PIPING INDUSTRY TRAINING CENTER

LABOR & MANAGEMENT | DEDICATED TO TRAIN

MECHANICAL APTITUDE TEST STUDY GUIDE

Building Trades and Mechanical Equipment Service

Apprenticeship program acceptance is contingent upon several criteria including scoring from several sections of Mechanical Aptitude, Differential Aptitude and Dexterity Testing. A guide to help better prepare the applicant for the Piping Industry Training Center Apprentice Ship Programs.

2026

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INTRODUCTION

Why Do We Conduct Mechanical Aptitude Testing?

This type of testing provides each applicant a fair and equal opportunity to demonstrate their strengths and weaknesses, helping the committee determine opportune placement of applicants into the Building Trades or Mechanical Equipment Service Apprenticeship Programs.

The piping industry trades require specific knowledge, skills, and abilities, some of which are taught and some of which can be innate. By utilizing the Ramsay Mechanical test, the Differential Aptitude test and the Dexterity test we can better asses an individual's abilities to excel and prosper in our programs.

Program selection consists of several aspects of the scoring process and realize that Testing by nature can cause anxiety and stress. So, to better prepare you we have created a series of practice test with answers to provide the best chance for the highest scores.

Dexterity Aptitude Testing

Timed exercises measure coordination in a controlled environment

- Determines agility to manipulate small objects
- Demonstrate task completion skills
- Measures quick and accurate movement

Mechanical Aptitude Testing

Questions assess cause and effect

- Predict direction changes
- Compare acceleration outcomes
- Identify friction impact
- Choose correct force diagram

Arithmetic Testing

Question assess problem solving

- Demonstrate computation abilities

Measurement Testing

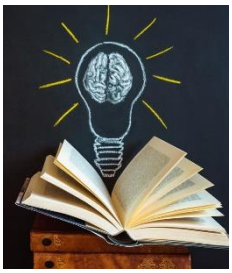
Questions assess tool selection

- Match tool to task
- Choose correct measuring tool
- Demonstrates accuracy

Reading Testing

Questions assess comprehension

- Measures cognitive recognition of topic
- Compliance, Following Directions
- Implementation



Spatial Reasoning Testing

Questions assess visual reasoning

- Visualization 3-dimensional concepts
- Predict linkage movement
- Identify correct assembled view
- Track motion through parts

Visualization Testing

Exercises measure vertical and horizontal tracking

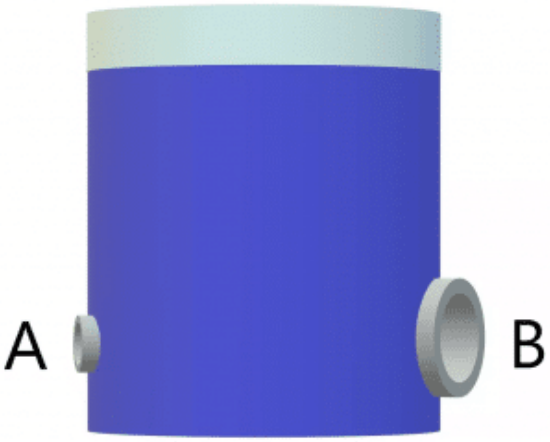
- Maintaining focus
- Coordination and persistence
- Object movement tracing

Each section contains several practice questions and correct answers are provided to identify where you may need some additional practice. Try timing yourself in each section and see how you do. Getting used to timed testing will also help with preparation.

Good Luck!

MECHANICAL APTITUDE PRACTICE TEST

1. Through which pipe will the water flow in greater pressure?



(If pressure will be the same, mark C.)

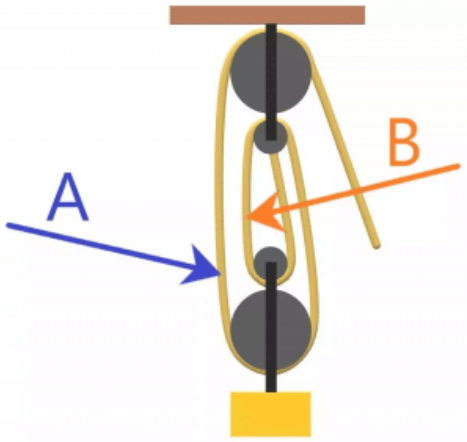
1. A **2. B** **3. C**

2. A friend asked you to hand over an Allen wrench.

Which screw does he probably wish to tighten?

