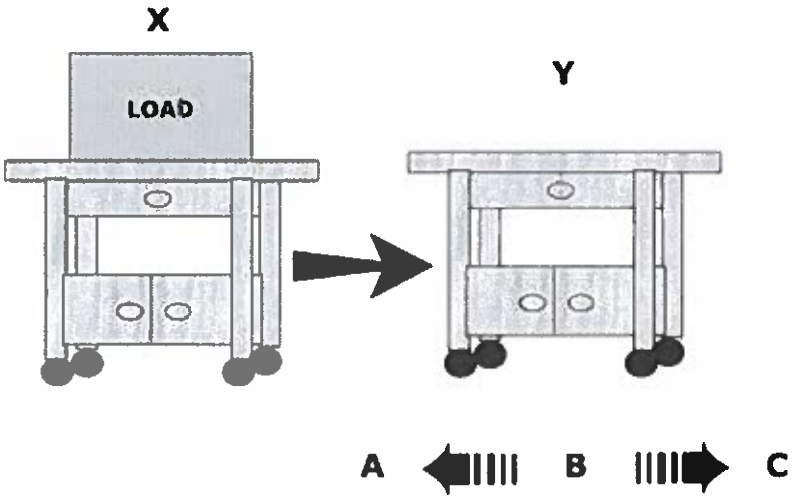


A B

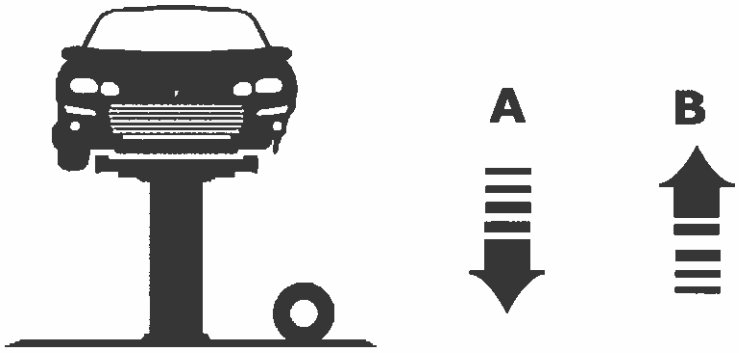
13. The beaker shown below has fallen on its side. At what point, (A, B, or C) will the liquid no longer drain out of the spout?



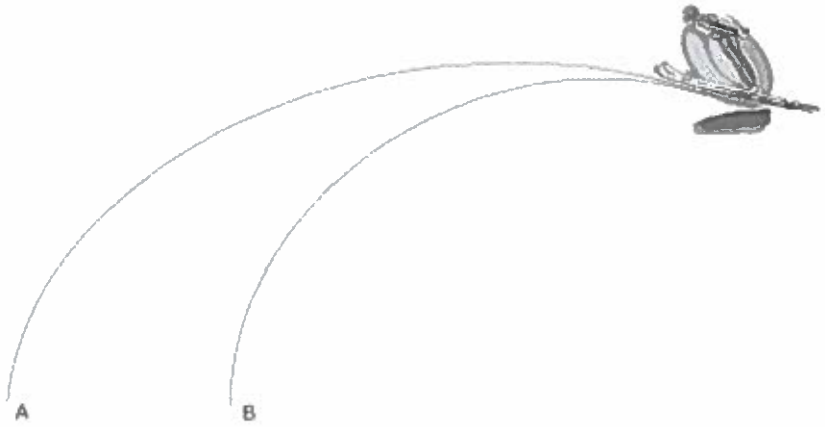
14. The carts X and Y have the same mass. When a load is placed upon cart X and it is then pushed into cart Y, will cart Y travel leftward (A), nowhere (B), or rightward (C)?



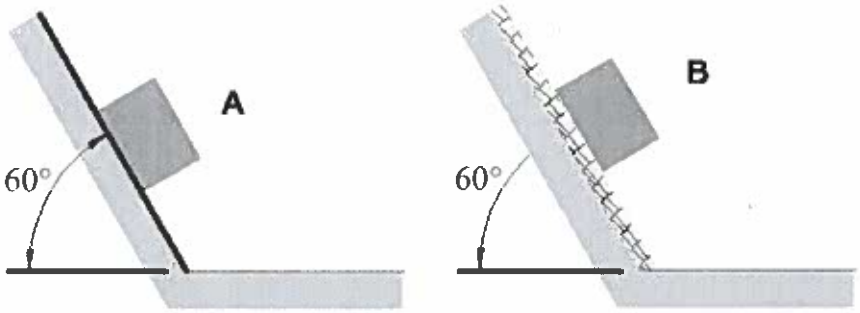
15. A hydraulic lift is used to raise the car to change its tire. If the hydraulic pressure in the lift begins to lower, will the lift move in direction A or B? (If equal, mark C.)



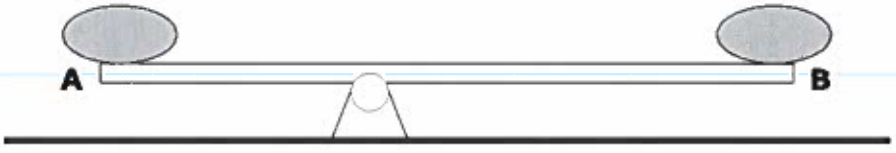
16. When the skier increases his speed at the jump off point, will he more likely increase his overall jump distance (A) or decrease his overall jump distance (B)? (If equal, mark C.)



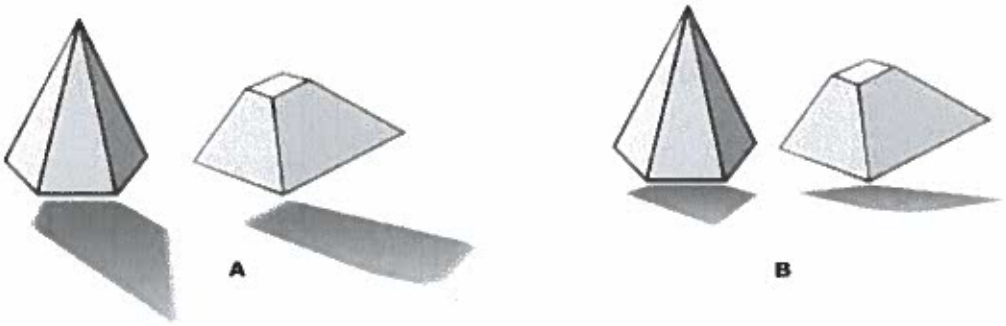
17. Box A and Box B have the same mass. Both are placed upon an incline of 60 degrees and released at the same time. The surface beneath Box A is glass. The surface beneath Box B is cobblestone. Will Box A or B reach the bottom first? (If equal, mark C.)



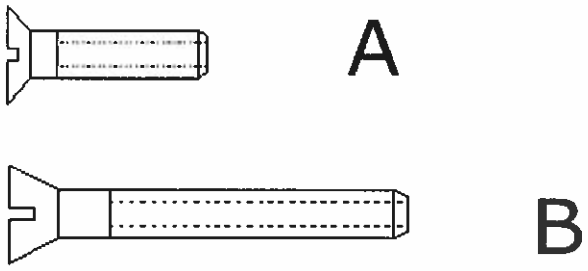
18. The mass applied at point A is equal to the mass applied at point B. Which side, (A or B) will move lower? (If equal, mark C.)



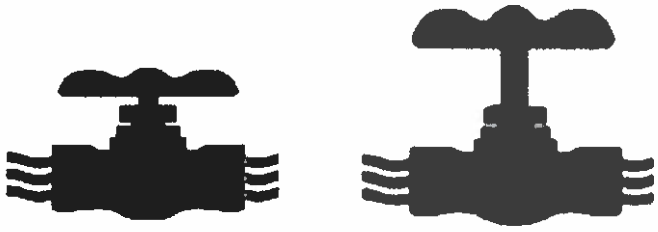
19. It is mid-day and sunny. Which picture shows a more likely representation (A or B)? (If equal, mark C.)



20. The screws shown below are equal diameter and each has the same distance between its threads. Which screw, (A or B) will require more work to embed? (If equal, mark C.)



21. Will more water ow through valve A or B? Both compression valves are the same size and connected to water lines with the same size and water pressure. (If equal, mark C.)

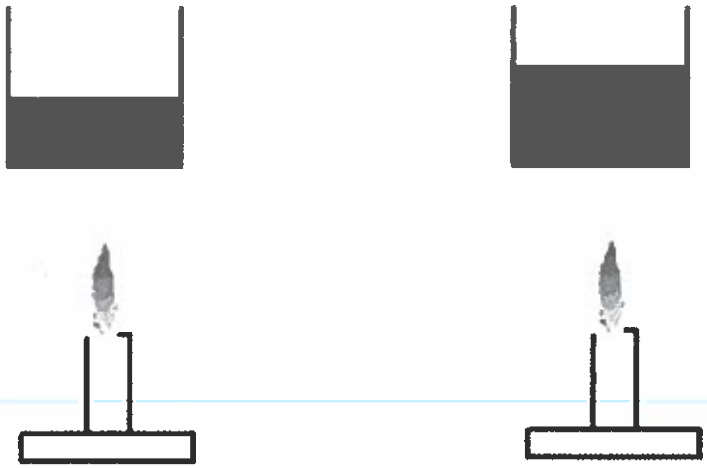


A **B**

22. The bottle shown in diagram A floats in fresh water. The same size and weight bottle in diagram B floats in ocean saltwater. Which bottle will be more exposed above the surface of the water (A or B)? (If equal, mark C.)

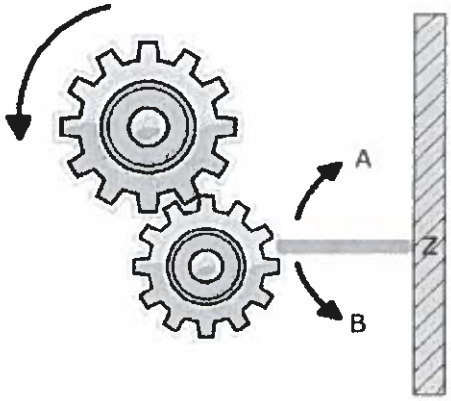
A B

23. After a burner is lit beneath a beaker of water and the water has boiled for 10 minutes, will the water surface be lower (A) or higher (B)? (If equal, mark C.)

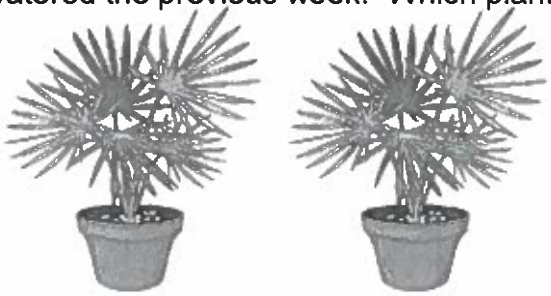


A B

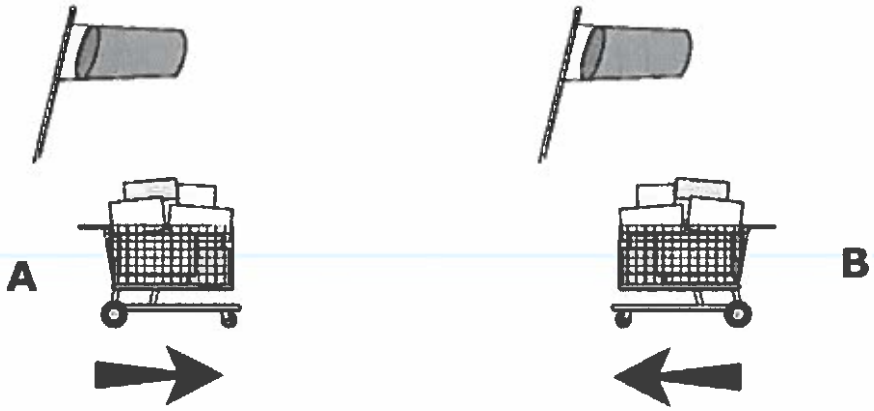
24. As the top gear moves counterclockwise, will the flexible bar that is secured to the wall at Z, move upward (A) or downward (B)? (If equal, mark C.)



25. Identical plants are maintained indoors by an office. Plant A has just been watered thoroughly for 1/2 hour. Plant B was watered the previous week. Which plant will be easier to move (A or B)? (If equal, mark C.)



26. The wind is blowing in the direction shown. In which direction, will the loaded cart move more easily (A or B)? (If equal, mark C.)



PRACTICE TEST #2

FOR

MECHANICAL CONCEPTS

PRACTICE FOR MECHANICAL CONCEPTS

Mechanical concepts are seen in everyday life, can be quite simple, and yet are actually founded on the principles of physics, material properties and basic electrical properties. This test gages your ability to draw appropriate conclusions regarding mechanical principles.

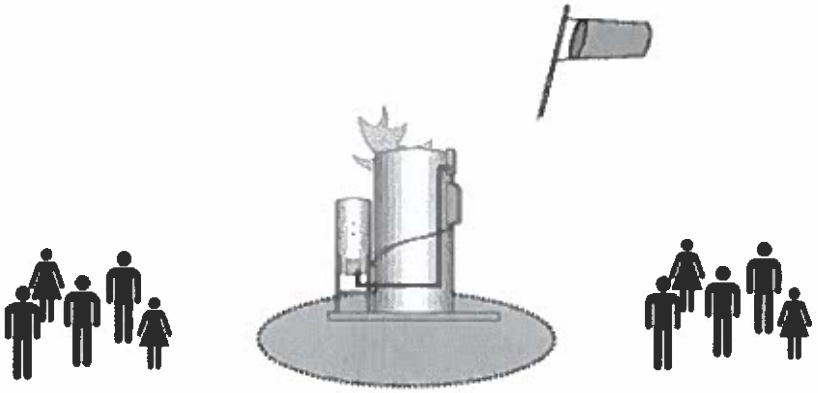
To help you prepare, a practice test follows with 26 different scenarios. Each scenario gives you a picture to illustrate a particular situation. For each situation, there will be one correct answer out of the three possible answers shown. This practice test helps you to practice determining the appropriate outcome for each situation, and within a suggested time limit.

The questions you answer will be multiple-choice, A, B or C. The correct answer depends upon your accurate determination of the outcome posed by the situation. Carefully consider each situational problem for the outcome that will occur. Select the appropriate answer on the answer sheet by completely filling in the circle of your choice of A, B, or C.

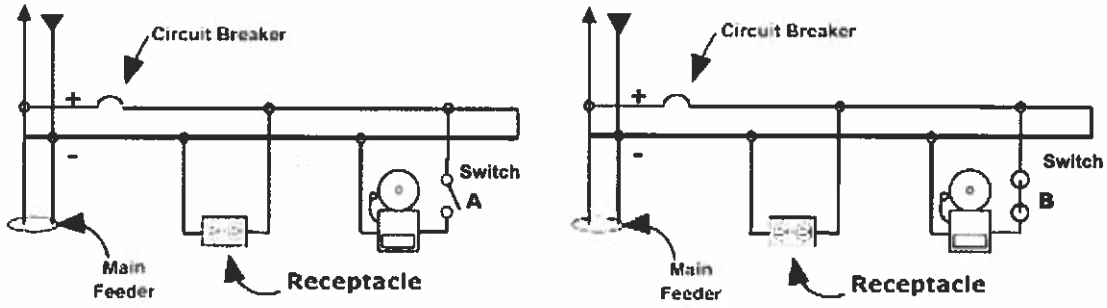
Practicing by taking this test will familiarize you with the style of the real selection test.

MECHANICAL CONCEPTS PRACTICE TEST

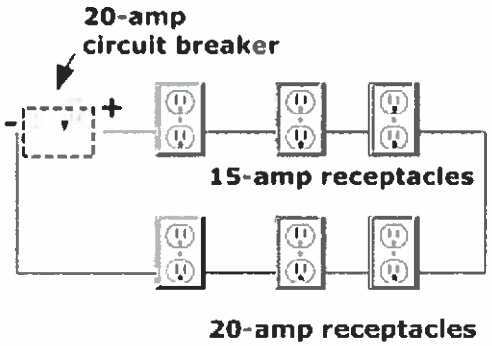
1. If the tank shown ruptures and the windsock points in the direction shown, which group of people are in the safest evacuation area (A or B)? (If equal, mark C.)



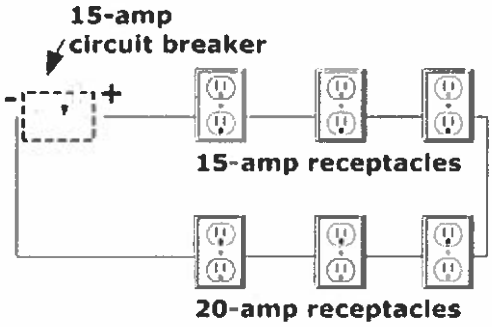
2. Should the switch be in position (A) or position (B) for the receptacle to operate? (If the receptacle will operate when the switch is in either position, mark C.)



3. Which circuit breaker shown in (A) or (B) will most likely trip first and shut off when all receptacles are used to the maximum capacity (amperage)? (If neither or both, mark C).

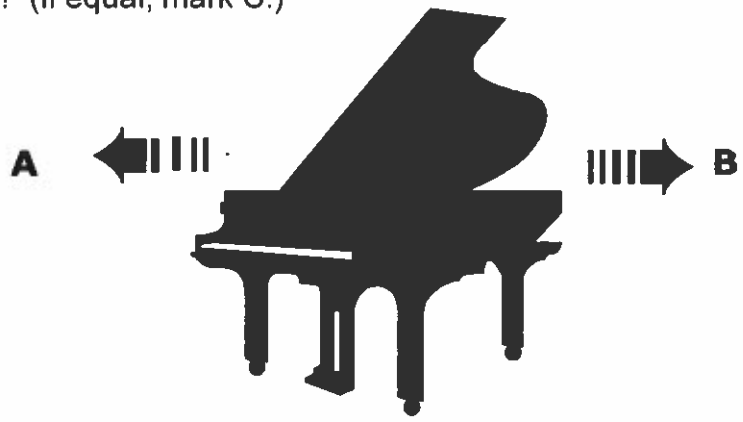


A

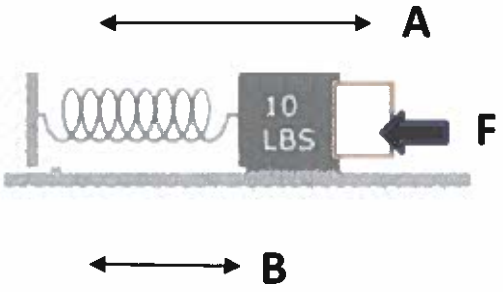


B

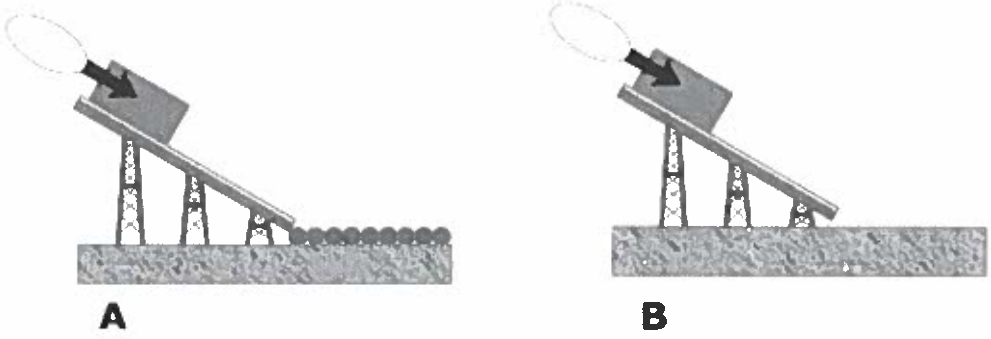
4. As the piano is played, will a person standing at position (A) or position (B) hear a greater sound intensity? (If equal, mark C.)



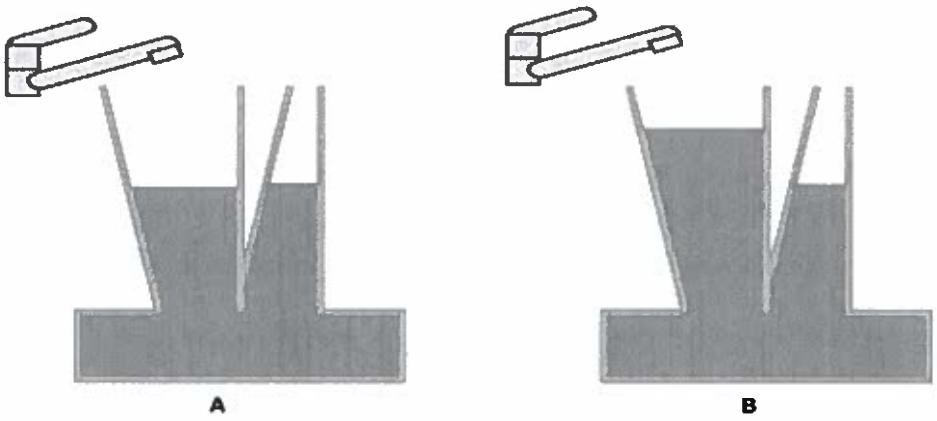
5. The force applied is large enough to move the object weighing 10 LBS toward the wall, which in turn, compresses the spring. If the force is released suddenly after the spring is compressed, will the object move back to the right, for a distance further from the wall than it was originally, (A), or will it more likely move only back to its original position and stop (B)? (If neither applies, mark C.)



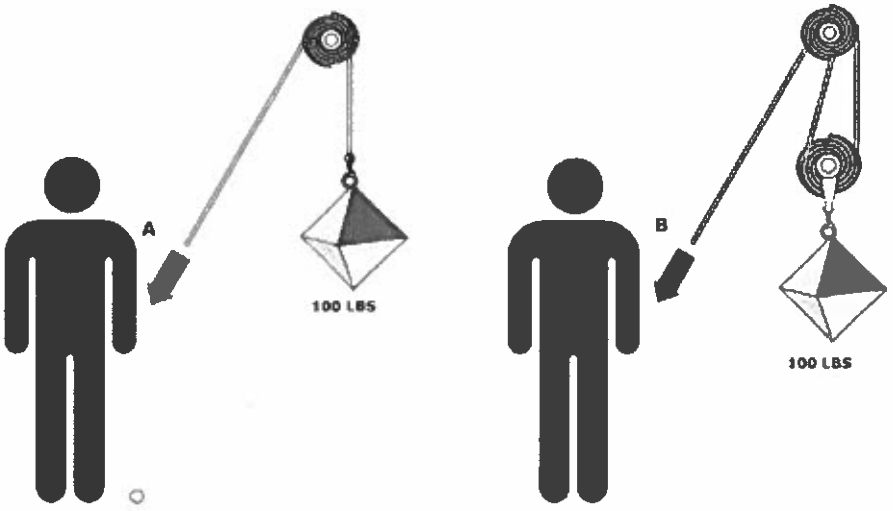
6. Each conveyor belt moves the same load at the same speed down an identical incline. When the load gets to the bottom, will it stop more easily on the roller surface shown in (A) or the flat surface shown in (B)? (If equal, mark C.)



7. The faucets in each view turn on simultaneously releasing the same flow of water in gallons per minute. Which view, (A) or (B), better represents how the tubes will fill? (If neither is correct, mark C.)



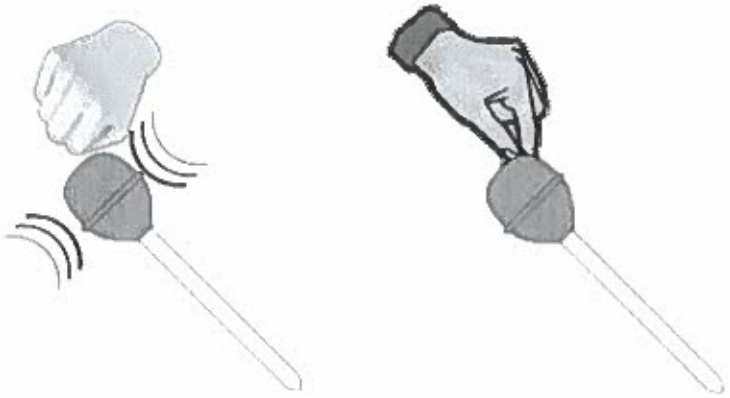
8. Which person (A or B) will have to apply less force to the rope to lift the 100-pound load, given the pulley arrangements shown? (If equal, mark C.)



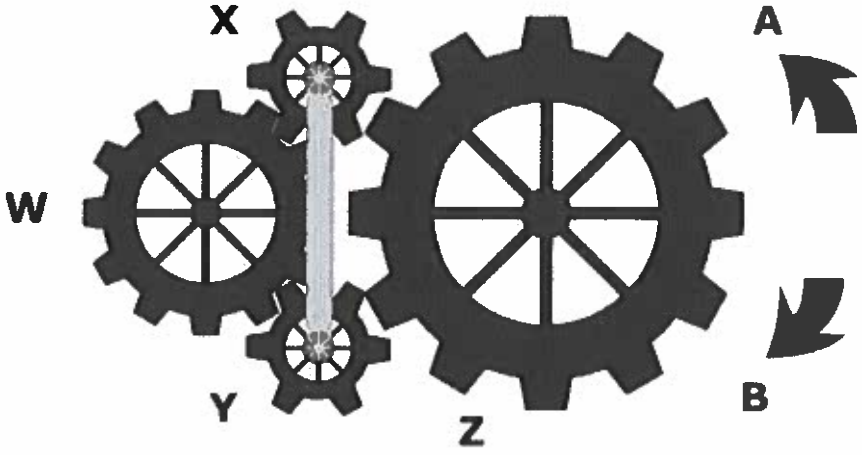
9. Both rooms are the same temperature to begin with, before the boiler flame is activated. Which room, (A or B) will likely become hotter when the boiler is activated and water continuously flows through the piping in the direction of the arrow? (If equal, mark C.)

10. Squeeze bulb A is squeezed and then released while the tip is in liquid. Squeeze bulb B is not squeezed. Which bulb's syringe will pick up more liquid (A or B)? (If equal, mark C.)

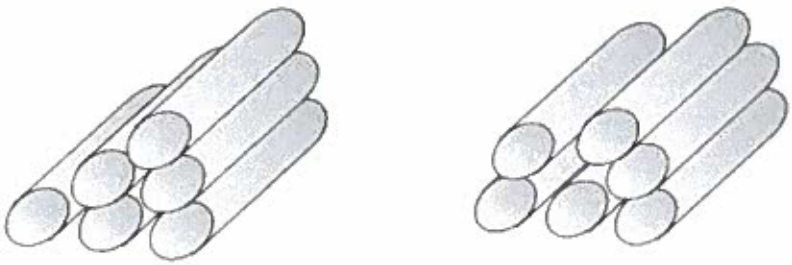
A **B**



11. When the gear W moves clockwise, will gear Z move in direction A or B? (If no movement, mark C.)



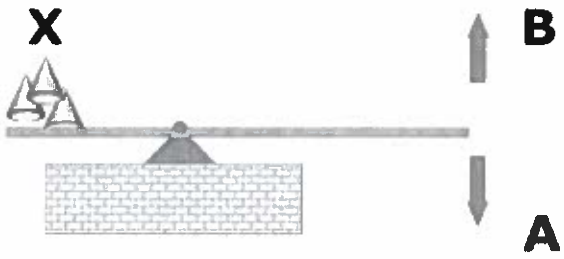
12. Which stockpile is more stable on a flat surface, (A or B)? (If equal, mark C.)



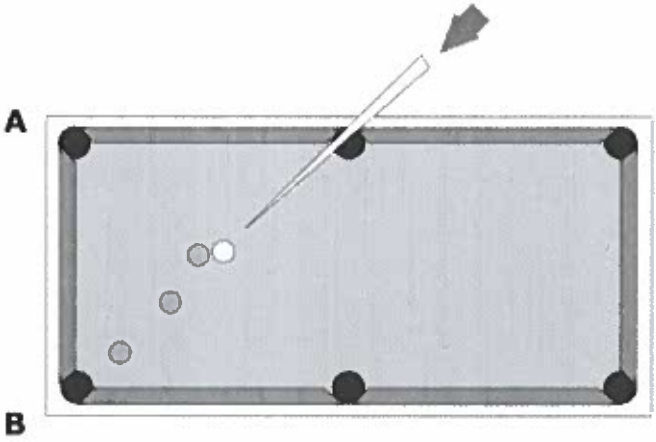
A

B

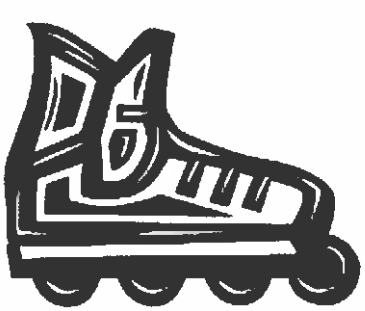
13. When the cone-shaped weights are placed at position X, the lever stays level. When the weights are removed, will the lever move up toward B or down toward A? (If the lever will not move, mark C.)



14. A strong force moves the pool cue in the direction shown. The cue hits the white ball "dead-on" (in the center of its profile). After the white ball is hit, will a ball be more likely to drop into the pool table pocket at corner (A) or (B). (If neither, mark C.)



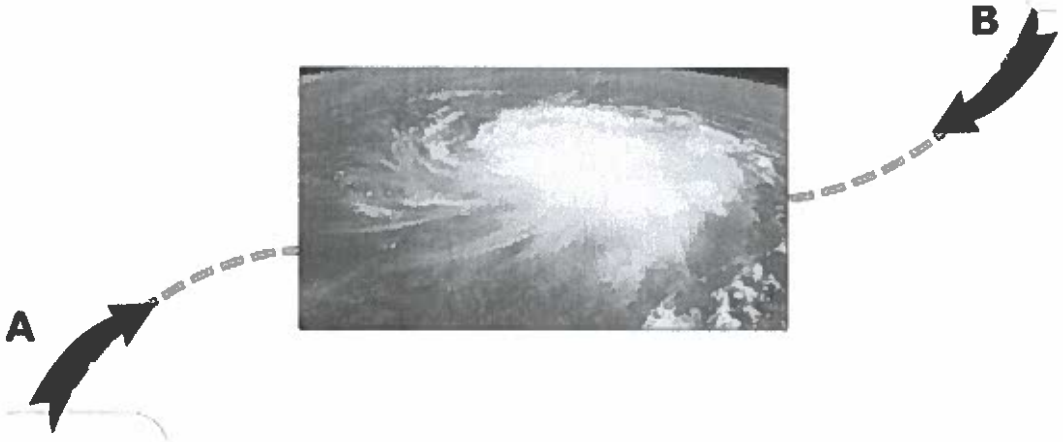
15. When skating on the same path, will a skater have an easier time stopping with a skate of the type and position shown in (A) or (B)? (If equal, mark C).



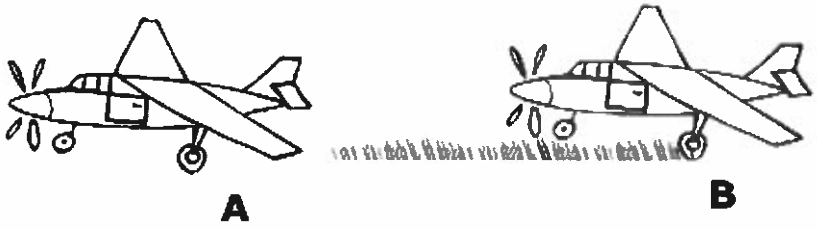
A

B

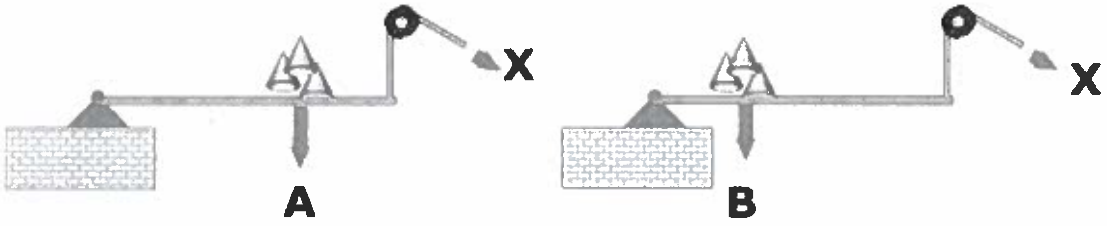
16. Based upon the satellite photo of the tropical storm (North Atlantic), has the storm more likely come from the direction (A) or (B)? (If each direction is an equal possibility, mark C.)



17. Airplanes A and B are identical and taking off under identical conditions (such as temperature, wind, altitude, load weight, and prop speed), except the runway beneath Airplane A is paved and the runway beneath Airplane B is grass. Which airplane (A or B) will lift off in less time? (If equal, mark C.)

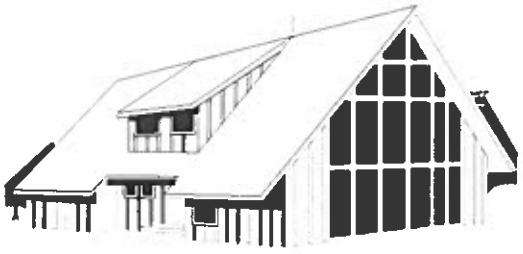


18. The mass loaded at point A is equal in weight to the mass loaded at point B. Will the force of the pull at X need to be larger when the load is at point (A) or point (B)? (If equal, mark C.)



19. Which home's roof is more likely to withstand a heavy snow load without collapsing (A or B)? (If equal, mark C.)

A



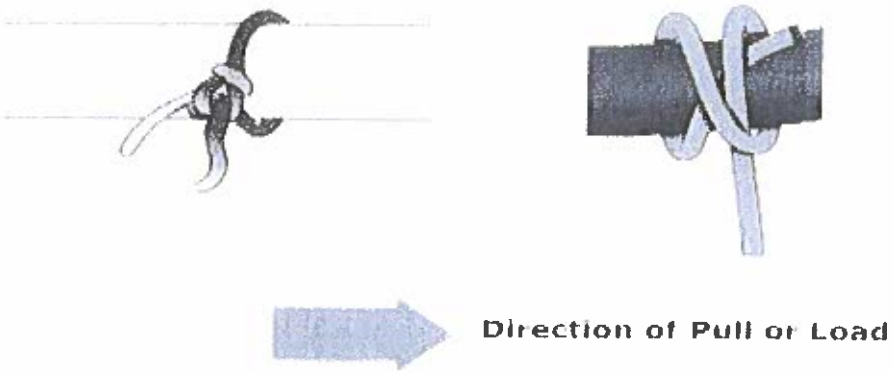
B

20. The scrap metal pile shown has been placed below a powerful magnet. Which magnet position, (A or B) is the most likely placement of the magnet to attract the scrap metal as shown? (If equal, mark C.)

A

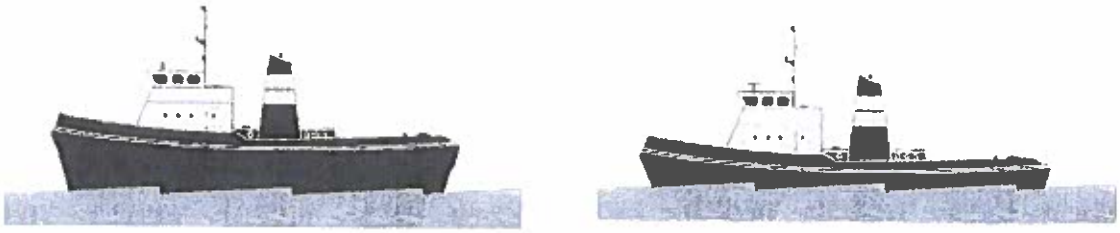
B

21. When the knots are pulled tight, which knot, (A or B) is less likely to slip off of a pipe? (If equal, mark C.)



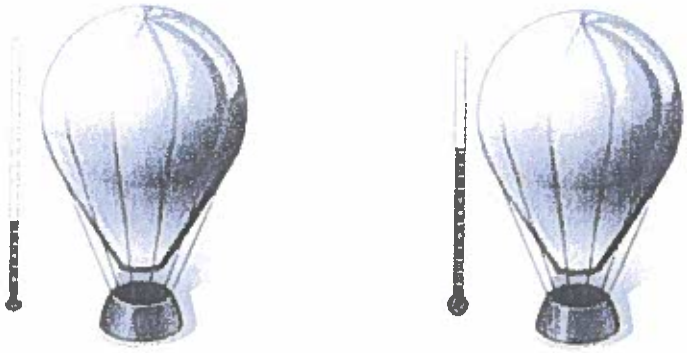
A B

22. Both tugboats are the same size and capacity. Each tugboat has the same cargo load, same power, and same size crew, but shows a very different profile on the water. One tugboat operates in salt water and the other in fresh water. Is tugboat (A) or (B) working in fresh water? (If both tugboats could be working in either fresh water or ocean water yet have a different profile, mark C.)



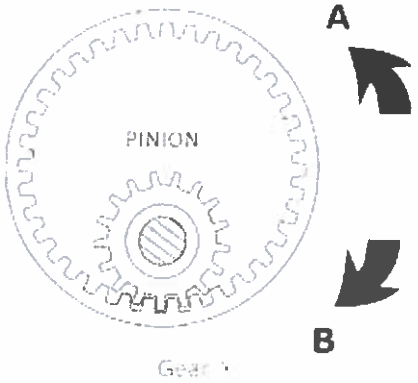
A B

23. Balloons A and B are in different regions of the country. The outside temperature is lower in the region where Balloon A is located than it is where Balloon B is located. If the burner for each balloon remains on long enough for one balloon to begin to rise, which balloon rises faster (A or B)? (If equal, mark C.)

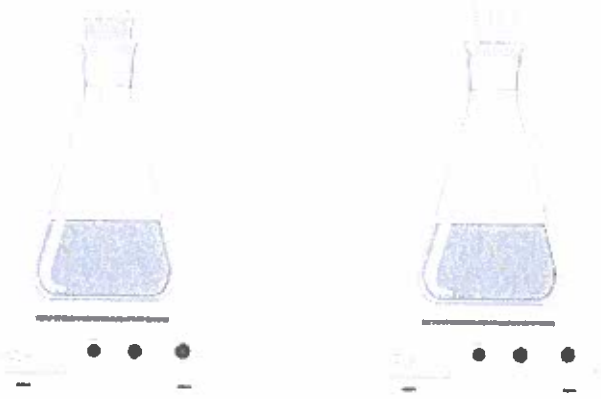


A B

As the pinion gear moves clockwise, will the outer gear X move toward (A) or (B)? (If no change in movement of the outer gear X, mark C.)

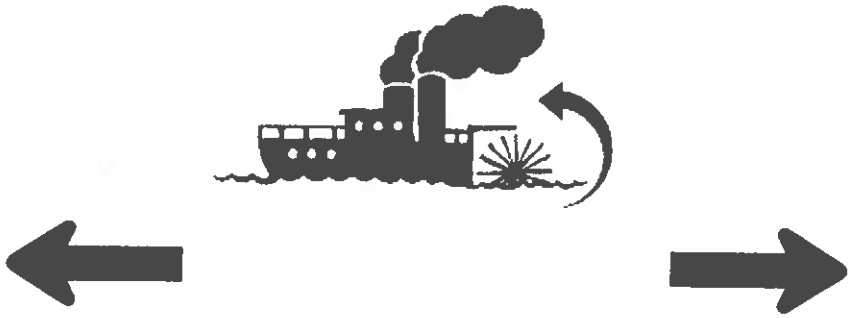


25. Both flasks contain the same amount of water and air. A tight fitting glass stoppers Flask A. Flask B was stoppered by manually pushing a vented cork into the top opening. If both flasks are heated at the same temperature for the same time, which flask will be safer to handle (A or B)? (If equal, mark C.)



A B

26. The steamboat's paddlewheel is turning in the direction shown. Will the steamboat move in direction A or B? (If equal, mark C.)



A B

PRACTICE TEST #3

FOR

MECHANICAL CONCEPTS

PRACTICE for MECHANICAL CONCEPTS

Mechanical concepts seen in everyday life, can be quite simple, and yet found on the principles of physics, material properties and basic electrical properties. This test gages your ability to draw appropriate conclusions regarding mechanical principles.

To help you prepare, a practice test follows with 26 different scenarios. Each scenario gives you a picture to illustrate a particular situation. For each situation, there will be one correct answer out of the three possible answers shown. This practice test helps you to practice determining the appropriate outcome for each situation, and within a suggested time limit.

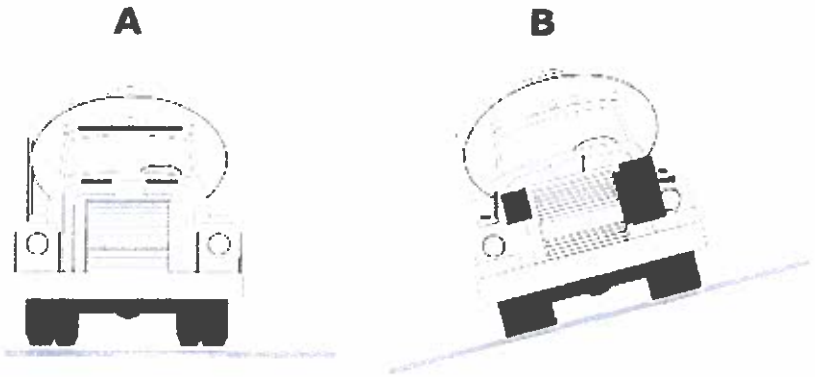
The questions you answer will be multiple-choice, A, B or C. The correct answer depends upon your accurate determination of the outcome posed by the situation. Set a timer for 20 minutes. Carefully consider each situational problem for the outcome that will occur. Select the appropriate answer on the answer sheet by completely filling in the circle of your choice of A, B, or C.

Practicing by taking this test will familiarize you with the style of the real selection test. To create conditions most like a real test:

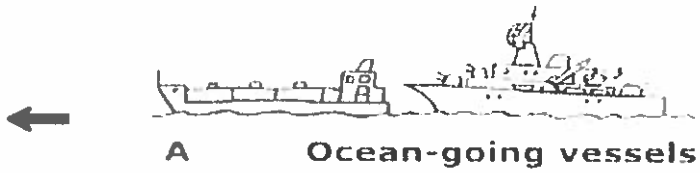
- Practice by completing all 26 test questions
- Be sure to set a timer before beginning each part
- Aim to finish within 20 minutes to achieve the pace needed to complete within the time allowed for the actual EEI assessment

MECHANICAL CONCEPTS PRACTICE TEST

1. Each truck travels at a very high rate of speed without braking, through a curve to their right side. Which truck is less likely to veer off the road while negotiating the curve (A or B)? (If equal, mark C.)



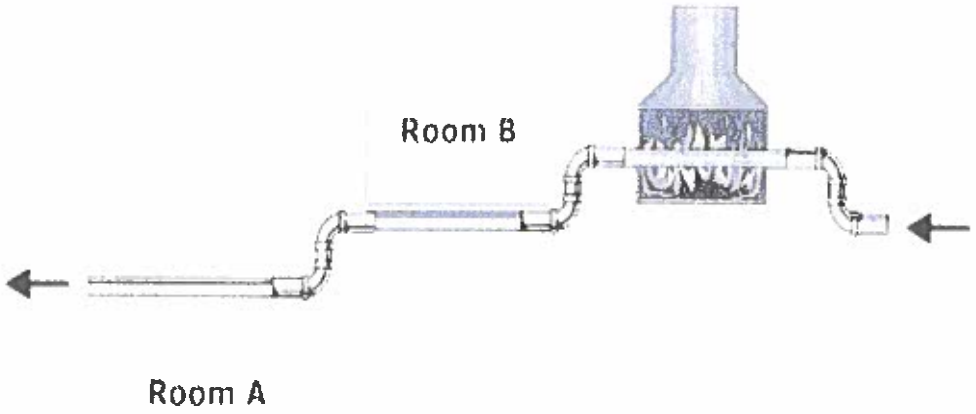
2. In each picture shown, the tugboat tows the military ship. Assume the tugboat and military ships all weigh the same; each tugboat operates at the same power; and in both situations, the distance to port is the same. Disregarding wind, currents and tides (all things being equal), which tug and ship (A or B) is more likely to reach port the faster. (If equal, mark C.)