1. **2.** **3.** **4.** **5.**

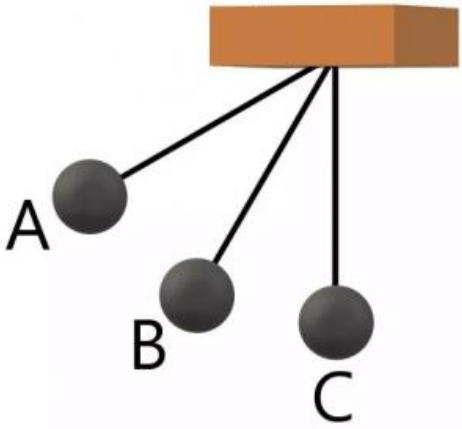
3. Which part of the string has a higher strain on it?



(If neither, mark C.)

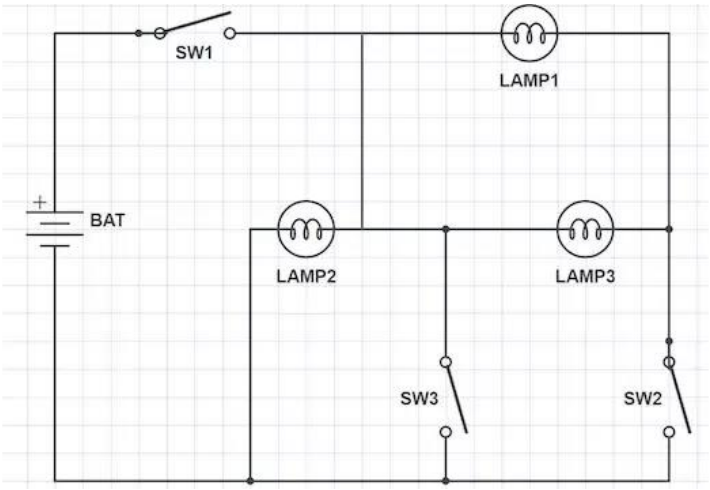
1.A 2. B 3. C

4. At which position will the pendulum normally travel the fastest?



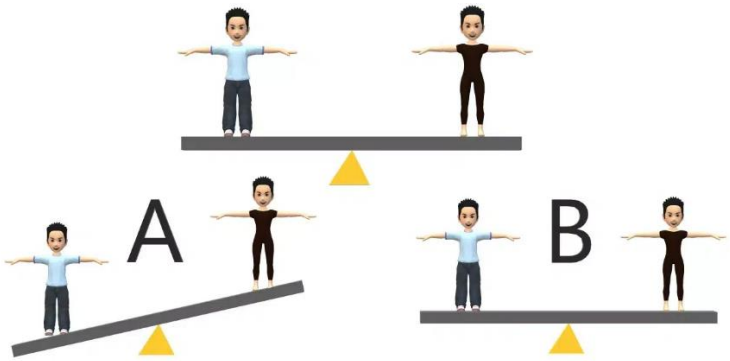
1. A. 2. B 3. C.

5. How many lamps will be lit if switch 1 is closed?



A. 1 B. 2. C. 3

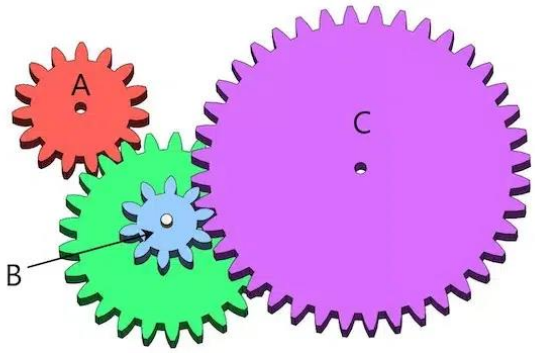
6. Two people are balanced on a teeter-totter as seen in the top part of the image. If the person on the left jumps up, which of the scenarios, A or B, is likely to happen upon landing on the teeter-totter?