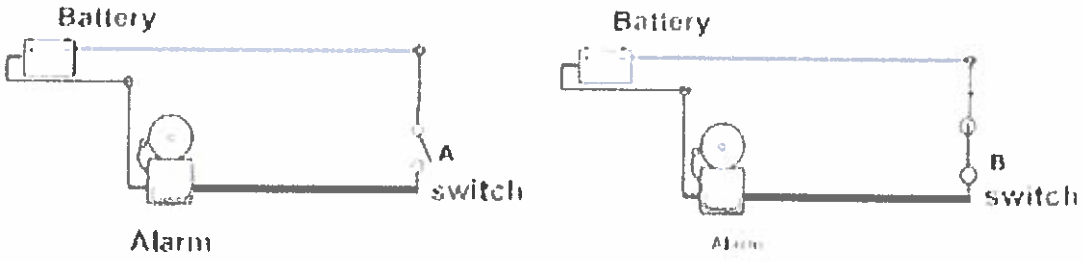
A Ocean-going vessels

B Inland-river vessels

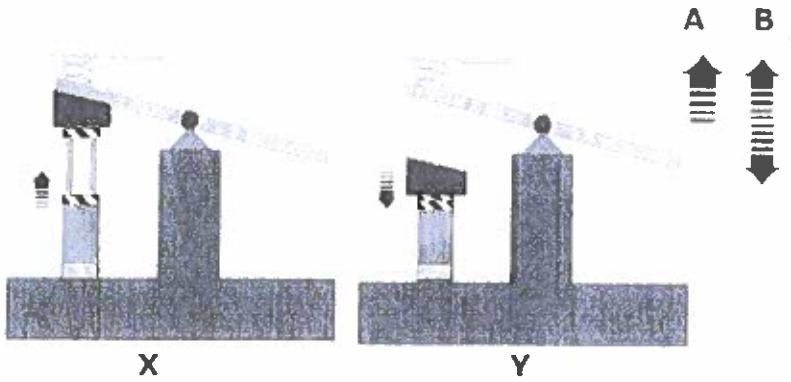
3. Water flows, in the direction of the arrows, through the piping when the boiler flame burns. Which room, (A or B) will likely remain the hottest when the boiler operates and water continuously flows through the piping in the direction of the arrow? (If equal, mark C.)



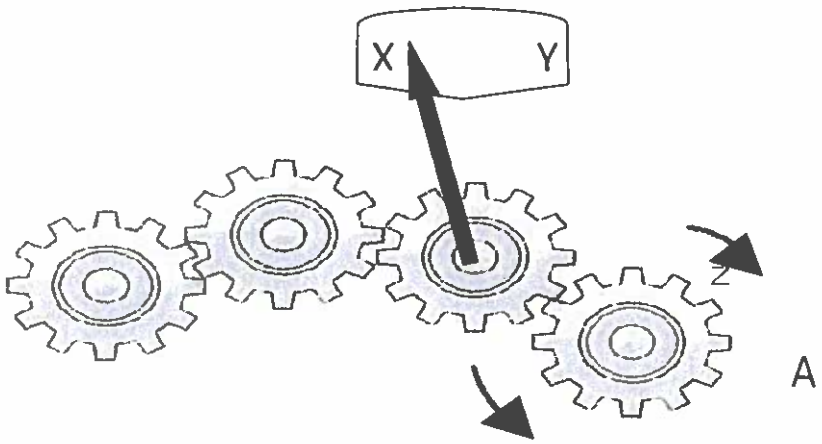
4. Should the switch be in position (A) or position (B) for the alarm to operate? (If the alarm will operate when the switch is in either position, mark C.)



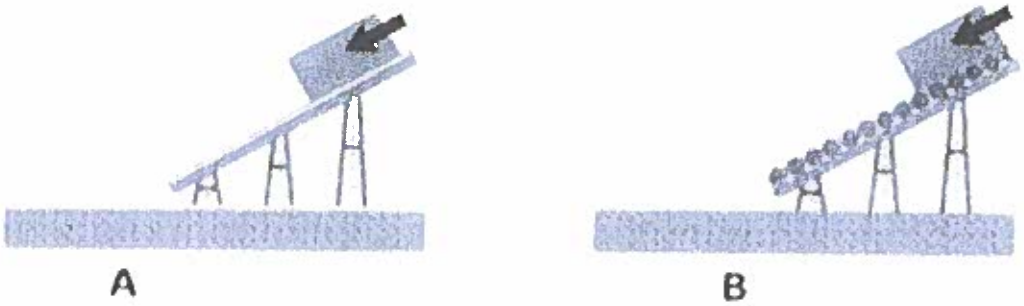
5. In view X, the lift has pushed upward on the lever to compress the spring that is attached to both the left end of the lever and a horizontal surface above the spring. If the lift suddenly drops, will the right end of the lever more likely move up (A) or up & down (B)? (If neither applies, mark C.)



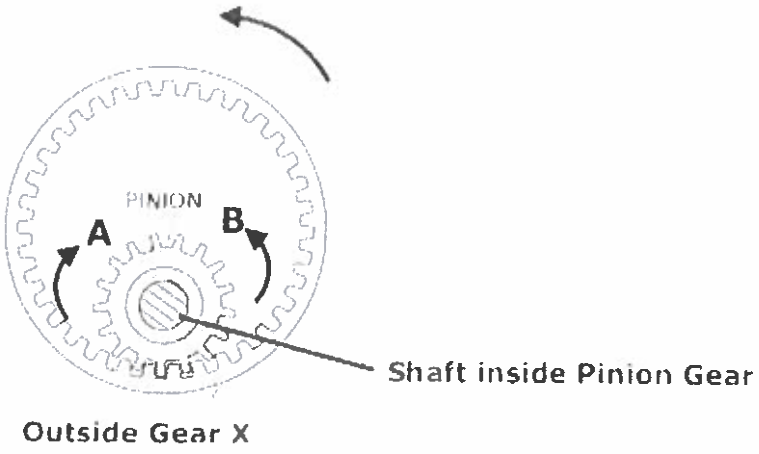
The indicator attached to Gear Y points to X. Which way must Gear Z rotate (A or B) in order for the indicator to point to X as shown? (If either rotation moves the indicator to X, mark C.)



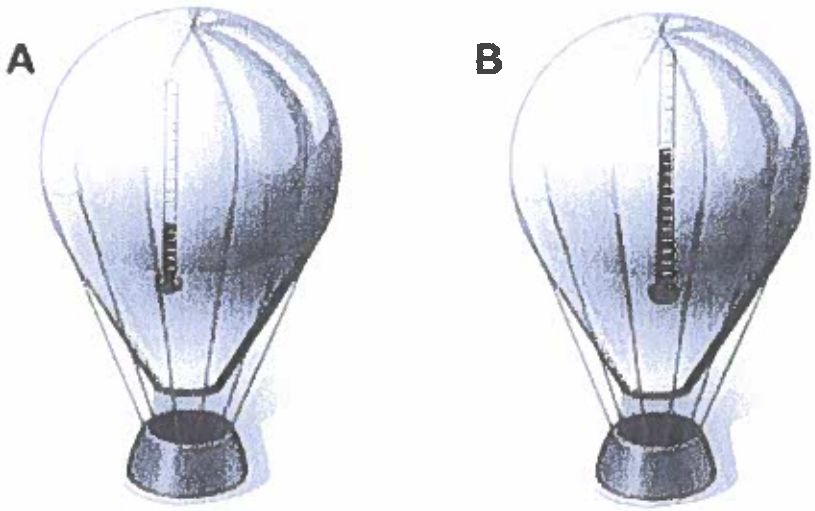
7. An equal push at the same speed propels an identical load down each slide toward the water. Both slides orient at the same angle and height relative to the water. The surface of the slide shown in A is a smooth, and in B, it is a roller surface. Will the splash at A or B be bigger? (If equal, mark C.)



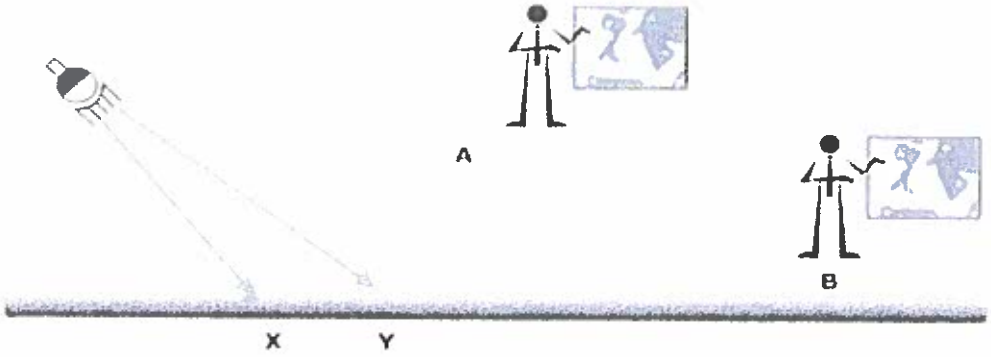
8. The outside gear X turns counterclockwise (in the direction of the outside arrow.)This enables the internal pinion gear to rotate. Will the shaft inside the pinion gear turn toward (A) or (B)? (If the shaft does not move, mark C.)



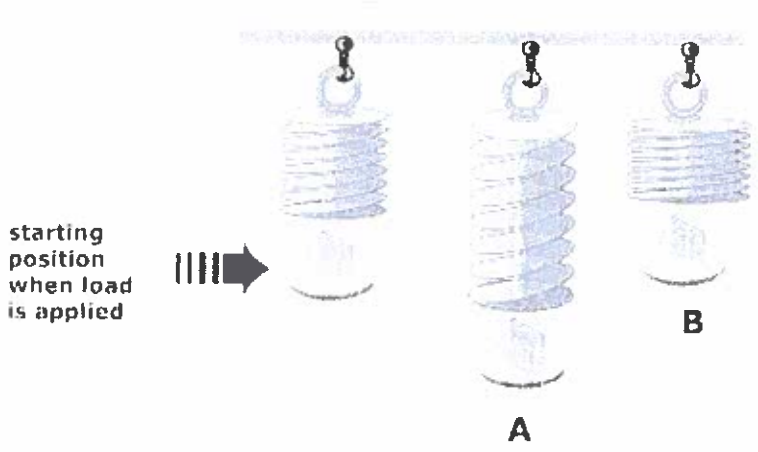
9. For each hot air balloon shown, the temperature inside each balloon displays on the thermometers. Based on the temperatures shown, which hot air balloon, (A or B), has the greatest internal pressure? (If equal, mark C.)



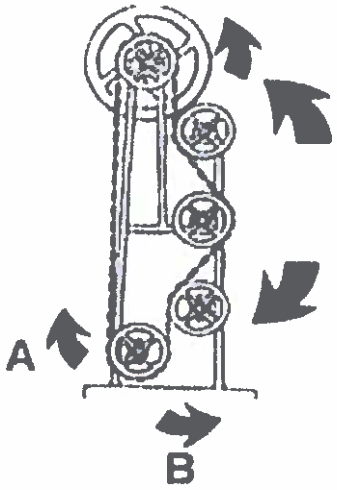
10. Light from the lamp reflects off the mirrored surface between points X and Y. Which person, (A or B) will have a better light on their display map? (If equal, mark C.)



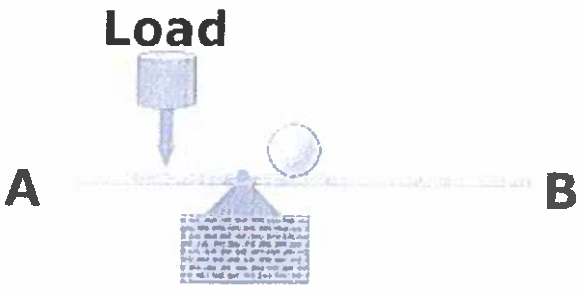
11. The picture shows a suspended coil spring in a starting position on the left. When a load much heavier than the spring, is loaded onto the suspended plate beneath the spring, how will the spring move? Will the spring more likely behave as shown in A or B? (If neither applies, mark C.)



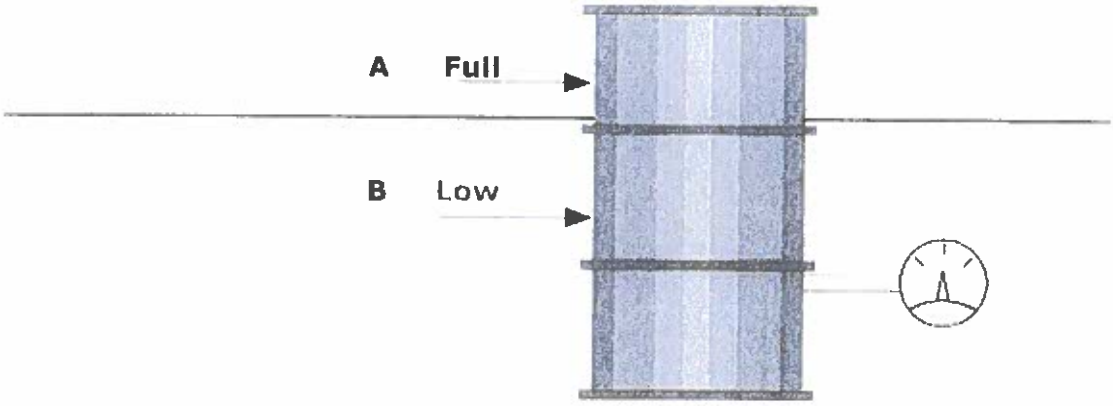
12. When the top gear moves counter-clockwise, will the chain around the bottom gear move in direction A or B? (If no movement, mark C.)



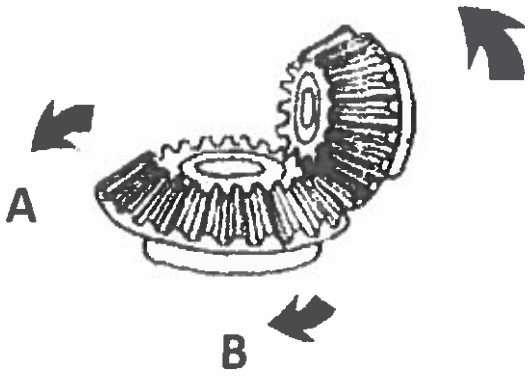
13. When the load applies downward upon the lever, will the ball move toward A or toward B? (If the ball remains unaffected by applying the load, mark C.)



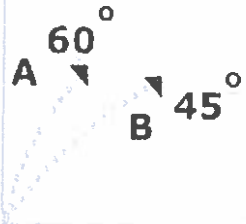
14. The drum of oil is full when filled to level A, and low when filled to level B. At which level will the pressure gage shown on the right side read the highest (A or B)? (If equal, mark C.)



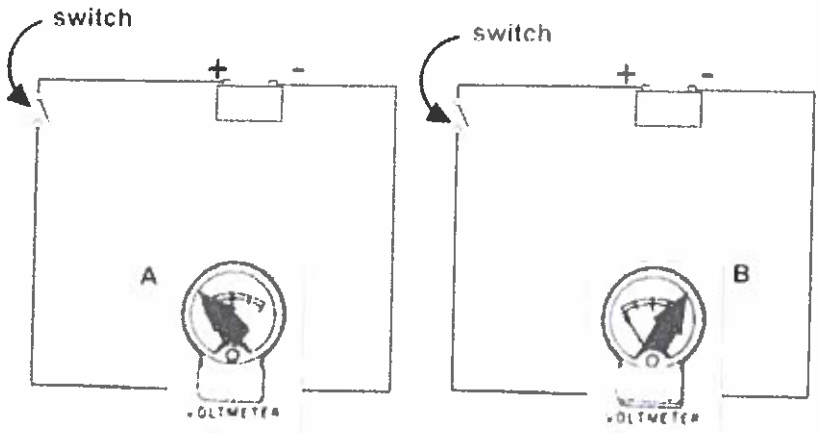
15. The top right gear moves, when a motor activates, in the direction of the arrow. Will this movement cause the bottom bevel gear to counterclockwise toward A, or clockwise toward B? (If the bottom bevel gear does not move, mark C).



16. Two arrows are shot from the ground with the same force. Arrow A follows the 60° path (A). Arrow B follows the 45° path. Which arrow will obtain the greatest height before falling to the ground (A or B)? (If equal, mark C.)

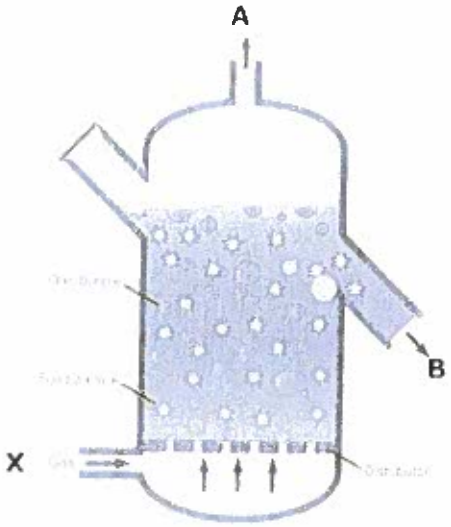


17. Each picture shows the same circuit, powered by a battery, with a voltmeter and an open switch. When the switch in each picture is closed, will the voltmeter more likely register at position A or B? (If neither, mark C.)

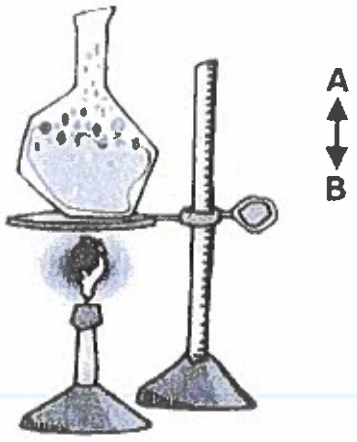


18. Will a motor pulling at point (A) or at point (B) require more horsepower to lift the 100-pound load? (If equal, mark C.)

19. Gas enters the chamber from the pipe at X. Is gas more likely to escape from (A or B)? (If equal, mark C.)

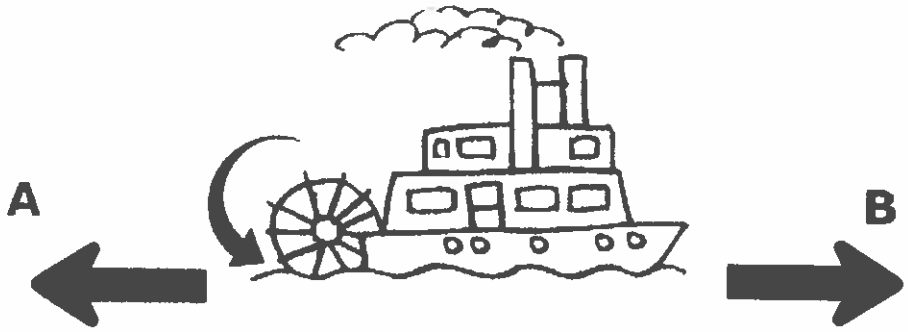


20. A burner heats the liquid in the glass beaker until vapor escapes from the top of the beaker. Will the liquid surface more likely register at (A) or (B) after prolonged heating? (If the surface of the liquid does not change, mark C.)

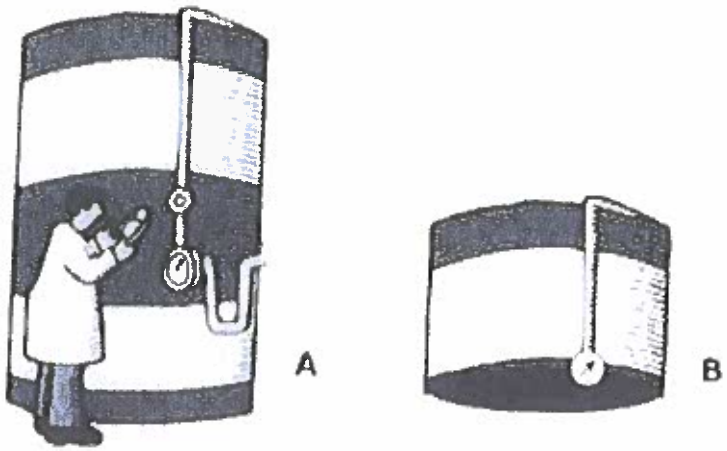


21. When the laboratory flask containing water heats until the water boils and steam forms inside the beaker, will the top of the flask grow tighter by expanding, like shown in (B), or will it more likely pop off, like shown in (A)? (If A or B could happen, or if nothing will happen, mark C.)

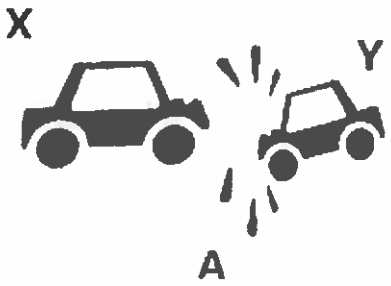
22. The steamboat's paddlewheel is turning in the direction shown. Will the steamboat move in direction A or B? (If neither, mark C.)



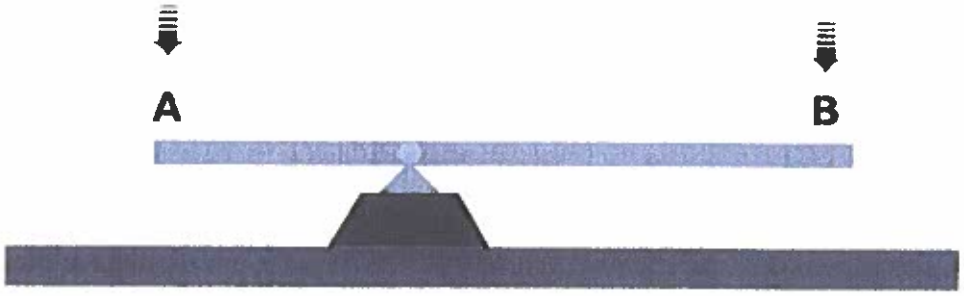
23. Tanks A and B contain the same type and volume of a gas. Will the laboratory technician find the pressure reading higher on Tank A or Tank B? (If equal, mark C.)



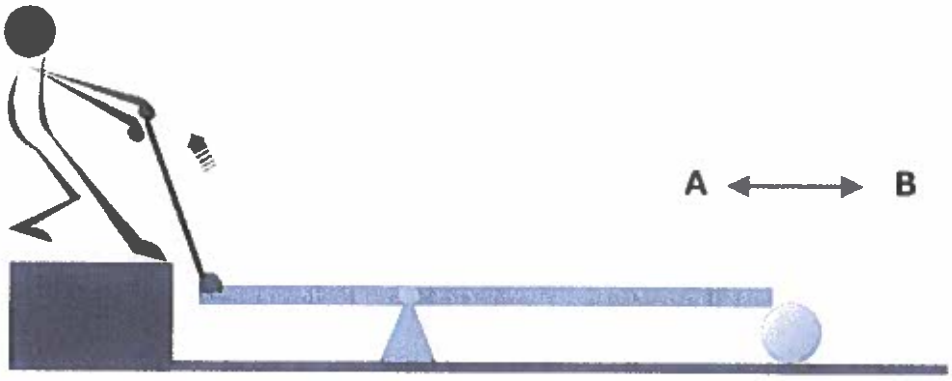
24. Car X is twice the weight of Car Y. If both cars, traveling at equal speeds hit head-on, which picture, (A or B) better represents the resulting collision? (If either could apply, mark C.)



25. An equal load is applied to each end of the lever in the direction of the arrows shown. Will the lever move up at (A), or at (B) when the loads are applied? (If the lever will not move, mark C.)



26. The lever shown is being pulled upward on the left side. Will this action create movement in the ball toward (A) or (B)? (If no movement is created, mark C.)



Testing Topic: Reading Comprehension

Main Idea

Main idea questions ask you to identify the "primary purpose" of a passage.

Here are some examples of how "Main Idea" questions may be worded:

- Choose the primary purpose of the passage
- The passage is primarily concerned with which of the following?
- The main point of the passage is…
- Of the following statements which most accurately states the main idea of the passage?

Supporting Idea

Supporting idea questions deal with finding specific facts about the passage.

Here are some examples of how "Supporting Idea" questions may be worded:

- According to the passage,…
- According to the passage choose the correct answer
- The passage mentions all of the following EXCEPT…

PRACTICE TEST #1

FOR

READING COMPREHENSION

The Reading Comprehension selection test measures a candidate's ability to read and understand written materials. The test consists of two reading passages, each followed by several multiple-choice questions about the passage.

Directions

This is a test of your ability to read and understand written materials. This test includes two passages, each followed by questions about the passage. You are to read each passage and then answer the corresponding questions. All questions should be answered based strictly on the information presented in the passage. Do not answer on the basis of experiences you have had, or any information not specifically presented in the passage. To do so might result in choosing an incorrect answer.

For each question, select the best answer from the choices given. Answer all the questions regarding one passage before moving on to the next. You may look back at the passage while you answer the question.

Practicing taking this type of test will familiarize you with the style of the real selection test.

PASSAGE 1: ENERGY FROM NATURAL GAS

Natural gas is a fuel that can be used to cook food; heat water; heat homes; and perform thousands of useful tasks in shops, plants, and factories. It is made mostly of methane, an odorless, colorless, and tasteless gas. Because of the hazards associated with gas leaks, as a safety precaution a scented chemical called mercaptan is injected into the gas. Mercaptan allows even small gas leaks to be detected and stopped.

The natural gas system starts with exploration and extraction through gas wells. Once natural gas is extracted from the ground in onshore or offshore fields, it is processed through cleaning and treatment systems. After cleaning and processing, pipelines then move the gas to a compressor station before being fed into high - pressure transmission lines.

To move natural gas from where it is produced to the places where it is needed, the natural gas industry has constructed more than 250,000 miles of large - diameter pipelines. The pressure of gas in each section of line typically ranges from 200 pounds to 1,500 pounds per square inch, depending on the type of area in which the pipeline is operating. As a safety measure, pipelines are designed and constructed to handle much more pressure than is ever actually reached in the system. For example, pipelines in more populated areas operate at less than one-half of their design pressure level.

A local gas company receives natural gas from the long-distance pipeline at what is called a city gate station where the pressure is lowered and mercaptan is added. After passing through the city gate station, the gas enters the underground network of pipes of the local distribution system. Pipes carry the gas under the streets to buildings in the community. These principal underground pipes are called gas mains.

Local gas distribution systems are divided into sections. Each section can be shut off by closing a valve in the street main for emergencies or for maintenance or repair. Individual service connections are attached to each home or business. A service pipe extends from the street main underground to a home gas meter. Gas flows through the meter into the pipes that supply your range, water heater, home heating furnace or boiler, and the other gas appliances in your home.

Answer questions 1 through 7 based on information presented in the above passage.

1. **What is a city gate station?**
   A. Station where a compressor increases the pressure of natural gas in the pipeline.
   B. Connection where local gas companies receive natural gas from long-distance pipelines.
   C. Facility that manufactures mercaptan for low-pressure local distribution systems.
   D. The primary system in natural gas transmission lines for ensuring safe pipeline pressures.

2. **After natural gas is extracted, what happens to it next?**
   A. It's compressed for high-pressure lines.
   B. It enters the service lines for distribution.
   C. It's processed through cleaning systems.
   D. It is depressurized for cleaning.

3. **How does the pressure in transmission lines compare to that in local distribution lines? The pressure in local distribution lines is:**
   A. Lower.
   B. Half as much.
   C. The same.
   D. Twice as much.

4. **What is the pressure of natural gas in local distribution lines?**
   A. 200 pounds per square inch.
   B. One-half that of transmission lines.
   C. One-half of their design pressure level.
   D. 100 pounds per square inch.

5. **What is the purpose of a service pipe for natural gas?**

   A. Provide a means to move natural gas from the well to a compressor.
   B. Serve as the input for adding mercaptan to natural gas.
   C. Move natural gas from the transmission to distribution lines.
   D. Transport natural gas from the street main to a gas meter.

6. **What is the purpose of mercaptan in the natural gas system?**

   A. Reduce friction in gas lines.
   B. Prevent corrosion in gas lines.
   C. Prevent overpressure in gas lines.
   D. Allow detection of gas leaks.

7. **What is the main theme of this reading passage?**

   A. The process of extracting and transporting natural gas.
   B. The hazards of working with natural gas.
   C. The different kinds of jobs for natural gas workers.
   D. The many uses of natural gas in today's environment.

PASSAGE 2: EMERGING TECHNOLOGIES

The electricity utility industry is facing the challenges of rising consumer demand and an aging infrastructure. The costs of new construction and improvements to the national electricity system are increasing along with consumer demand for better service and technology. New construction and upgrades will be needed to maintain system integrity. Just as with the national transmission system, emerging technologies are being sought to keep the national power grid, including local power distribution, working efficiently and smoothly. The main areas of research and development in electric power distribution include new technologies to increase accuracy and efficiency. Technologies that enable increased accuracy and efficiency include automated operations and increased monitoring and control capabilities.

Electric metering technologies are being updated to provide advanced bidirectional communication and monitoring abilities. Advanced metering technology provides enhanced sensing and measurement accuracy that allows for the collection and relay of important real - time data. Advanced metering enables functions, such as remote connect/disconnect, outage monitoring, and real-time measurement of electricity use to adjust generation capability to meet changing needs.

New advanced supervisory control equipment and systems allow for more advanced remote control of system components. This remote control saves labor and time, allowing remote operation of distribution equipment to restore power faster with reduced outage time. Advanced power monitoring and control avoids equipment damage with timely recognition and correction of electric faults. In addition to timely remote control, the increased supervisory capabilities provide continuous system analysis, ensuring proper operations and better overall system security.

The new smart grid will affect all parts of the national electricity system—generation, transmission, and distribution. Smart - grid technology provides many possible benefits for the electric power distribution systems. For example, it will enable real - time acquisition of energy use data and provide feedback to customers. The most familiar implementation of smart - grid technology in the distribution system is the installation of new smart meters. As mentioned earlier, smart meters can help improve the distribution system by improving sensing, measurement, and control technologies. New smart meters will allow distribution system controllers to monitor power quality and to better detect and correct system anomalies. On the consumer side, enhanced smart - grid technologies in the distribution system will help consumers be better informed about power consumption activities and will also provide them with opportunities to actually apply that new knowledge in good use practices and demand response control choices.

Answer questions 8 through 14 based on information presented in the above passage.

8. **Which parts of the national electricity system will be affected by the new smart grid?**
   A. Generation.
   B. Transmission.
   C. Distribution.
   D. All of the above.

9. **The challenges facing the electricity utility industry are:**
   A. Rising consumer demand and an aging infrastructure.
   B. Acquisition of energy use data and getting feedback from customers.
   C. Increasing efficiency of operations and acquiring control capabilities.
   D. Using bidirectional communication and monitoring energy use.

10. **A major benefit of advanced metering technology is:**
    A. Ability to adjust generation capability to meet changing needs.
    B. Enhanced sensing and measurement accuracy.
    C. Bidirectional communication and monitoring abilities.
    D. Consumers limit electricity demand during peak usage periods.

11. **What is the main idea of this reading passage?**
    A. New advanced remote control of system components.
    B. Benefits of advanced electric metering technologies.
    C. Data-driven decision-making and demand response.
    D. Technologies that enable increased accuracy and efficiency.

12. How do new advanced supervisory control e uipment and systems eep the national power grid wor ing efficiently and smoothly?

A. Time and labor savings enabling more efficient restoration of power.
B. Advanced power monitoring and remote operation of distribution equipment.
C. Electric power consumers with more real-time data for decision-making.
D. Collection and relay of important real-time data.

13. What is one benefit of smart grid technology?

A. The installation of new smart meters.
B. Real-time acquisition of energy use data.
C. Remote control of transmission and distribution equipment.
D. Larger capacity transmission power carrying capabilities.

14. Why does the electric power industry need emerging technologies?

A. Costs of new construction are increasing along with consumer demand.
B. Consumer demand for real-time data is essential for decision-making.
C. eep the national power grid working efficiently and smoothly.
D. Provide the remote control capability need for distribution systems.

PRACTICE TEST #2

FOR

READING COMPREHENSION

The Reading Comprehension selection test measures a candidate's ability to read and understand written materials. The test consists of two reading passages, each followed by several multiple-choice questions about the passage.

Directions

This is a test of your ability to read and understand written materials. This test includes two passages, each followed by questions about the passage. You are to read each passage and then answer the corresponding questions. All questions should be answered based strictly on the information presented in the passage. Do not answer on the basis of experiences you have had, or any information not specifically presented in the passage. To do so might result in choosing an incorrect answer.

For each question, select the best answer from the choices given. Answer all the questions regarding one passage before moving on to the next. You may look back at the passage while you answer the question. This test has **15 questions**.

Practicing taking this type of test will familiarize you with the style of the real selection test.

PASSAGE 1: TRANSFORMERS

Power that is generated at power plants must be collected and delivered to the transmission system at the voltages required for use. In modern power plants, the electrical power leaving the generator travels to a main power transformer which steps up the generated voltage. A transformer is an electrical device by which alternating current of one voltage is changed to another voltage. They operate on the theory of mutual inductance. A basic transformer consists of two windings coiled around an iron core and placed in a covered tank. The primary winding is connected to the source voltage. The secondary winding is connected to the load. There is no physical connection between the windings.

As alternating current flows in the primary winding of the transformer, a magnetic field or flux is developed in the iron core. As the current reverses direction, the magnetic field also changes direction. This action induces an alternate voltage in the secondary winding, and if the secondary circuit is closed, an alternating current will flow. When there is the same number of turns in the primary and secondary windings, the voltage will be the same in both the source and the load circuits. A generating plant's typical output voltages are between 12kV and 30 kV. Typical transmission voltages range from 138kV to 765kV.

If there are fewer turns in the primary winding than in the secondary winding, the transformer is said to be a step-up transformer and the voltage in the primary circuit will be less than the voltage in the secondary circuit. A step-down transformer has more turns in the primary winding than in the secondary winding. Voltages are higher in the primary circuit than in the secondary circuit.

Transformers operate on two basic principles: 1) Whenever an electric current flows, there is magnetism around it. 2) Whenever a magnetic field changes (by moving or by changing strength), voltage is created. If there is a wire close by when this happens then a current will flow in the wire as the magnetism changes.

A transformer can only transfer power, not produce it. Besides the main power transformer that steps voltage up to transmission levels, a variety of other transformers are found along the transmission and distribution lines that adjust voltages for the power grid and that step down voltages to voltages needed by various consumers.

Answer questions 1 through 8 based on information presented in the above passage.

1. _____ develops in the iron core of a transformer as alternating current flows in the primary winding.

A. Arcing
B. Three-phase service
C. Transmission switching
D. A magnetic field

2. What is the core made up of in a transformer?

A. Iron
B. Copper
C. Silver
D. Plastic

3. The primary winding is connected to the _____.

A. load
B. source voltage
C. secondary winding
D. core

4. The secondary winding is connected to the _____.

A. load
B. source voltage
C. primary winding
D. core

5. **When there is the same number of turns in the primary and secondary windings, the voltage the load circuit will be _____ the voltage in the source circuit.**

   A. higher than
   B. lower than
   C. the same as
   D. higher then lower than

6. **The voltage in the primary circuit will _____the voltage in the secondary circuit if the transformer is a Step-up transformer.**

   A. be more than
   B. be less than
   C. be the same
   D. vary in comparison to

7. **A transformer can do which of the following:**

   A. Even electric power flow
   B. Change voltage
   C. Transmit power
   D. Produce electricity

8. **Which theory is the basis for a transformer as an electrical device by which alternating current of one voltage is changed to another voltage?**

   A. Ohm's Law
   B. Electrical resistance
   C. Kirchoff's Law
   D. Mutual inductance

PASSAGE 2: SOLAR POWER GENERATION

Solar energy is radiant energy from the sun. Solar energy is considered a renewable energy source because the chemical reactions that power the sun are expected to keep generating sunlight for many billions of years.

Solar photovoltaic energy relies upon chemical reactions to generate electricity. Most solar cells used today are composed of thin sheets of purified silicon. These materials are made into flat plates with electrical contacts and leads attached to them. These assemblies are called photovoltaic cells, or solar cells. Multiple cells are arranged together to form solar panels.

Photovoltaic systems rely on the photovoltaic effect. The photovoltaic effect is the creation of an electric current in a material when it is exposed to light. Certain materials produce electricity when they are exposed to light. Sunlight is composed of photons, or bundles of radiant energy. When sunlight shines on a solar cell, photons set electrons in motion which initiates a flow of electric current. Current flows up and out of the cell by way of the contacts and leads. Solar cells are encased behind glass plates to protect them from the environment.

The amount of electricity a solar cell produces depends on the size of the solar cell, its conversion efficiency, and the intensity of the light source. For electric energy applications, cells are connected to form photovoltaic modules called solar panels. Solar cells produce electricity in DC form, which must be converted to AC form by an inverter. For personal or small household use, multiple panels would be needed. The majority of private - use photovoltaic systems require the use of a battery to store energy since photovoltaic systems cannot store electricity. An arrangement of multiple connected solar panels is called an array. For mass electricity generation such as generation in solar power plants by utility companies, large numbers of arrays are arranged across many acres of land, hence the term solar farm. Most solar power plants are tied into the electrical grid and do not use batteries or other energy storage devices.

Even though solar energy systems operate without the production of air emissions, pollutants, or solid wastes, there are a few other environmental concerns associated with them. Certain photovoltaic systems require a large area of land for their solar panels. It is possible that the use of land may have environmental implications such as interference with habitats. The other concern some people have is that the appearance of the large groups of solar panels has a negative aesthetic impact on the environment.

Answer questions 9 through 15 based on information presented in the above passage.

9. Why is solar energy considered a renewable energy source?

A. The materials needed to produce solar panels are abundantly available.
B. Chemical reactions of the sun are expected to keep generating sunlight for billions of years.
C. The production of solar panels uses unlimited natural resources with infinite availability.
D. The solar array assembly process require no use of finite energy sources.

10. What is the main idea of the entire passage?

A. Use of solar photovoltaic cells to produce electricity.
B. Environmental concerns associated with using photovoltaic systems.
C. Using unlimited energy produced by the sun for generating electricity.
D. Construction of solar farms using photovoltaic cells in large arrays.

11. A possible environmental impact of solar power plants is:

A. Cost of the large amount of materials to be processed for solar panels.
B. Large areas of land needed may interfere with habitats.
C. Waste generated in the process of manufacturing solar panels.
D. Public resistance to radiation from solar farms.

12. According to the passage, which of the following is NOT true about solar cells?

A. Solar energy systems operate without producing air emissions or pollutants.
B. Solar cells produce electricity in a form ready for use without conversion.
C. Most solar power plants do not use batteries or other energy storage devices.
D. Large arrays of solar panels may have a negative aesthetic impact on the environment.

13. How does a photovoltaic cell produce electricity?

A. The heat produced by the photons in sunlight sets electrons in motion to create electricity.
B. Photovoltaic solar cells contain materials that expand and contract under sunlight.
C. The photons in sunlight set electrons in a solar cell in motion, initiating a flow of electric current.
D. Photovoltaic solar cells interact with batteries to connect to the electric grid.

14. What is the photovoltaic effect?

A. The creation of an electric current in a material when it is exposed to light.
B. The chemical composition of certain materials excitable by electricity.
C. The measurement of the amount of electricity produced by a solar cell.
D. The protection provided by the construction of solar cells encased in glass plates.

15. Which is the best description of a solar farm?

A. Large amount of agriculture land used for solar production of electricity.
B. An arrangement of multiple connected solar panels.
C. Large areas used for mining of the materials used to manufacture solar panels.
D. Large numbers of solar panel arrays arranged across many acres of land.

PRACTICE TEST #3
FOR
READING COMPREHENSION

The Reading Comprehension selection test measures a candidate's ability to read and understand written materials. The test consists of two reading passages, each followed by several multiple-choice questions about the passage.

Directions
This is a test of your ability to read and understand written materials. This test includes two passages, each followed by questions about the passage. You are to read each passage and then answer the corresponding questions. All questions should be answered based strictly on the information presented in the passage. Do not answer on the basis of experiences you have had, or any information not specifically presented in the passage. To do so might result in choosing an incorrect answer.

For each question, select the best answer from the choices given. Answer all the questions regarding one passage before moving on to the next. You may look back at the passage while you answer the question. This test has **16 questions**.

Practicing taking this type of test will familiarize you with the style of the real selection test. To create conditions most like a real test:

- Practice by taking the complete test with all questions.
- Be sure to set a timer before beginning.
- Aim to finish within 16 minutes to achieve the pace needed to complete within the time allowed for the actual EEI assessment.

PASSAGE 1: EARLY HISTORY OF ELECTRICITY

When we think of the history of electricity, we usually think of Benjamin Franklin. But his famous kite experiment with lightning didn't occur until 1752. The first recorded mention of the electricity was made by ancient Egyptians about electric fish in the Nile River. Until 1821, when Michael Faraday developed a very crude electric motor, discoveries about electricity were limited to scientific theory with no value to the average citizen. Starting in the mid-1800s, however, clever inventors began to see the potential uses of its power. Samuel Morse invented the telegraph in 1835, revolutionizing communication with messages sent long distances via wires. In 1844, Congress approved funds to build a telegraph line from Washington to Baltimore. Telegraph lines quickly spread across the United States. They caught the attention of Thomas Edison, who was a telegraph operator in the Midwest. He moved to the main Western Union telegraph company office in Boston in 1868. He soon turned his efforts to inventing refinements to the telegraph system, such as the ability to send more than one message at once.

In 1878 Thomas Edison founded the Edison Electric Light Company in New York City and bought a number of patents related to electric lighting. On September 4, 1882, Edison opened the Pearl Street Station—one of the first electricity-generating plants. Powered by steam engines, it provided direct current (DC) electricity to customers within a one-mile radius. In lieu of overhead transmission lines, Edison designed a system of underground tubes containing thick copper wire. A few weeks later, a hydroelectric plant began operation in Appleton, Wisconsin. Consumer demand for electric service quickly grew with the use of labor-saving devices such as the electric iron and fan.

Another technological breakthrough was the installation in 1888 of the nation's first large-scale electric streetcar system. It covered twelve miles in Richmond, Virginia. Just as electric lights replaced gas lighting, streetcars replaced horse drawn public transportation. The advent of transformers and the ability to use high-voltage alternating current (AC) rather than just DC further improved the electric power system. The system allows voltage to be stepped up and the high-voltage power to be transmitted long distances and stepped down for consumer use at the end.

Answer questions 1 through 8 based on information presented in the above passage.

1. **What is the first recorded mention of electricity?**

   A. Ben Franklin's experiment with lightning
   B. Egyptian mention of electric fish in the Nile River
   C. Michael Faraday's development of an electric motor
   D. Thomas Edison's electric light company

2. **Early discoveries about electricity were:**

   A. Of great benefit to the average citizen
   B. Curiosities displayed in museums
   C. Limited to scientific theory
   D. Quickly in use across the country

3. **Government funds were used early on to build:**

   A. An electricity plant in New York
   B. A hydroelectric plant in Appleton, Wisconsin
   C. An electric streetcar system in Richmond, Virginia
   D. A telegraph line from Washington to Baltimore

4. **Who revolutionized communication with messages sent long distances via wires?**

   A. Michael Faraday
   B. Thomas Edison
   C. Edward Appleton
   D. Samuel Morse

5. **Based on information in the passage, which of the following statements is not true?**

   A. Thomas Edison invented the light bulb
   B. Thomas Edison invented refinements to the telegraph system
   C. Direct current can be transmitted only over short distances
   D. The Pearl Street Station was one of the first electricity-generating plants

6. **Which of the following increased consumer demand for electricity?**

   A. Electric irons
   B. Electric street cars
   C. Electric lights
   D. Telegraph lines

7. **According to the passage, which of the following is a true statement about transformers?**

   A. Transformers convert alternating current to direct current
   B. Transformers step up voltage for use by consumers
   C. Transformers were first used to charge small appliances
   D. Transformers allow power to be transmitted long distances

8. **Which inventor's invention was essential to the development of electric streetcars?**

   A. Ben Franklin
   B. Michael Faraday
   C. Thomas Edison
   D. Samuel Morse

PASSAGE 2: GENERATING PLANT COMPONENTS

The Furnace. In the furnace, the chemical energy of the fuel is converted into thermal energy (heat) through combustion. The three most common fuels used in fossil fueled plants today are natural gas, oil, and coal. Because of the relative cost and availability of the various fuels, coal had been the first choice for decades. Hydropower and nuclear power do not require a furnace, as combustion is not part of the hydroelectric power or nuclear power generation processes.

The Boiler. In a fossil fuel-fired plant, the heat energy that is released as the fuel burns is absorbed by water in the boiler, converting it to steam.

The Turbine. The third major component of a steam-electric generating station is the turbine. The turbine converts steam energy to mechanical energy. The turbine is essentially a windmill, but it has hundreds of blades. The turbine blades are arranged in groups called stages on a shaft that turns as the steam is forced through the turbine.

The Generator. The main function of a generator is to convert the mechanical energy of the turbine into electrical energy. A generator uses a magnetic force to push electrons along a conductor. The magnet in a generator excites electrons in the conductor and generates an electrical force. A single electron doesn't flow through a conductor and return. Instead one electron from one atom will become excited to the point it will leave its atom. It will collide with another atom, knock an electron free, and then join the atom with which it collided. The continued movement of the magnet keeps the flow of electrons moving through the conductor.

A generator in a power plant may operate by itself or with other generators. Most electrical power utilities have more than one power plant, each plant having more than one generator. When electric demand is low, such as at night, only a few generators will be operating. As the customer demand for electric power increases, more generators are placed in operation to meet the demand. All generators supplying electricity are said to be operating in parallel. In cases where a system is small or a system has only one power plant, it is possible that only one generator is supplying the total system demand. A single generator operating to supply the demand is called an isolated generator.

Answer questions 9 through 16 based on information presented in the above passage.