(If equally likely, mark C.)

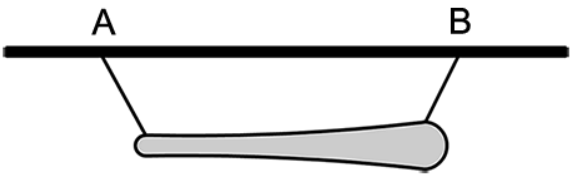
1. A 2. B 3. C

7. Which gear rotates fastest?



1. A 2. B 3. C

8. Look at the image below...



Which wire carries the most weight?
(If equal, choose C)

The entire object has the same density.

1. A 2. B 3. C D. Impossible to tell

9. Which of these objects will not float on water?



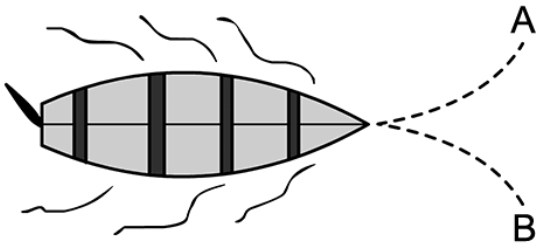

A. Scissors

B. Wooden Pencil

C. Empty water bottle (plastic)

D. Banana

10. With the position of the rudder on the left side of the boat....



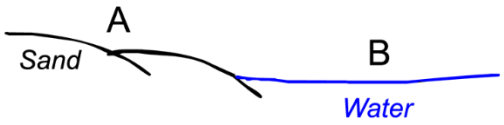
Which way will the boat go through the water? (If either, choose C)

1. A

2. B

3. C

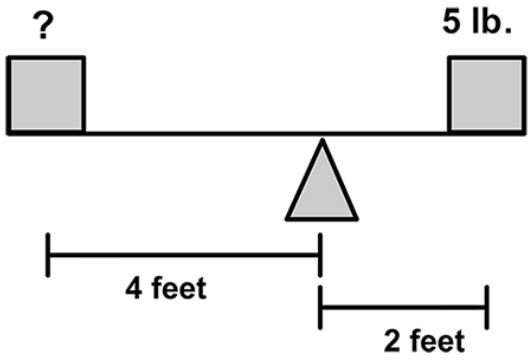
11. Between sand and water...



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

1. A 2. B 3. C, no difference

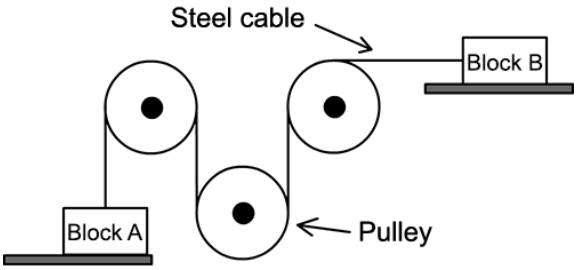
12. Look at the image below...



To balance the bar, how much weight should be positioned on the left side?

A. 7.5 lbs. B. 2.5lbs C. 5 lbs. D. 10 lbs.

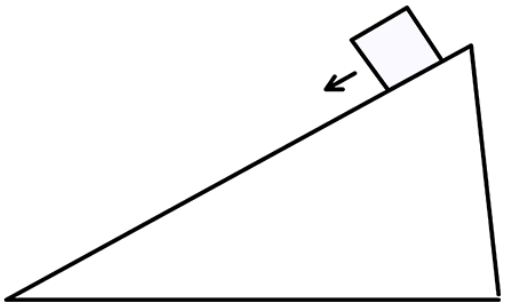
13. Look at the image below...



If block B is moved 20 feet to the right,
how far up is block A lifted?