9. The main purpose of the furnace in a generating plant is to convert:

A. Heat energy into steam
B. Fuel into electricity
C. Chemical energy into thermal energy
D. Nuclear energy into generation energy

10. What source of fuel had been the first choice for many years?

A. Nuclear
B. Coal
C. Solar
D. Oil

11. Why do hydropower and nuclear power not require a furnace?

A. Combustion is not part of their power generation processes
B. Their power sources are more efficient than others
C. Generation of steam is a natural part of the hydropower process
D. Neither of these sources relies on the production of steam

12. The primary purpose of the boiler in a generating plant is to:

A. Connect the furnace to the generator
B. Capture pollution from the furnace
C. Absorb heat from the water
D. Convert water to steam

13. A generating plant requires a turbine to convert:

A. Steam energy to mechanical energy
B. Thermal energy to chemical energy
C. Fuel to electric power
D. Mechanical to electrical energy

14. The main function of a generator is to convert the mechanical energy of the _____into electrical energy.

A. furnace
B. boiler
C. turbine
D. fuel

15. What does a generator use to push electrons through a conductor?

A. Pump
B. Turbine
C. Steam pressure
D. Magnet

16. Most electrical power plants have multiple generators to be able to:

A. Have a spare when one breaks down
B. Meet changes in demand
C. Avoid the case of an isolated generator
D. Keep them operating in parallel

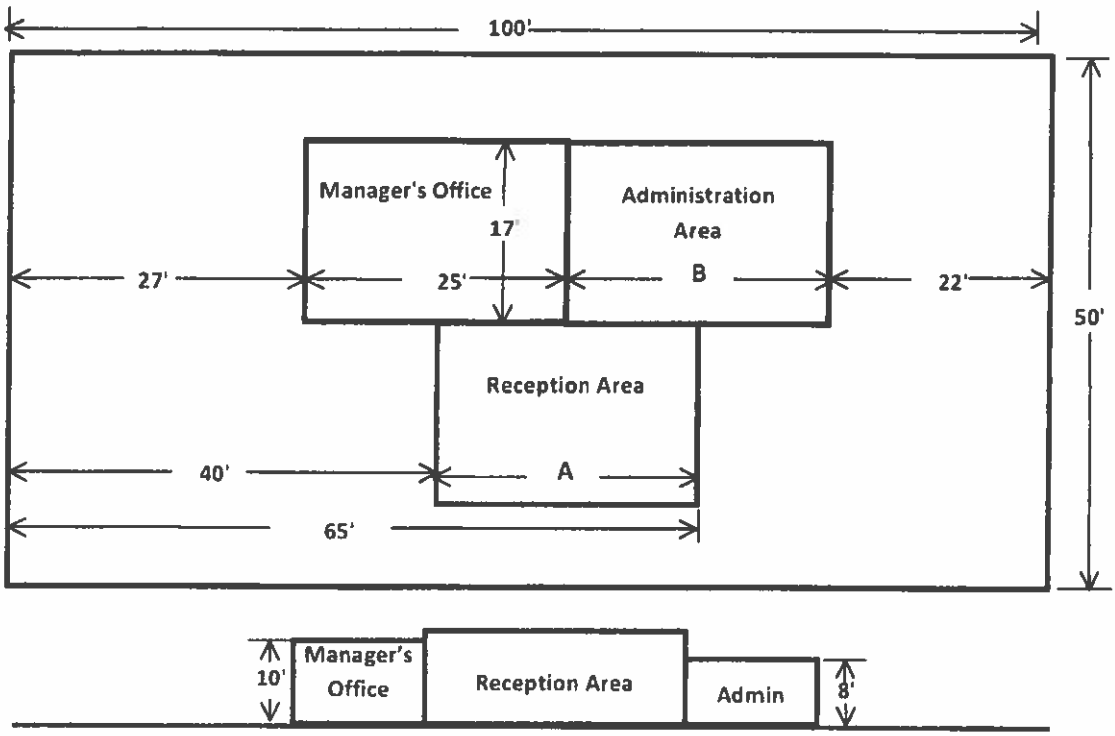
Testing Topic: Graphic Arithmetic

Graphic Arithmetic problems present information about distance and sizes in a drawing. Sometimes it will be called a blueprint, print, or an as-is drawing. These drawings may be on paper or appear in digital format. In most cases, the front of the property or building will be at the bottom of the drawing and the back of the building or property will be at the top of the drawing. Often, you will have more than one drawing, such as the illustration on the next page. The larger drawing is a bird's eye view of the property while the smaller drawing represents the height of structures while standing in front of the property.

You will use the information presented to locate objects on a property, in a right of way or in a structure. Often, not all the distances will be presented in the drawing and you will need to use available information to compute the distance needed for your task.

A common problem is to determine the distance from the property line to the location of a structure to modify or install, such as a pole or gas meter. For example, you may be tasked to install a service drop pole six feet from the foundation of a building at a construction site before construction has begun. In this case, you will need to examine the plans to find the distance between the foundation and the nearest property line and subtract six feet to determine the distance between the property line and the service drop pole.

SOLVING GRAPHIC ARITHMETIC PROBLEMS



Notice the overall dimensions of the rectangle or property, 50' long by 100' wide, and the three buildings or objects within the drawing and the dimensions shown in the drawing. Also note the unknown dimensions, A and B. How would you determine these unknown dimensions?

For distance A, note that the left edge of the Reception Area is 40' from the left edge of the rectangle and the right edge is 65' from the edge of the rectangle. The equation to determine the width is:
A = 65' – 40'
A = 25'

To determine dimension B, subtract the known dimensions from the total width of the property. That is, subtract 27' plus 25' plus 22' from 100'. The equation is:
B = 100' – (27' + 25' + 22')
B = 100' – 74'
B = 26'

PRACTICE TEST #1

FOR

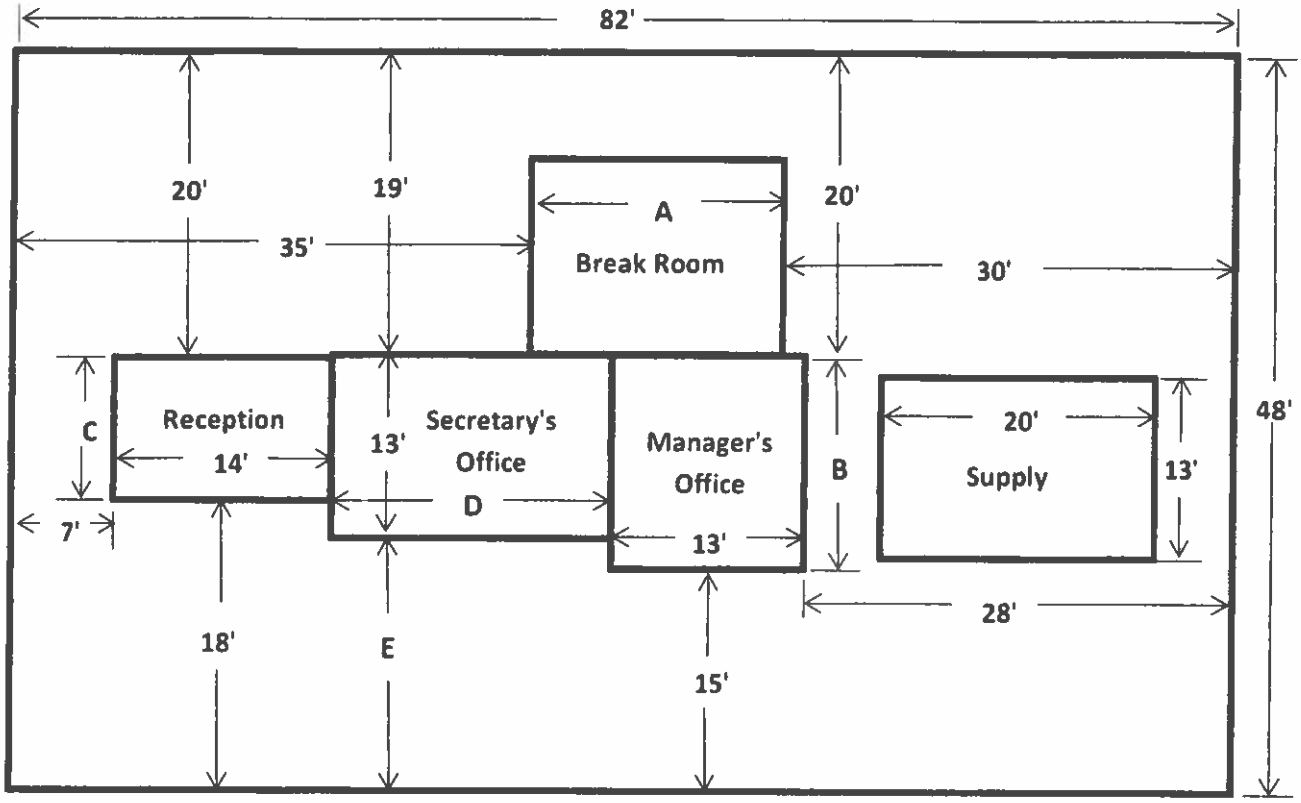
GRAPHIC ARITHMETIC

The Graphic Arithmetic test measures a candidate's ability to solve arithmetic problems by using information from prints or drawings.

This practice test is similar in content and structure to the actual selection test. We recommend that you keep track of your time as you go through the practice tests so that you know how long it takes you to complete each one in relation to the time limits on the actual test. You may use scratch paper and a calculator for calculations.

Directions

This test requires you to use information from drawings to solve problems. You will need to use the dimensions in the drawing to compute distances and areas and compare sizes of different objects.



Question 1

What is the width ("A") of the break room?

A. 13'

B. 17'

C. 27'

D. 35'

Question 2

What is the length ("B") of the manager's office?

A. 7'

B. 11'

C. 13'

D. 20'

Question 3

What is the length ("C") of reception?

A. 10'

B. 14'

C. 20'

D. 27'

Question 4

By how much is the width of supply (from left to right) greater than the width of reception?

A. 4'

B. 5'

C. 6'

D. 7'

Question 5

What is the area of supply?

A. 140 square feet

B. 169 square feet

C. 260 square feet

D. 400 square feet

Question 6

The total length (top to bottom) of the property is _____ times longer than the width of supply.

A. 1.5

B. 2.1

C. 2.2

D. 2.4

Question 7

What is the width ("D") of the secretary's office?

A. 13'

B. 14'

C. 17'

D. 20'

Question 8

What is the distance ("E") between the edge of the property and the secretary's office?

A. 7'

B. 16'

C. 18'

D. 20'

PRACTICE TEST #2

FOR

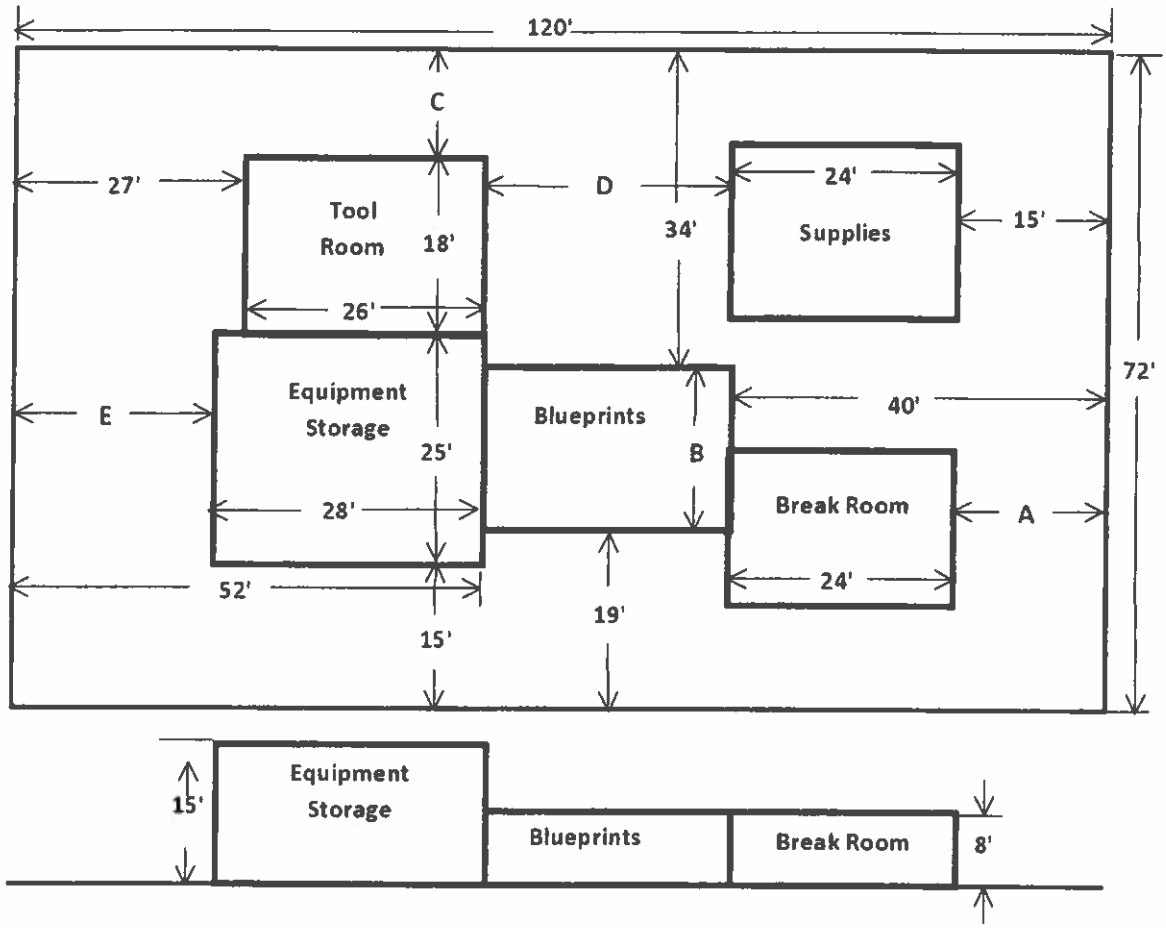
GRAPHIC ARITHMETIC

The Graphic Arithmetic test measures a candidate's ability to solve arithmetic problems by using information from prints or drawings.

This practice test is similar in content and structure to the actual selection test. We recommend that you keep track of your time as you go through the practice tests so that you know how long it takes you to complete each one in relation to the time limits on the actual test. You may use scratch paper and a calculator for calculations.

Directions

This test requires you to use information from drawings to solve problems. You will need to use the dimensions in the drawing to compute distances and areas and compare sizes of different objects.



Question 1

What is the distance ("A") between the break room and the right edge of the rectangle?

A. 13'

B. 16'

C. 27'

D. 35'

Question 2

What is the length ("B") of the blueprints room?

A. 1'

B. 19'

C. 24'

D. 28'

Question 3

What is the distance ("C") between the tool room and the top edge of the rectangle?

A. 10'

B. 14'

C. 20'

D. 27'

Question 4

What is the area of the front wall of the blueprints room?

A. 152 square feet

B. 192 square feet

C. 224 square feet

D. 361 square feet

Question 5

What is the area of the tool room?

A. 140 square feet

B. 169 square feet

C. 260 square feet

D. 468 square feet

Question 6

The total length (top to bottom) of the property is _____ times longer than the length of the tool room (top to bottom).

A. 2

B. 2.5

C. 3.5

D. 4

Question 7

What is the distance ("D") between the tool room and supplies?

A. 20'

B. 23'

C. 28'

D. 30'

Question 8

What is the distance ("E") between the edge of the property and equipment storage?

A. 8'

B. 14'

C. 18'

D. 24'

PRACTICE TEST #3

FOR

GRAPHIC ARITHMETIC

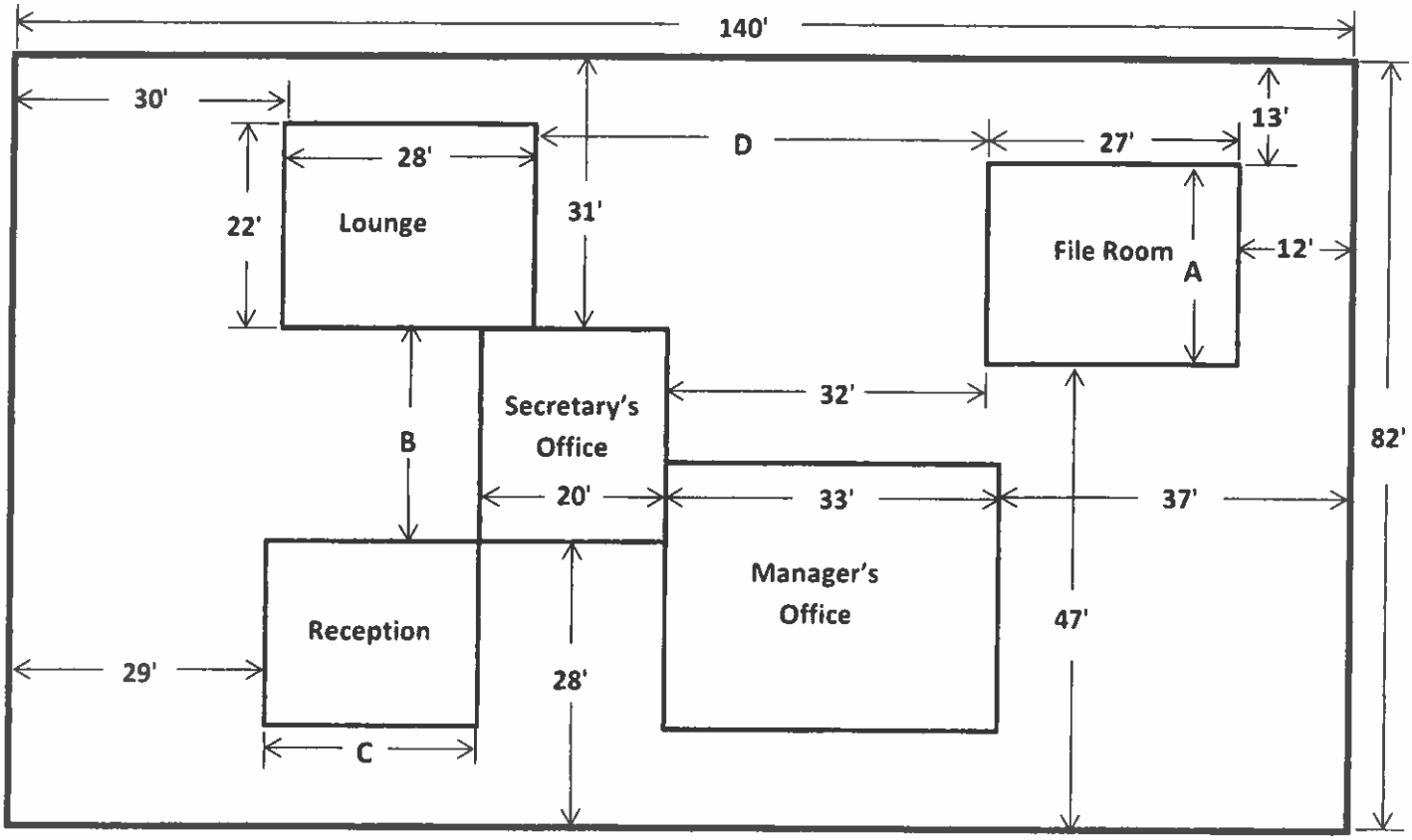
The Graphic Arithmetic test measures a candidate's ability to solve arithmetic problems by using information from prints or drawings.

This practice test is similar in content and structure to the actual selection test. We recommend that you keep track of your time as you go through the practice tests so that you know how long it takes you to complete each one in relation to the time limits on the actual test. You may use scratch paper and a calculator for calculations.

Directions

This test requires you to use information from drawings to solve problems. You will need to use the dimensions in the drawing to compute distances and areas and compare sizes of different objects.

- Practice by completing all 8 test questions
- Be sure to set a timer before beginning
- Finish within 15 minutes to achieve the speed needed to complete the actual EEI assessment within the time allowed



Question 1

What is the length ("A") of the file room?

A. 13'

B. 22'

C. 27'

D. 35'

Question 2

What is the length ("B") of the secretary's office?

A. 18'

B. 22'

C. 23'

D. 31'

Question 3

What is the width ("C") of the reception area?

A. 21'

B. 23'

C. 29'

D. 33'

Question 4

By how much is the width of the manager's office (from left to right) greater than the width of the secretary's office?

A. 32'

B. 28'

C. 25'

D. 13'

Question 5

What is the area of the lounge?

A. 460 square feet

B. 560 square feet

C. 616 square feet

D. 868 square feet

Question 6

The total width of the property is _____ times longer than the width of the lounge.

A. 3.5

B. 4

C. 4.5

D. 5

Question 7

What is the distance ("D") between the lounge and the file room?

A. 43'

B. 37'

C. 29'

D. 27'

Question 8

What is the distance between reception and the manager's office?

A. 19'

B. 20'

C. 22'

D. 23'

PRACTICE TEST #4

for

GRAPHIC ARITHMETICIC

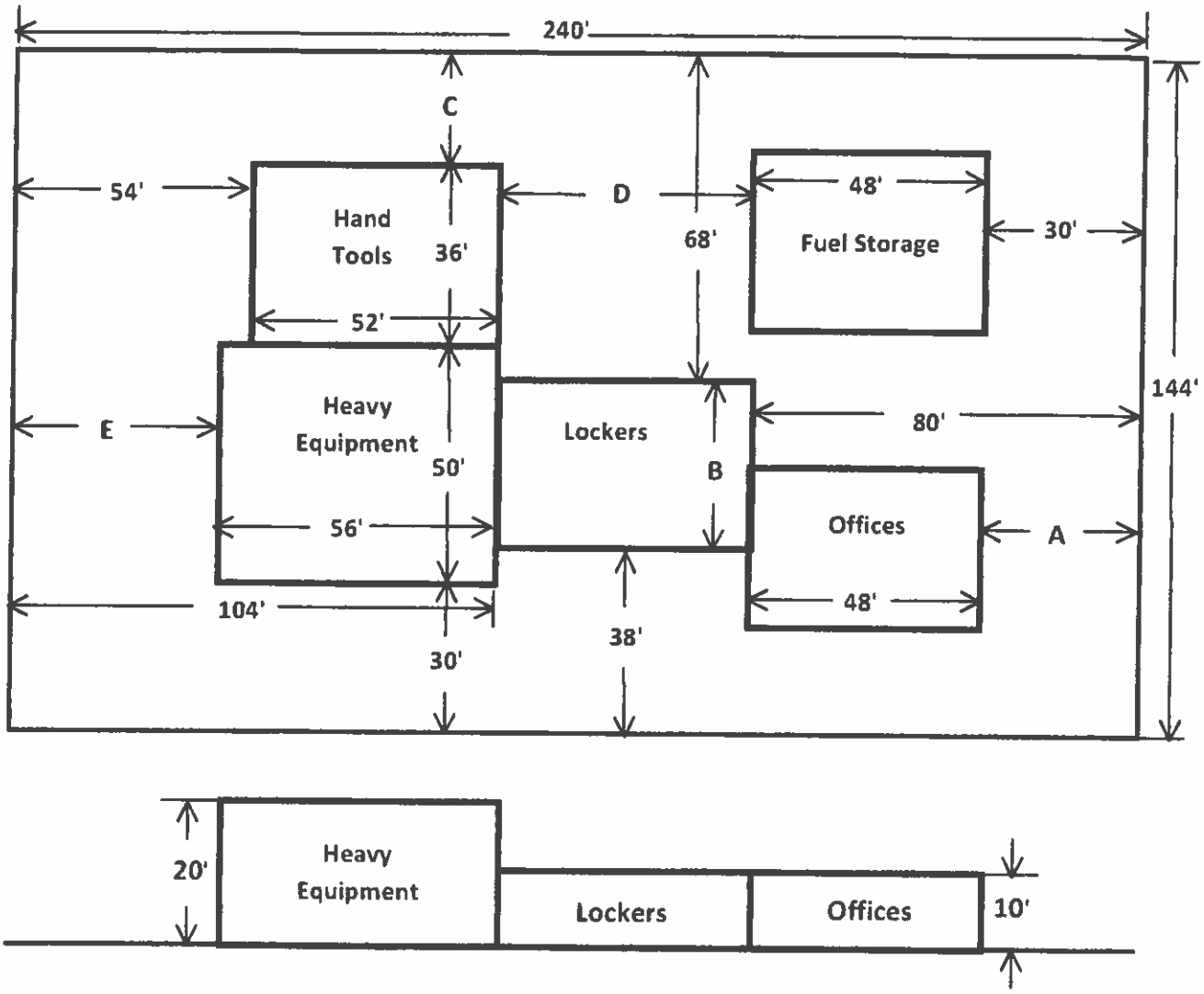
The Graphic Arithmetic test measures a candidate's ability to solve arithmetic problems by using information from prints or drawings.

This practice test is similar in content and structure to the actual selection test. We recommend that you keep track of your time as you go through the practice tests so that you know how long it takes you to complete each one in relation to the time limits on the actual test. You may use scratch paper and a calculator for calculations.

Directions

This test requires you to use information from drawings to solve problems. You will need to use the dimensions in the drawing to compute distances and areas and compare sizes of different objects.

- Practice by completing all 8 test questions
- Be sure to set a timer before beginning
- Finish within 15 minutes to achieve the speed needed to complete the actual EEI assessment within the time allowed



Question 1

What is the distance ("A") between the office building and the right edge of the property?

A. 32'

B. 54'

C. 68'

D. 72'

Question 2

What is the length ("B") of the lockers building?

A. 18'

B. 38'

C. 48'

D. 56'

Question 3

What is the distance ("C") between the hand tools building and the back edge of the property?

A. 20'

B. 28'

C. 40'

D. 54'

Question 4

What is the area of the hand tools building?

A. 560 square feet

B. 680 square feet

C. 1,040 square feet

D. 1,872 square feet

Question 5

By how much is the width of heavy equipment building (from left to right) greater than the width of the office building?

A. 14'

B. 12'

C. 10'

D. 8'

Question 6

The total length (front to back) of the property is _____ times the height of the heavy equipment building.

A. 3.6

B. 6.4

C. 7.2

D. 14.4

uestion 7

What is the distance ("D") between the hand tools building and the fuel storage building?

A. 40'

B. 46'

C. 56'

D. 60'

Question 8

What is the distance ("E") between the edge of the property and the heavy equipment building?

A. 16'

B. 28'

C. 36'

D. 48'

2- HOUR

CAST-R PRACTICE TEST

(given and timed by instructor)

Name:_____ Date:_____

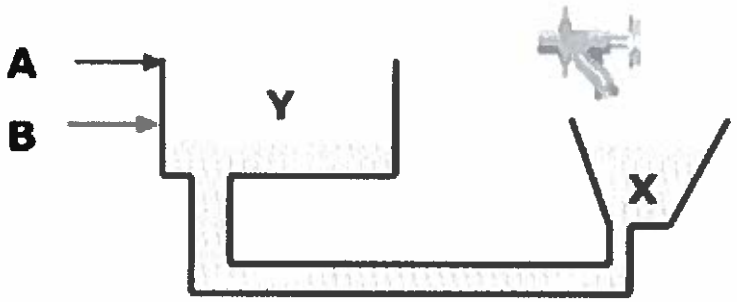
MECHANICAL CONCEPTS PART I

The Mechanical Concepts selection test measures a candidate's ability to understand mechanical principles. Each question contains a pictorial description of a mechanical situation, a question, and three possible answers.

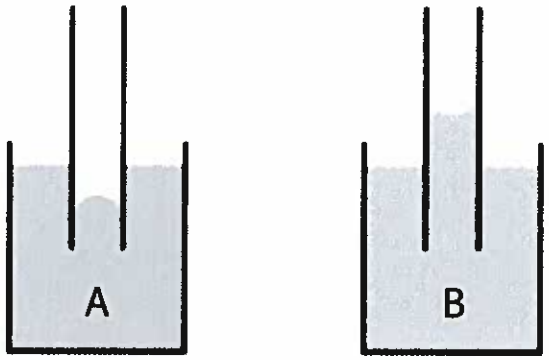
Directions

Read each question carefully, study the picture, and decide which answer is correct. This test has 26 questions and should take you **12 minutes** to complete.

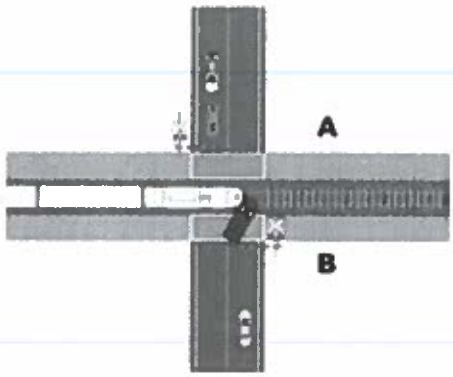
1. The spigot (faucet) shown is turned on, allowing a slight trickle of water to begin filling Tank X. Tank X connects to Tank Y with the piping as shown. The faucet is allowed to stay on until the water completely fills to the top of Tank X. By the time the water reaches the top of Tank X, will the water level in Tank Y be closer to level A or B? (If either are a possibility, mark C.)



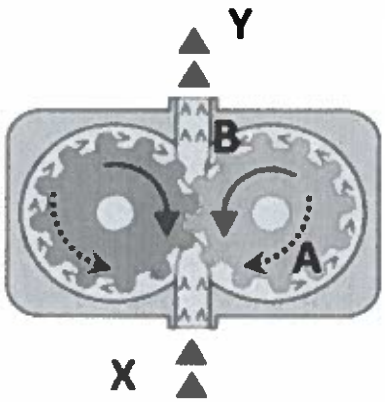
2. In each picture shown, a liquid fills a container that has a tube in the middle. If the containers and their tubes are the same size, with the same volume of liquid placed in each, and the containers are both at sea level, which container (A or B) is more likely to hold water instead of a liquid of greater density? (If equal, mark C.)



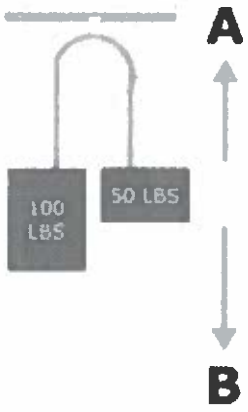
3. When the train hits a stalled car, would it be safer to stand at location A or B to avoid being hit by the car if it moves? Assume the train remains on the track after the collision. (If equal, mark C.)



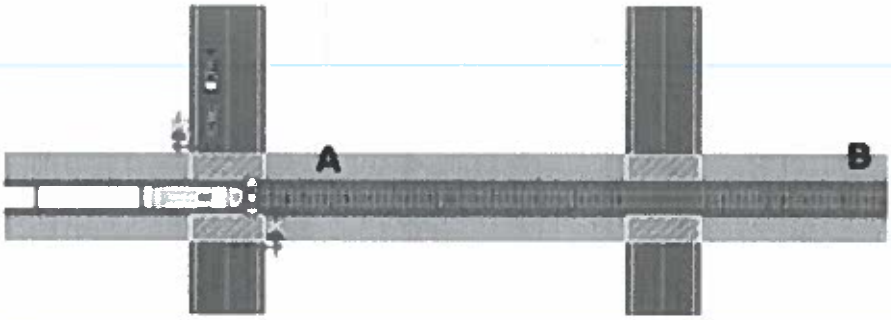
4. Fluid enters the pump in the direction of the arrowheads at position X. Should the internal gears of the pump turn in the direction of the dotted arrows (A) or the solid arrows (B) in order for the liquid to leave the pump at Y? (If either direction will work, mark C.)



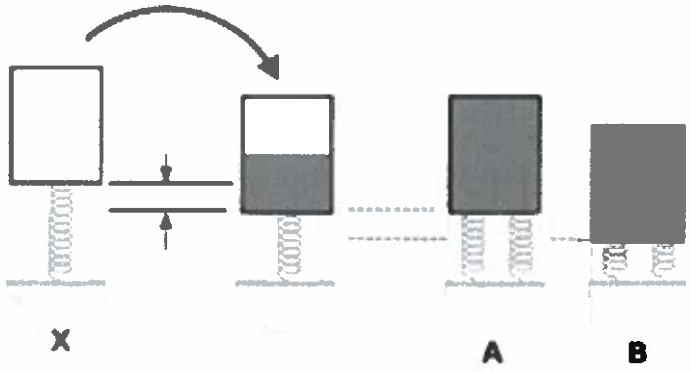
5. Given the pulley loaded as shown, will the 50-pound load accelerate toward A or B? (If neither applies, mark C.)



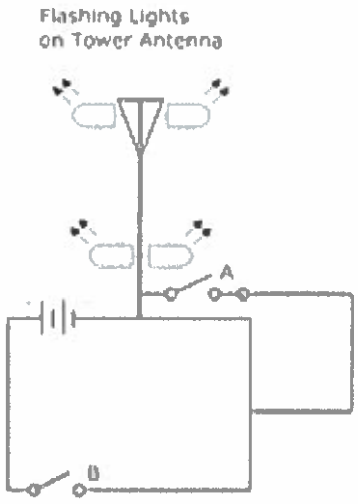
6. As the train hits the stalled car, the train's brakes fail. By crashing into the car, will the train more likely slow to a stop closer to A or B? (If equal, mark C.)



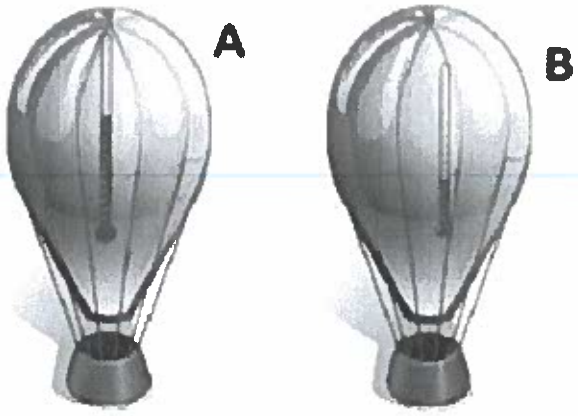
7. A spring supports Tank X. When Tank X fills half-full, the spring compresses as shown. If a second spring is added and the tank is filled completely, will the springs compress as shown in A or B? (If equal, mark C.)



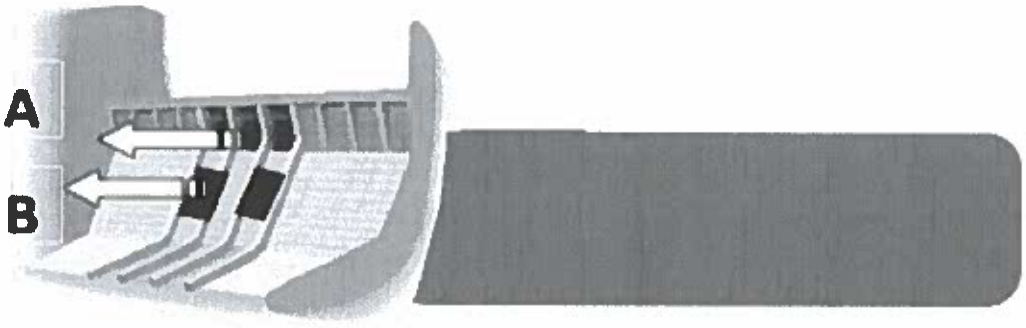
8. Does closing the switch at A or B enable the lights on the antenna to flash and warn the helicopter? (If neither or both, mark C.)



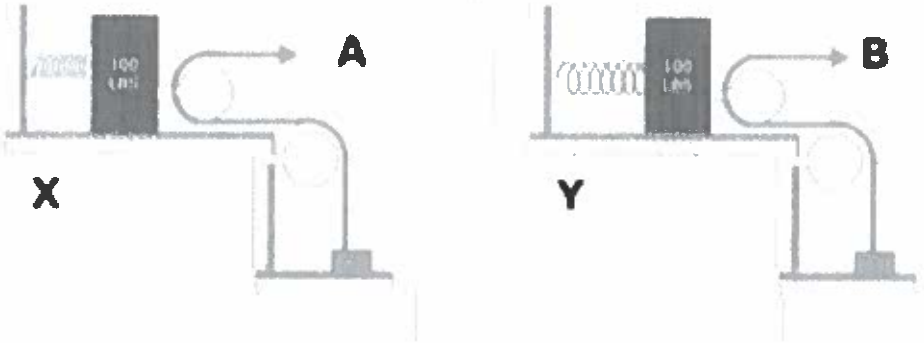
9. For each hot air balloon shown, the thermometer displays the temperature inside the balloon. Which balloon will gain altitude more quickly, A or B? (If equal, mark C.)



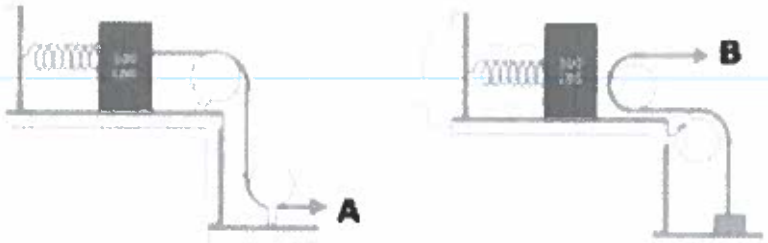
10. The dam releases water through its gates. Will water released at level A or level B jet out with less velocity? (If equal, mark C.)



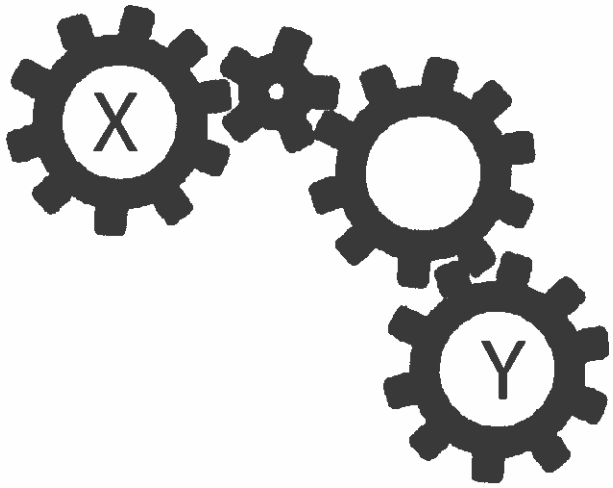
11. In picture X, a 100-pound mass compresses a coil spring and is connected to Pulley A. In picture Y, a coil spring is at rest, not compressed and not stretched, and is attached to a 100-pound mass connected to Pulley B. Which will be easier to move, Pulley A or Pulley B? (If equal, mark C.)



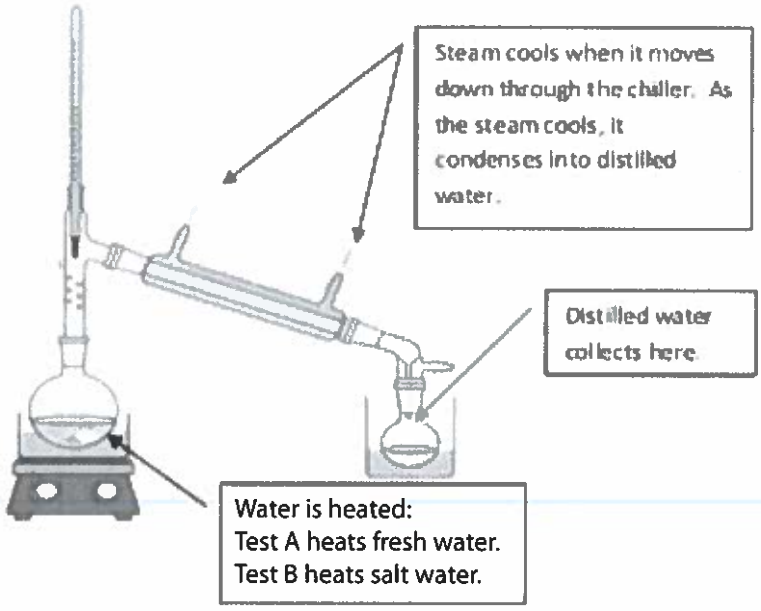
12. Is more force required at A or B to move the 100-pound weight to the right? (If equal, mark C.)



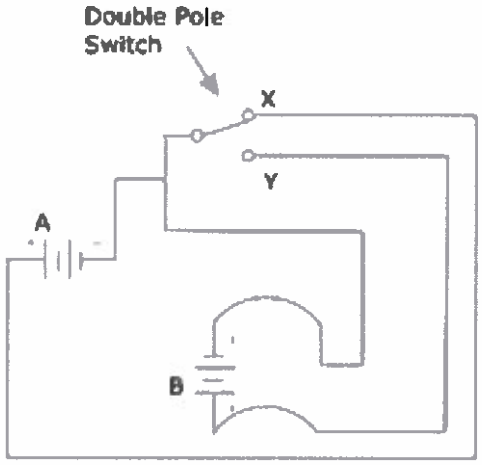
13. When gear X turns clockwise, will gear Y turn counterclockwise (A) or clockwise (B)? (If equal, mark C).



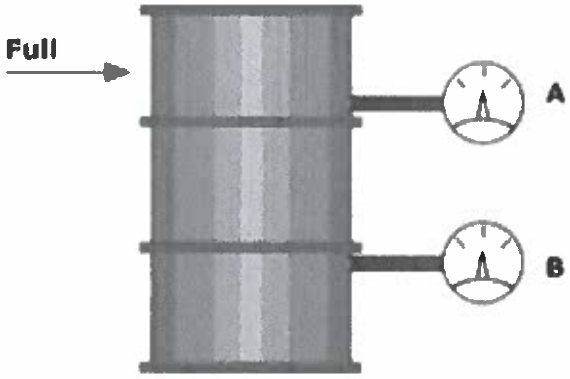
14. The figure below illustrates the process for distilling water. When heated, which would produce more distilled water, fresh water (A) or salt water (B)? (If equal, mark C.)



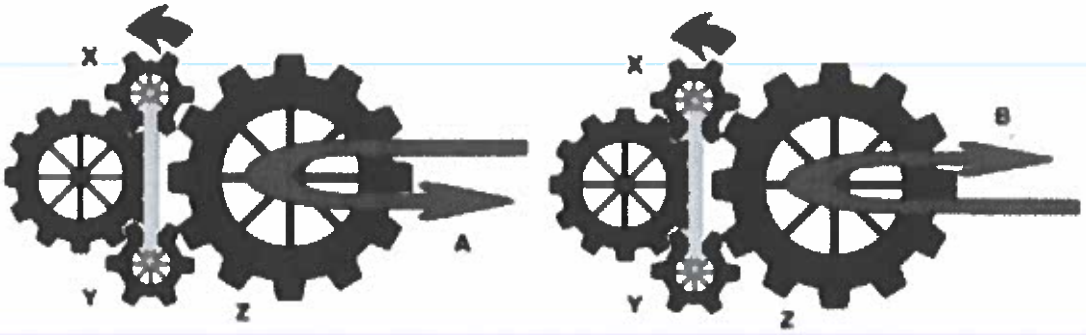
15. Does battery A or battery B power the double pole switch when it is closed to position X? (If either battery powers the switch when it is in position X, mark C.)



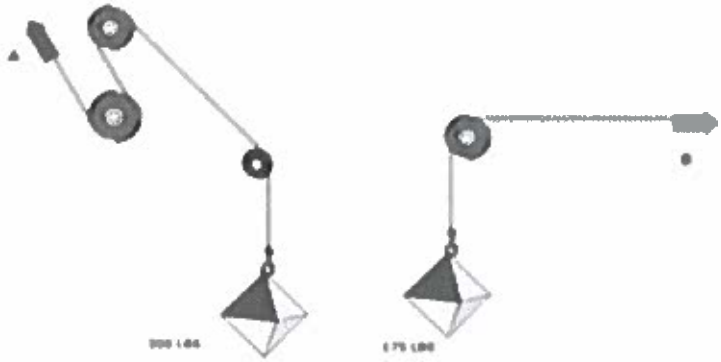
16. Assuming the liquid in the container is level with the Full line and pressure readings are taken when the container is full, will the gauge read a higher pressure at A or B? (If equal, mark C.)



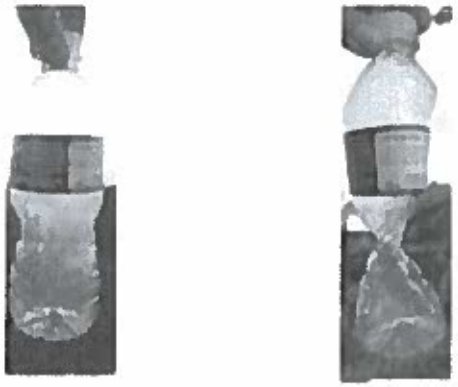
17. The pair of gears X and Y both move in the direction of the arrow (counter-clockwise). When gears X and Y are in motion, will the pulley powered by gear Z move in direction A or B? (If either direction could result, mark C.)



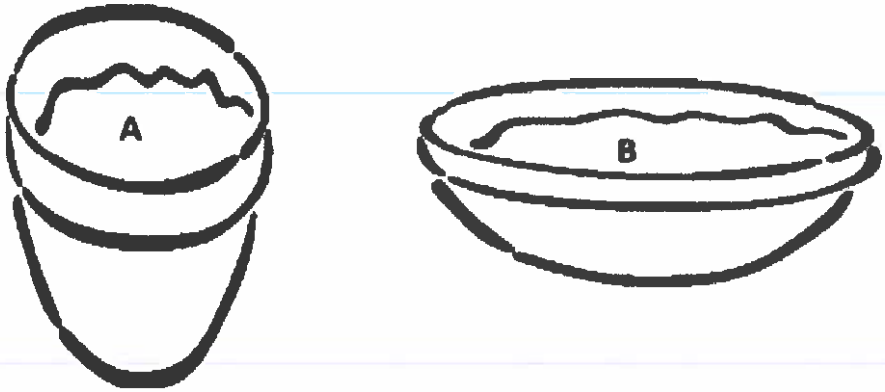
18. Will a motor pulling at point A or at point B require more work to lift the load? In both cases, the pulleys do not move with the load. (If equal, mark C.)



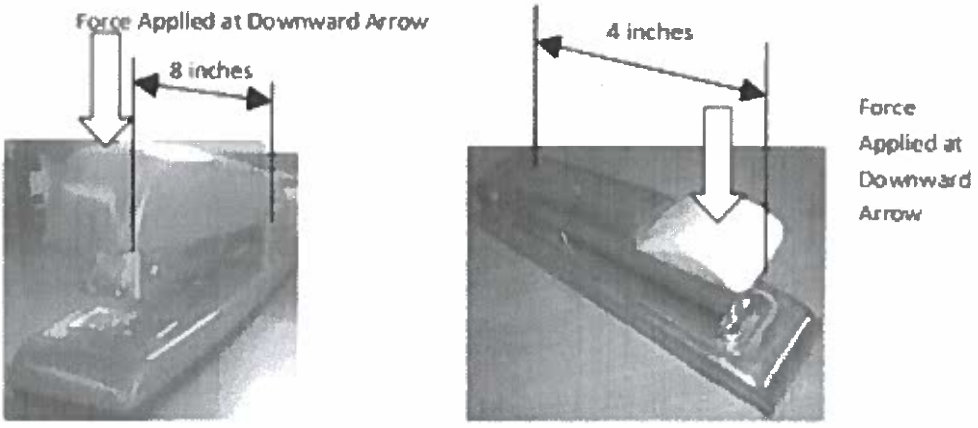
19. A bottle is sealed and then transported from location A to B. At location B, the bottle begins to collapse. Is the altitude higher at location A or location B? (If equal, mark C.)



20. Bowls A and B contain the same volume of the same type of liquid. Assume the temperature of the liquid, the bowl, and the outside temperature are all the same. If so, from which bowl will evaporation occur more quickly, A or B? (If equal, mark C.)



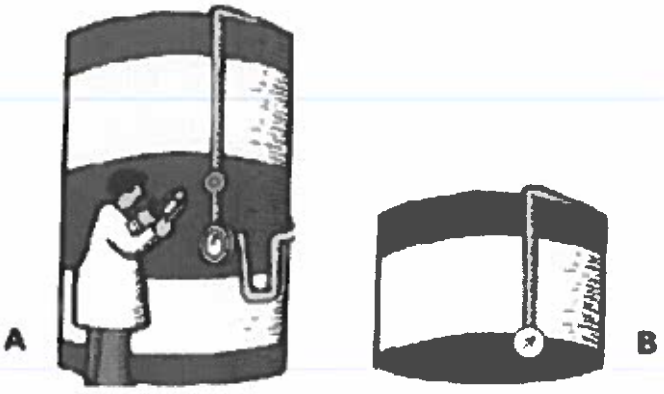
21. Each of the two staplers is used to staple together a stack of 20 pages. Stapler A has a greater distance between its open jaw and its pivot point (as shown by the dimension line). Stapler B has a smaller distance between its open jaw and its pivot point (as shown by the dimension line). Which stapler, A or B, will require greater force applied to staple the papers, if the force is applied as shown? (If equal, mark C.)



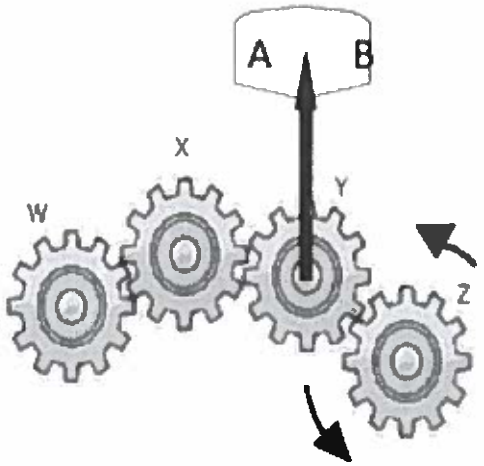
A B

22. A flask containing water is loaded onto the lever at the position shown. If the type of water is seawater (A) or freshwater (B), which flask moves the end of the lever farther down? (If equal, mark C.)

23. Tank A holds exactly twice the volume of Tank B. Both tanks contain the same type and mass (amount) of gas. For the pressure gauge on each tank to read the same, is the temperature higher in Tank A or Tank B? (If equal, mark C.)

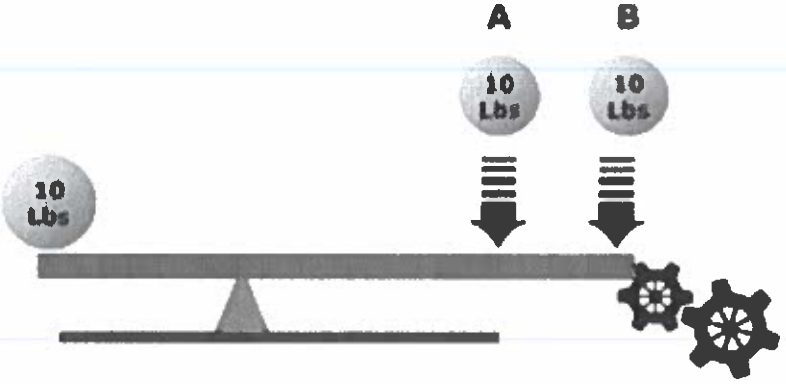


24. Gear Z moves as shown. A gauge pointer attached to Gear Y indicates when it moves and in what direction. When Gear Z rotates counterclockwise, will the gauge pointer attached to Gear Y move toward A or B? (If neither, mark C.)



25. Consider a load applied to each end of the lever in the direction of the arrows shown. Does the load need to be heavier at A or B in order to keep the lever balanced? (If equal loading at each end keeps the lever from moving, mark C.)

26. If the lever shown is not balanced, it will not make contact with the gears and move them. A 10-pound load sits at the left end. Will placing a 10-pound load at location A or B more likely cause the gears to move? (If equal, mark C.)



Name:_____ Date:_____

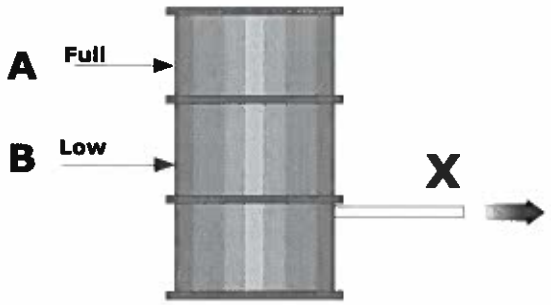
MECHANICAL CONCEPTS PART II

The Mechanical Concepts selection test measures a candidate's ability to understand mechanical principles. Each item contains a figure of a mechanical situation, a question, and three possible answers.

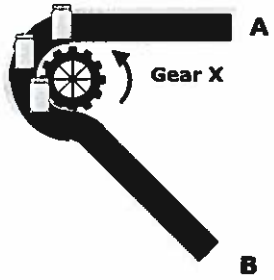
Directions

Read each item carefully, study the figure, and decide which answer is correct. This test has 15 questions and should take **6 minutes** to complete.

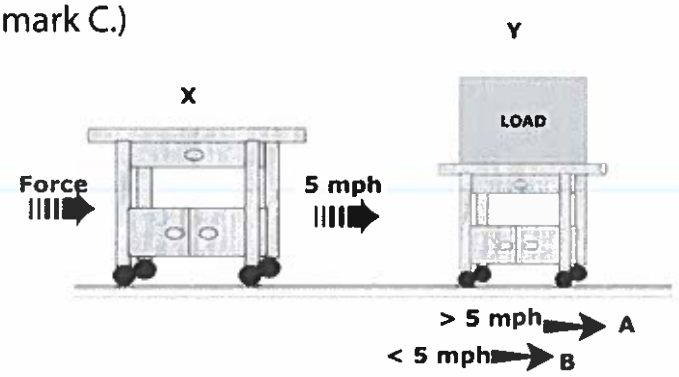
1. The drum of oil is full when filled to level A, and low when filled to level B. When the oil spills out through pipe X, will its flow rate at pipe X's outlet be higher if pipe X was opened when the tank was at A or at B? (If equal, mark C.)



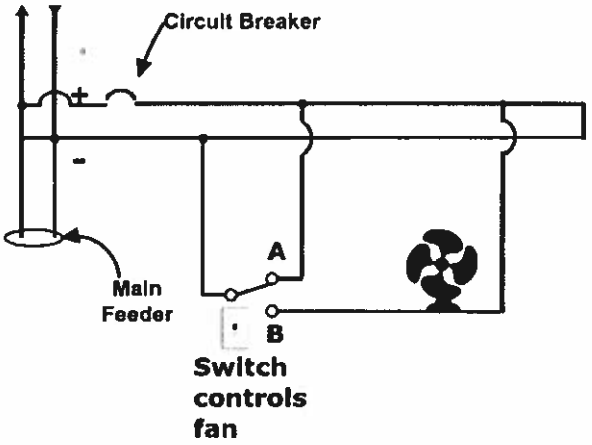
2. When Gear X rotates counterclockwise, the conveyor belt moves the three bottles. Will the bottles travel toward A or B when Gear X rotates? (If either direction is possible, mark C.)



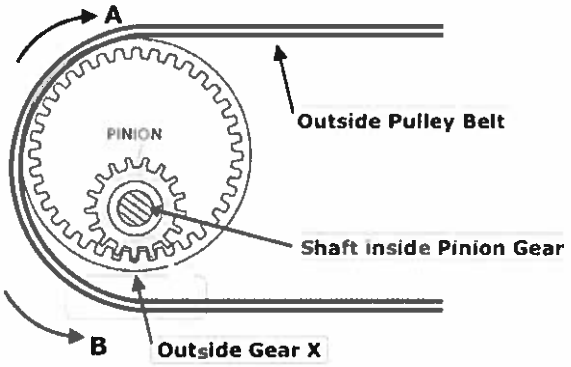
3. Cart X is not loaded and has a mass of 50 pounds. Cart Y is loaded and with its load it weighs 100 pounds. Cart X is given a hard push so that it moves toward Cart Y at a steady 5 mph. After Cart X hits the stationary Cart Y, will its velocity be greater than its original velocity (A) or less than its original velocity (B)? (If neither applies or is possible, mark C.)



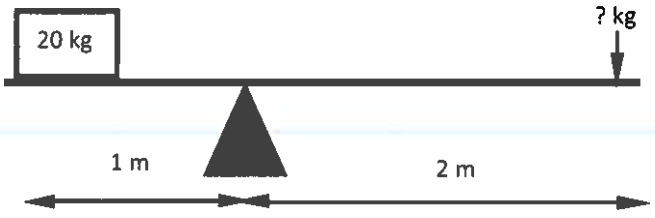
4. Does the switch controlling the fan need to be closed at A or B for the fan to work? (If either, mark C.)



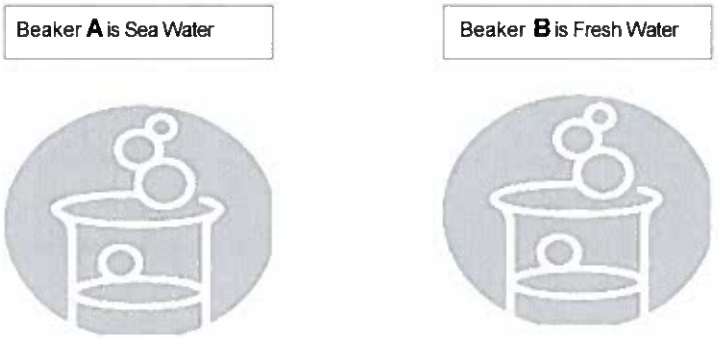
5. When the shaft inside the pinion gear moves clockwise, will the outside pulley belt rotate toward A or B? (If either is possible, mark C.)



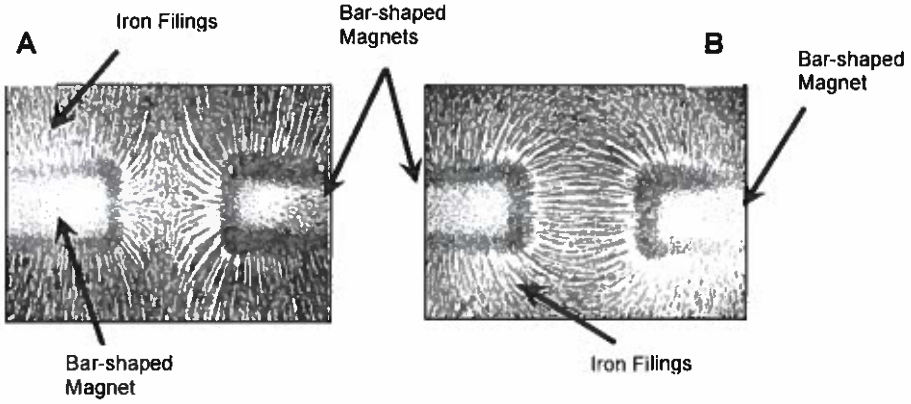
6. How much weight is needed to balance the lever? 20 kg (A) or 10 kg (B).



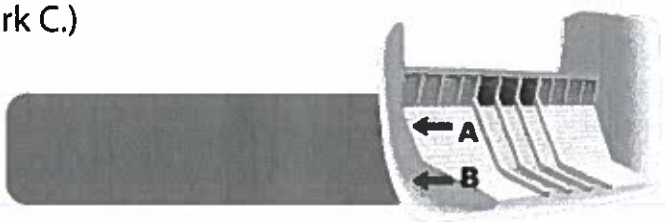
7. Given the same conditions, which beaker will evaporate more quickly over time, A or B? (If equal, mark C.) Beaker A is seawater; beaker B is freshwater.



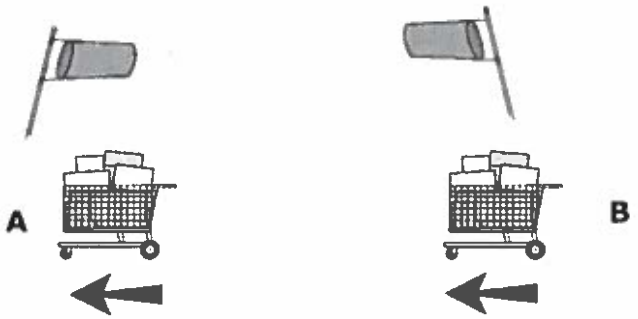
8. The pictures show how iron filings behave when laid over two bar-shaped magnets with ends near each other. The iron filings are shaped as if long, thin needles oriented parallel to the magnetic field lines. In one picture, the magnets are attracted to each other because their opposite poles are close together. In the other picture, the magnets repel each other because their similar poles are close together. From the position of the iron filings in the pictures, which set of magnets has their opposite poles next to each other, A or B? (If both or neither, mark C.)



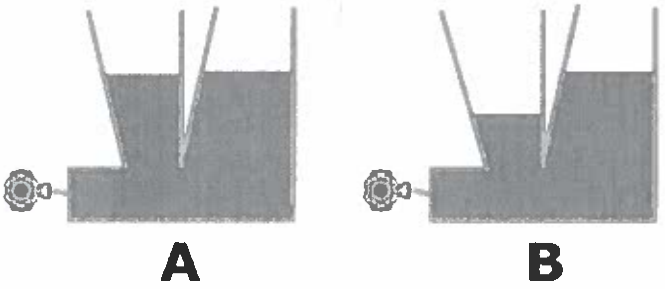
9. If the strength of this dam is based upon the thickness of the material from which it is built, should the dam be thicker at point A (near the top) or point B (near its base) in order to counteract the force of the water behind the dam? (If equal, mark C.)



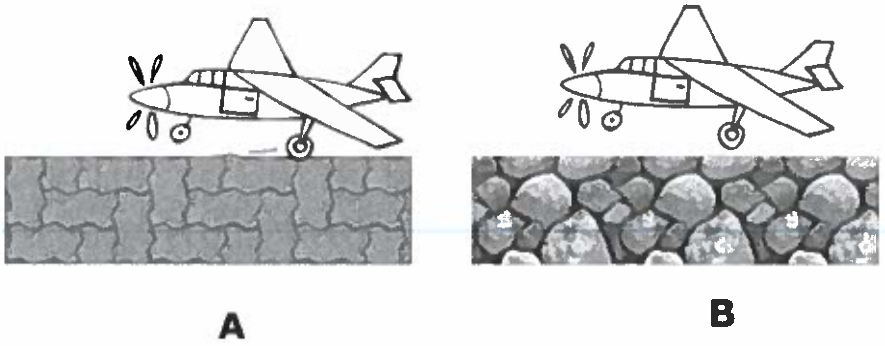
10. Which loaded cart, A or B, will be easier to move in its forward direction? (If equal, mark C.)



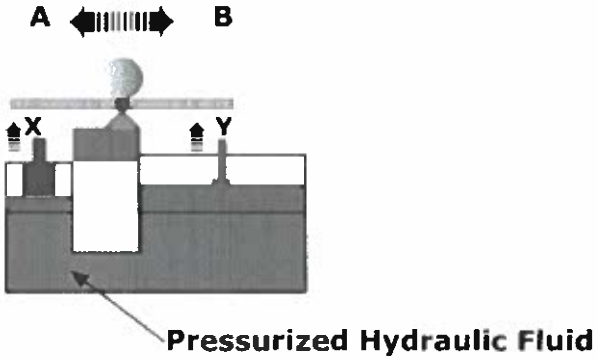
11. The faucet shown fills the container. Does condition A or condition B better represent how the container will fill? (If neither applies, mark C.)



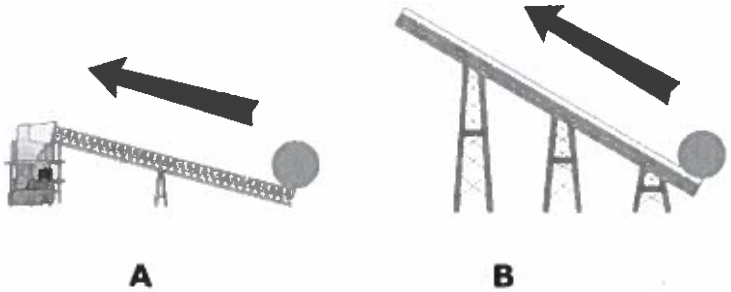
12. Airplanes A and B are the same model, with identical engines, same loaded mass, and same propeller speed. Both are on a level runway. The runway beneath Airplane A is paved. The runway beneath Airplane B is cobblestone. Both airplanes take off at the same time. Which airplane, A or B, is more likely to become airborne first? (If equal, mark C.)



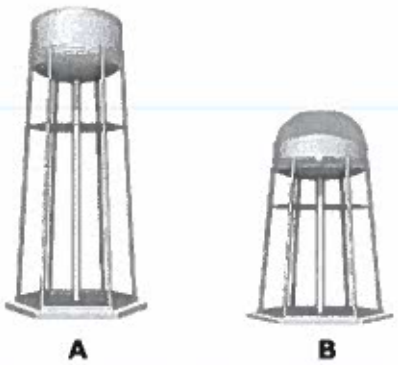
13. Pressurized hydraulic fluid flows freely between the two hydraulic rams X and Y. When the hydraulic rams push upward beneath the lever, it moves. When the lever moves, does the ball resting atop the lever roll toward A or B? (If neither applies, mark C.)



14. Each conveyor belt moves the same load from bottom to top over a total distance of 100 feet. If each conveyor begins at the same time and under the same power, which load will reach the top first? (If equal, mark C.)



15. Water tanks A and B are both installed at sea level with piping to access the water at their base. Which water tank, A or B, will require less power to serve a community at a higher elevation? (If equal, mark C.)



Name:_____ Date:_____

READING COMPREHENSION

The Reading Comprehension selection test measures a candidate's ability to read and understand written materials. The test consists of three reading passages, each followed by several multiple-choice questions about the passage.

This practice test is similar in content and structure to the real selection test. We recommend that you time yourself while taking the practice test to get a feel for how much time you will have to complete the real selection test. It may be to your advantage to complete all practice test questions. Answers and explanations for the practice test questions will be provided by the instructor at the end of the practice test. You should consult these answers only after completing all the practice test questions.

Directions

This is a test of your ability to read and understand written materials. This practice test includes three passages, each followed by questions about the passage. You are to read each passage and then answer the corresponding questions.

All questions should be answered based strictly on the information presented in the passage. Do not answer on the basis of experiences you have had, or any information not specifically presented in the passage. To do so might result in choosing an incorrect answer.

For each question, select the best answer from the choices given. Answer all the questions regarding one passage before moving on to the next. You may look back at the passage while you answer the questions. This practice test has 27 questions and should take you **24 minutes** to complete.

PASSAGE 1: ELECTRIC POWER GENERATION

Most electricity is generated by electromechanical generators that are driven by mechanical energy forces. The most common electricity generation mechanical force source is what is referred to as a "steam-electric cycle." Water (in liquid form) is heated in a furnace to produce steam. Steam rushes past the windmill (fan blades of a turbine) connected by a driveshaft to an electricity generator. It is the mechanical force of the steam that rotates the turbines.

The simplest form of a boiler could be a tea kettle. When a tea kettle is placed over a source of heat, the water inside the kettle begins to boil and steam is discharged from the spout. Steam, like controlled wind, can be used to turn blades on a shaft to generate electricity to illuminate a light bulb. Blades turned by steam are the basic principle on which steam power plants operate. The actual equipment in a steam power plant is much more sophisticated, yet the principle remains the same.

A boiler is defined simply as a large vessel enclosed by an assembly of metal tubing in which water is heated and steam is generated and superheated under pressure by the application of additional heat. Although this definition lends itself to a wide interpretation concerning boiler design, the primary purpose remains the same—that of converting water to steam. The boiler must be constructed and operated to separate the vapor phase (steam) in an effective manner from the liquid phase (water). The three basic functions of the boiler are pressure containment, heat transfer, and steam separation.

Typically, a fuel source ignites as it enters the furnace and the heat of the combustion transfers to the water that circulates through the metal tubing in the boiler. This water leaves the boiler as superheated steam, at about 1,000 degrees Fahrenheit, which passes through a turbine and rotates the turbine's fan blades.

The superheated steam from the boiler enters the first stage (high pressure) and goes through a nozzle into the second stage (intermediate pressure). From the second

stage, the steam goes through another nozzle into the third stage (low pressure). As the steam goes through the three stages, it continues to lose temperature and pressure and to expand until it is exhausted from the third stage. This example is a better method for turning the shaft and generator than the simple windmill as describe earlier.

Chemical energy in the form of fuel is converted to heat energy in the form of high temperature-high pressure steam. The steam turns a turbine, thereby converting the heat energy into rotating mechanical energy. The turbine rotor is connected to the rotor of the main power generator. As the turbine rotor turns, so turns the rotor of the generator. The generator rotor is made to produce a magnetic field. The action of the rotating magnetic field changes the mechanical energy into electrical energy, which is sent to the transmission system. Electrical energy is the end product for which the power plant is built.

The power plant main generators produce electrical power, which is conveyed to the transmission system along with electricity produced by the other main generators on the utility's system. Other smaller-sized generators perform other functions in the subsystems with the plant. These subsystems provide the support necessary to control, operate, and maintain the energy conversion processes of the plant.

Answer questions 1-9 based on information presented in Passage 1.

1. **Which of the following is NOT a basic function of the boiler?**
   A. Heat transfer
   B. Steam separation
   C. Pressure relief valve
   D. Pressure containment

2. **What happens to the superheated steam?**
   A. Can be piped to buildings for heating
   B. Expands when passing through the turbine
   C. It is drier and less likely to condense in the turbine
   D. Passes through a turbine and rotates the turbine blades

3. **The power plant main generators produce electrical power. Where is the electrical power sent?**
   A. Transported to subtransmission interconnection switching station
   B. Transported to the transmission system
   C. Conveyed to the subtransmission station
   D. Collected at the substation

4. **What is a vessel in which water is heated and steam is generated?**
   A. Simple boiler
   B. Boiler reactor
   C. Boiler turbine
   D. Boiler generator

5. **What is the simplest form of a boiler?**
   A. Steel box
   B. Tea kettle
   C. Stoker fired furnace
   D. Coal-burning steam boiler

6. **Which of the following is NOT a characteristic of a simple three-stage turbine?**
   A. Loss of pressure
   B. Loss of temperature
   C. Expands until exhausted
   D. Separates the vapor phase

7. **What is the action of a rotating magnetic field?**
   A. Convert all of the input into useful power
   B. Change the mechanical energy into electrical energy
   C. Produce induces current in the armature winding of the stator
   D. Move current when conductors are connected to an external load

8. What type of energy is produced by steam turning a turbine?

A. Mechanical energy
B. Chemical energy
C. Electrical energy
D. Steam energy

9. What is the most common electricity generation mechanical force source?

A. A large vessel enclosed by metal tubing
B. Enclose the fire in a steel box
C. Steam-electrical cycle
D. Coal-burning steam boilers

PASSAGE 2: TRANSMISSION SYSTEM OVERVIEW

Electric power transmission, also referred to as high voltage electric transmission, can be defined as the bulk transfer of electrical energy from power generation plants to substations. The transfer of electrical energy from substations to the customer is referred to as distribution.

Transmission serves two main purposes: to transfer electricity from generation plants and to interconnect various systems. This interconnection of transmission lines is often referred to as the electrical power grid or, simply, "the grid." Most of the power generated in the station passes through the generating plant switchyard to the transmission system.

About 5-8% of the generated power is used within the plant to operate the equipment necessary to run the plant. The switchyard contains all the equipment necessary to transform and route power (buses, circuit breakers, disconnects, transformers, protective relays, monitoring and controlling devices, and insulators and supporting structures), which together move the power from the generator to the transmission system transformers. A bus is a specially designed conductor having low resistance. The switchyard also houses protective relays, monitoring and controlling devices, and insulators and supporting structures, which move the power from the transmission system to the distribution system.

The electric power transmission process is complex when moving electricity through the transmission system. Electricity produced by power generation plants is first routed to substations at or near the plant. These substations use transformers to "step up" the voltage of electricity in preparation of the movement through the transmission lines from one point to another with a minimum loss of electrical energy. Required voltage levels depend on the distance that electricity must travel though the transmission system. Electricity then exits from the transmission system to be further distributed for consumer use at substations where the electricity must go through another transformer to "step down" the voltage to a lower level.

The principle of electric power transmission uses two main types of currents used in electricity applications: direct current (DC) and alternating current (AC). In DC, an electric charge flows in one direction. In AC, an electric charge flows back and forth, rapidly reversing direction many times each second. Whether AC or DC current is used in an electrical application often depends on the type of voltage source.

An AC voltage source reverses the positive and negative terminals many times per second. In the majority of AC circuits, the voltages and currents cycle at a rate of 60 times per second. This cycling is called the frequency. Frequency is measured in cycles per second or hertz (Hz). Commercial power generation companies in the United States utilize a 60-hertz current.

AC transmission lines typically carry a three-phase current, and the voltage varies depending on the particular system or grid. DC transmission towers typically only carry lines in pairs, one positive current and one negative current.

Answer questions 10-18 based on information presented in Passage 2.

10. What type of current is only carried in pairs, one positive current and one negative current, on transmission towers?

A. AC
B. DC
C. HVAC
D. HVDC

11. What is frequency measured in?

A. Reduces voltage between the source and load
B. Measures electrical current waveforms
C. The flow of alternating current
D. Cycles per second

12. Which of the following is the characteristic of DC current as it flows through the electric power transmission lines?

A. Less expensive
B. Lower electrical loss
C. Electric charge flows in one direction
D. Allows large amounts of power over greater distances

13. After entering the substation, what must happen to the electricity before it is distributed for consumer use?

A. Step down the voltage to a lower level
B. Force current through a conductor
C. Adjust voltages for the power grid
D. Decrease energy for delivery

14. What is the purpose of stepping up the electricity voltage?

A. Deliver at required voltage
B. To meet the customer's needs
C. Minimize loss of electrical energy
D. Reduce the resistance in a conductor

15. What is a specially designed conductor having low resistance?

A. Wire
B. Bus
C. Cable
D. Power line

16. What is contained in the switchyard?

A. The equipment necessary to transform and route power
B. Facility increase overall delivery system reliability
C. Facilities for monitoring the system operation
D. Detects abnormalities

17. According to the text, the interconnection of transmission lines is referred to as:

A. Electrical substation switchyard
B. Electrical subtransmission substation
C. Electrical power grid or, simply, "the grid"
D. Electrical generating plant switchyard

18. What is the definition for the term "distribution"?

A. Electric power transmission between substations
B. The transfer of electrical energy from the substation to the customer
C. The transfer of transmission system power to the distant substations
D. The transfer of the interconnection system to the electric power grid

PASSAGE 3: DISTRIBUTION SYSTEM OVERVIEW

The voltages that are required for bulk electricity transmission are too high for most consumer applications. Lower voltage levels are required for electricity to flow safely through smaller cables and distribution lines. At transmission interconnection intervals such as substations, some of the electrical energy is tapped off of the transmission lines. These substations step the voltage down to lower voltage levels with large power transformers.

Substations are interconnected and dispersed among high-voltage transmission lines and distribution lines. They typically consist of one or more power-transformer banks that contain multiple transformers. These transformers are electrical devices that change the alternating current of one voltage to another voltage. A step-down transformer has more turns in the primary winding than in the secondary winding. Voltages are higher in the primary circuit than in the secondary circuit.

These substations vary in size depending on the system they are servicing. Most substations are constructed in an area where the vegetation has been removed, and the lot is filled with gravel and is fenced and gated for safety and security.

Substations are interconnected to the transmission system and distribution system by two methods:

- High-voltage transmission circuits carrying 138 kV or 230 kV directly step down voltage to distribution connections carrying 13 kV.

- High-voltage transmission, circuit-supplying switching stations step down voltages to a subtransmission voltage level commonly in the range of 26 to 34 kV. The subtransmission circuit's voltage level can easily be routed along public streets on wood poles or through underground cables to industrial, commercial, and utility substations. These subtransmission-supplied substations provide system monitoring and control for distribution circuits in the 4 and 13 kV range.

Some customers need higher voltage levels than what is typically provided from a residential distribution circuit but do not need voltages that are high enough to warrant a direct connection to the transmission system. These high-use customers are serviced by special distribution connections at voltages ranging from 7.2 kV to 14.4 kV through a service drop line, which comes from a transformer on or near a distribution pole to the customer's end-use structure.

Residential customers require electricity that is distributed at a reduced voltage, typically 120/240 volts (single phase). This reduced voltage is usually achieved through a pole-mounted or pad-mounted transformer.

In other instances, the service line might be buried, as is the case with underground distribution lines. Residential electrical power is delivered to residential customers through what is referred to as a service drop line, which leads from the distribution pole transformer to the customer's structure via overhead distribution lines.

Answer questions 19-27 based on information presented in Passage 3.

19. How is the voltage reduced to 120/240 volts for residential customers?

A. This reduced voltage is usually achieved at the switching station
B. This reduced voltage is usually achieved at a transmission interconnection substation
C. This reduced voltage is usually achieved from a transformer on or near a distribution pole
D. This reduced voltage is usually achieved through a pole-mounted or pad-mounted transformer

20. What device changes the alternating current of one voltage to another voltage?

A. Substation
B. Transformer
C. Distribution bus
D. Switching station

21. Which of the following is NOT a characteristic of a substation constructed area?

A. Gated for security
B. Fenced for safety
C. Manicured lawn
D. The lot is filled with gravel

22. What is one of two methods a substation is interconnected to the transmission system and distribution system?

A. High-voltage transmission circuits carrying 138 kV or 230 kV directly step down voltage to distribution connections carrying 13 kV
B. High-voltage transmission circuits carrying 38 kV or 110 kV directly step down voltage to distribution connections carrying 4 kV or 13 kV
C. High-voltage transmission circuits carrying 108 kV directly step down voltage to distribution connections carrying 4 kV
D. High-voltage transmission circuits carrying 38 kV directly step down voltage to distribution connections carrying 14.4 kV

23. What happens to this electrical power after it is tapped off the transmission lines at the substation?

A. Step the voltage down to lower voltage levels
B. Routed directly to a building's service line
C. Route power to a specific service area
D. Route power to smaller area

24. What type of service drop line is used for high-use customers?

A. A service drop line with a voltage ranging from 7.2 kV to 14.4 kV
B. A service drop line with a voltage ranging from 3 kV to 13 kV
C. A service drop line with a voltage ranging from 26 kV to 34 kV
D. A service drop line with a voltage of 13 kV

25. How is electrical power delivered to residential customers?

A. A distribution line from a single power source to the customer's structure
B. A service drop line from the distribution pole transformer to the customer's structure
C. A distribution line from a single power source and continue through the service area
D. A service drop line from the secondary distribution lines route power to the customer's structure

26. What component (facility) provides system monitoring and control for distribution circuits in the 4 and 13 kV range?

A. Distribution feeder circuit
B. Substation control house
C. Subtransmission switching station
D. Subtransmission-supplied substations

27. When a high-voltage transmission, circuit-supplying switching station steps down voltages to a subtransmission, what is the voltage range?

A. 4 to 13 kV
B. 7.2 to 14.4 kV
C. 13 to 26 kV
D. 26 to 34 kV

Name: Date:

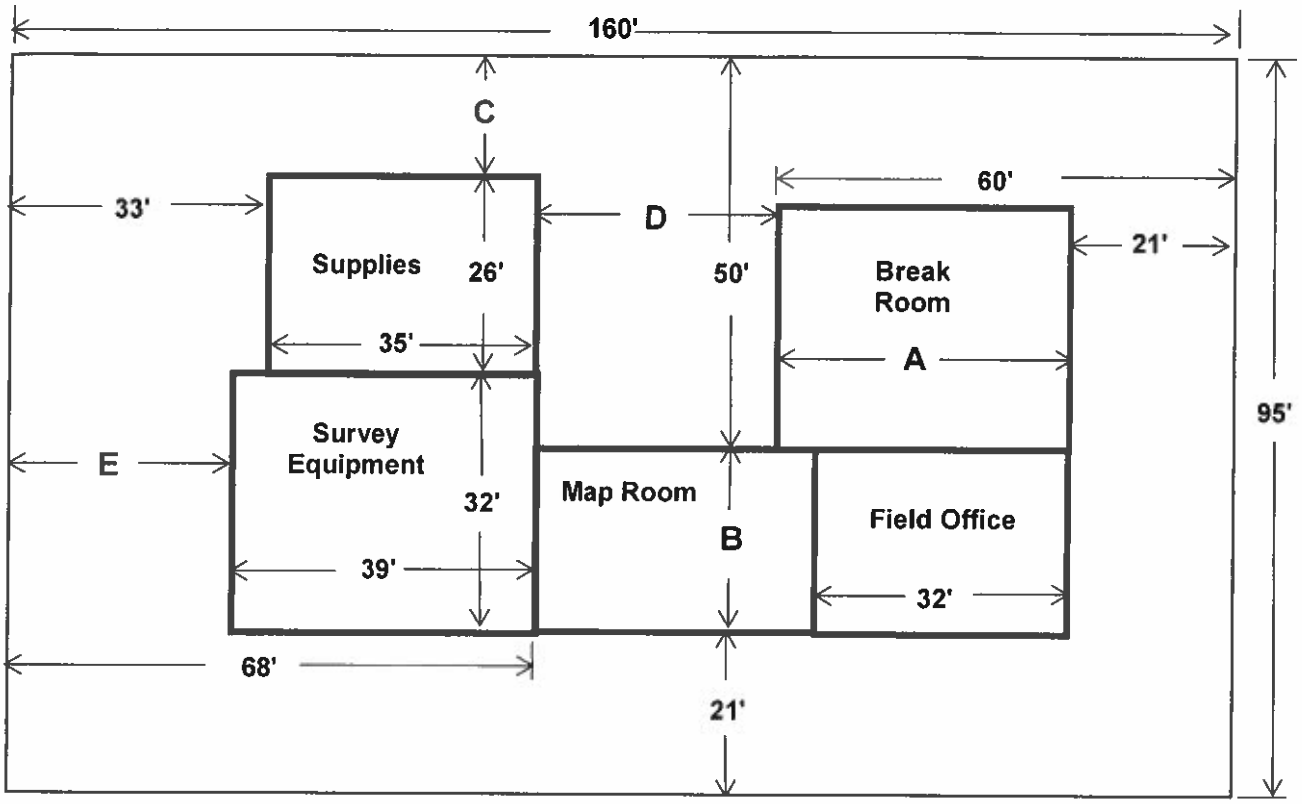
GRAPHIC ARITHMETIC EXAM

The Graphic Arithmetic Test measures a candidate's ability to solve arithmetic problems by using information from prints or drawings.

This exam is similar in content and structure to the actual selection test. We recommend that you keep track of your time as you go through the exam so that you know how long it takes you to complete each one in relation to the time limits on the actual test. The use of scratch paper and calculators is permitted on the actual test.

Directions

This exam requires you to use information from drawings to solve problems. You will need to use the dimensions in the drawing to compute distances and areas and compare sizes of different objects. The exam includes two drawings and 16 questions and you have 30 minutes to complete the exam. Exams will be scored after completion.



Question 1

What is the width ("A") of the break room?

A. 21'

B. 32'

C. 39'

D. 40'

Question 2

What is the length ("B") of the map room?

A. 21'

B. 24'

C. 32'

D. 39'

Question 3

What is the distance ("C") between supplies and the top of the rectangle?

A. 16'

B. 21'

C. 24'

D. 33'

Question 4

By how much is the width of survey equipment (from left to right) greater than the width of the field office?

A. 3'

B. 5'

C. 7'

D. 8'

Question 5

What is the area of supplies?

A. 768 square feet

B. 875 square feet

C. 910 square feet

D. 1248 square feet

Question 6

The total width (left to right) of the property is _____ times longer than the width of the field office.

A. 4.5

B. 5

C. 5.5

D. 6

Question 7

What is the distance ("D") between supplies and the break room?

A. 60'

B. 39'

C. 35'

D. 32'

Question 8

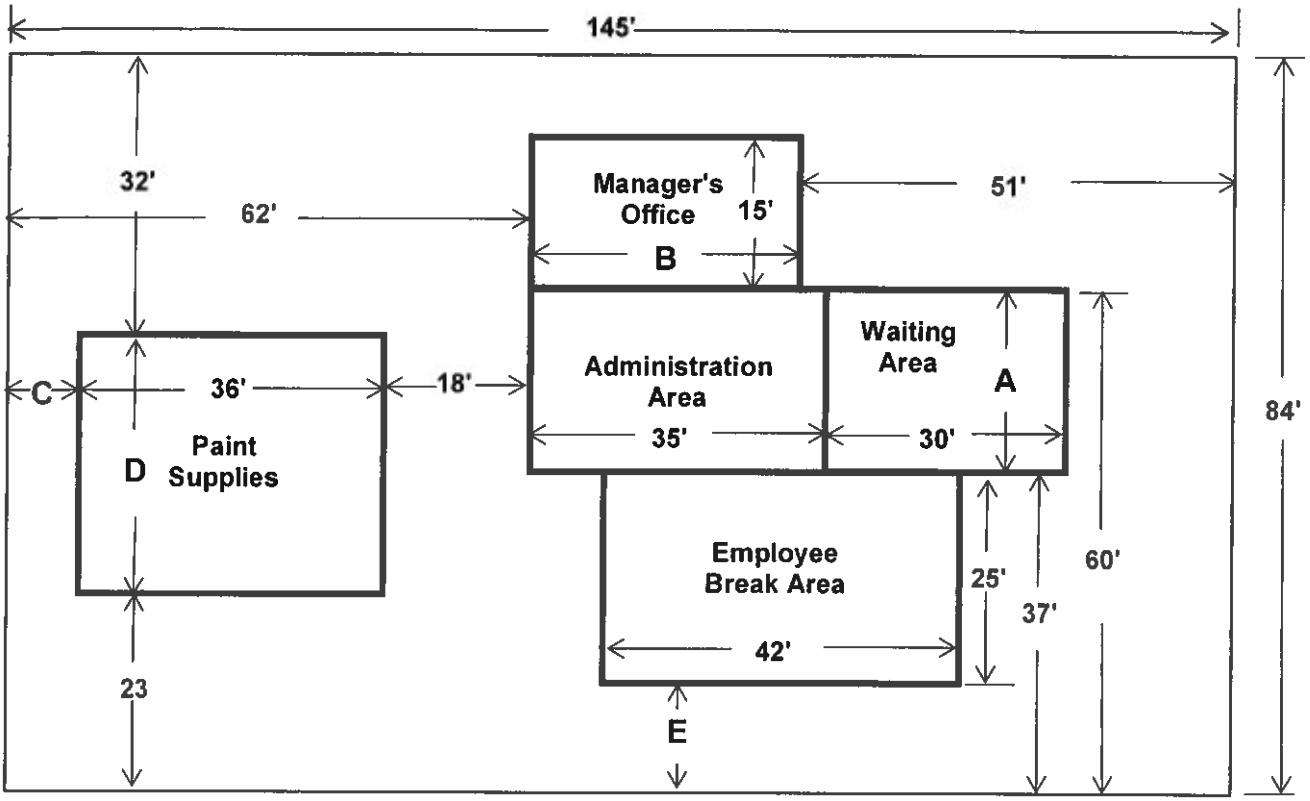
What is the distance ("E") between the edge of the property and survey equipment?

A. 16'

B. 21'

C. 24'

D. 29'



Question 9

What is the length ("A") of the waiting area?

A. 23'

B. 30'

C. 35'

D. 37'

Question 10

What is the width ("B") of the manager's office?

A. 30'

B. 32'

C. 35'

D. 37'

Question 11

What is the distance ("C") between paint supplies and the left edge of the rectangle?

A. 8'

B. 12'

C. 15'

D. 18'

Question 12

By how much is the width of the employee break area (from left to right) greater than the width of paint supplies?

A. 3'

B. 5'

C. 6'

D. 8'

Question 13

What is the area of the employee break area?

A. 690 square feet

B. 960 square feet

C. 1050 square feet

D. 1260 square feet

Question 14

The total length (top to bottom) of the property is _____ times longer than the width of the administration area.

A. 2.3

B. 2.4

C. 2.5

D. 2.8

Question 15

What is the length ("D") of paint supplies?

A. 90'

B. 68'

C. 39'

D. 29'

Question 16

What is the distance ("E") between the bottom of the property and the employee break area?

A. 6'

B. 8'

C. 12'

D. 23'

How to Keep Preparing for Your Big Day!

Given the high stakes nature of pre-employment testing, it is highly recommended you continue to prepare. You can do this by:

- If applicable, complete extra practice test problems leftover from the program by going back through each section of your student guide. You can also retake the practice tests. Select the topics that you found to be most difficult. You instructor will provide you with blank copies of the practice tests along with answer keys.
- If math computation and/or algebra are still areas you could use brushing up, continue to use the Khan Academy web site (https://www.khanacademy.org/) to get ready as well as utilize searches for additional online quizzes, if you have already completed the ones on Get Into Energy (http://getintoenergy.com/test-prep/).
- Utilize EEI's pre-employment test posted on their website. You can access the test using the information below.

  URL: https://secure.eei.org/eeitests/onlineproducts/Login.aspx

  User name: giepractice

  Password: testing

  Some suggestions for utilizing the practice tests:

  - Print out your results and study the explanations.
  - Retake the tests as many times as you wish to improve your skill level.

Test Taking Tips for the Day of the Pre-employment Test*

Reducing Test Taking Anxiety

- Test anxiety is when a student excessively worries about doing well on a test. This can become a major hindrance on test performance and cause extreme nervousness and memory lapses among other symptoms. The following are tips on reducing test taking anxiety.
- Being well prepared for the test is the best way to reduce test taking anxiety.
- Try to maintain a positive attitude while preparing for the test and during the test.
- Exercising for a few days before the test will help reduce stress.
- Get a good night's sleep before the test.
- Show up to early so you won't have to worry about being late.

- Stay relaxed, if you begin to get nervous take a few deep breaths slowly to relax yourself and then get back to work.
- Read the directions slowly and carefully.
- Skim through the test so that you have a good idea how to pace yourself.
- Don't worry about how fast other people finish their test; just concentrate on your own test.
- If you don't know an answer to a question skip it for the time being (come back to it later if you have time), and remember that you don't have to always get every question right to do well on the test.
- Focus on the question at hand. Don't let your mind wander on other things.

Multiple Choice Question Tips

- Read the question before you look at the answer.
- Come up with the answer in your head before looking at the possible answers, this way the choices given on the test won't throw you off or trick you.
- Eliminate answers you know aren't right.
- Read all the choices before choosing your answer.
- If there is no guessing penalty, always take an educated guess and select an answer.
- Don't keep on changing your answer, usually your first choice is the right one, unless you misread the question.
- In "All of the above" and "None of the above" choices, if you are certain one of the statements is true don't choose "None of the above" or one of the statements are false don't choose "All of the above".
- In a question with an "All of the above" choice, if you see that at least two correct statements, then "All of the above" is probably the answer.
- A positive choice is more likely to be true than a negative one.
- Usually the correct answer is the choice with the most information.

Math-related Question Tips

- Repetition is important in math. You learn how to solve problems by doing them so keep on practice problems but don't do it blindly. Make sure you learn how to recognize when/why you should use a specific method to solve a problem.
- When practicing, try to solve the problem on your own first then look at the answer or seek help if you are having trouble.
- Make estimates for your answers... e.g. if you are asked to answer 48 x 12 = ?, you could expect a number around 500 but if you end up with an answer around 5000, you'll know you did something wrong.

*From Testtakingtips.com