A. 5 ft. B. 40 ft. C. 20 feet D. 10 feet

14. Look at the image below...

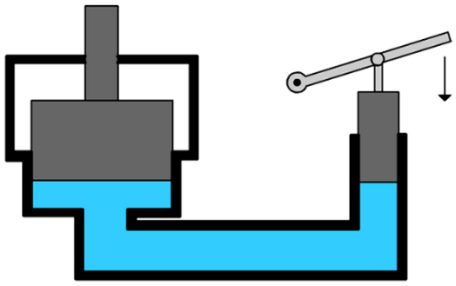


Consider a block sliding down a frictionless
inclined plane with an acceleration of A.
If the mass of the block is doubled,
what is its acceleration?

A. 2A B. A x A C. A/2 D. A

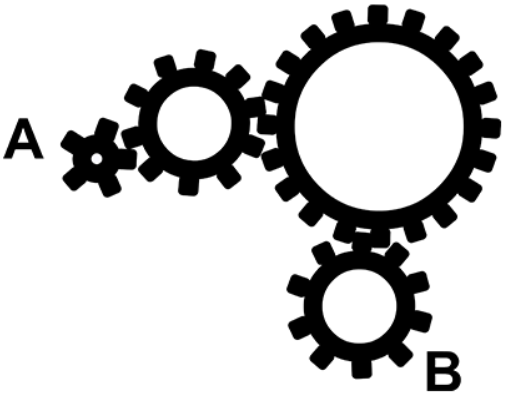
15. Look at the image below...

If the small plunger is forced down by 5 units,
how far will the larger plunger move?



A. Up to more than 5 units
B. Down less than 5 units
C. Up less than 5 units
D. Down more than 5 units

16. Look at the image below...



If gear A turns clockwise
by 20 rotations, how does gear B turn?

A. 10 rotations counter-clockwise
B. 10 rotations clockwise
C. 20 rotations counter-clockwise
D. 5 rotations clockwise

MECHANICAL APTITUDE TEST ANSWERS

1. The correct answer is C. – the pressure will be the same.

Explanation

The pressures in pipes A and B can be described by Bernoulli's Theorem, which divides total pressure into three heads:

Total Pressure = Static Head + Dynamic Head + Elevation Head

The static head is the static pressure at the given point. The dynamic head, as the name suggests, is due to the velocity of the liquid and the elevation head is due to the height of the liquid.

In our case, the pressure at pipes A and B is due to the elevation head of water above them. This exerts equal pressure on both points A and B. When water shoots out from the pipes, its velocity is equal, in accordance with Toricelli's theorem which gives the velocity of a jet as $v = \sqrt{2gh}$. h is equal for both A and B, so velocity is the same.

Due to the same velocity, the dynamic pressure head will also be the same. It is known that pressure is defined as, "force per unit area" i.e., $P=F/A$. So even though the jet force due to the flow rate will be greater for pipe B, the flow rate of a unit area will remain the same, and hence pressure for both A and B will be the same.

2. The correct answer is 3. – Allen Wrench

1. Flat Head / Slotted / Straight wrench
2. Phillips / Cross Head wrench
3. Allen / Hex Head / Hex Key wrench
4. Torx / Star Head wrench
5. Robertson / Square-Head wrench

3. The correct answer is C.

Explanation

The string attached to a pulley is massless and “non-stretchable.” Therefore, it has an equal distribution of tension forces acting on it. This is due to Newton’s Third Law of equal and opposite reaction, acting on every point of the string. Also, consider the force balance on a small section of the string. As each small section of the string is in equilibrium, the tension (T) acting on it on both sides will be the same as shown in the figure.

If you extend this argument over the full length of the string, you can conclude that the tension will remain the same on every part of the string, which means that neither part of the string has a higher strain rate than the other.

4. The correct answer is C.

Explanation

The pendulum given above is a simple pendulum, having a bob of mass “m,” hanging from the pivot with a string of length “l.” Let us assume that the pendulum is released from the horizontal position, which is the highest the pendulum can go.

As we know the potential energy of an object is greatest at its highest position, the pendulum will have the most potential energy at the horizontal position A. However, the speed of the pendulum at this point will be zero, which shows that the kinetic energy will also be zero.

According to the law of conservation of energy, the total energy at all points should remain the same.

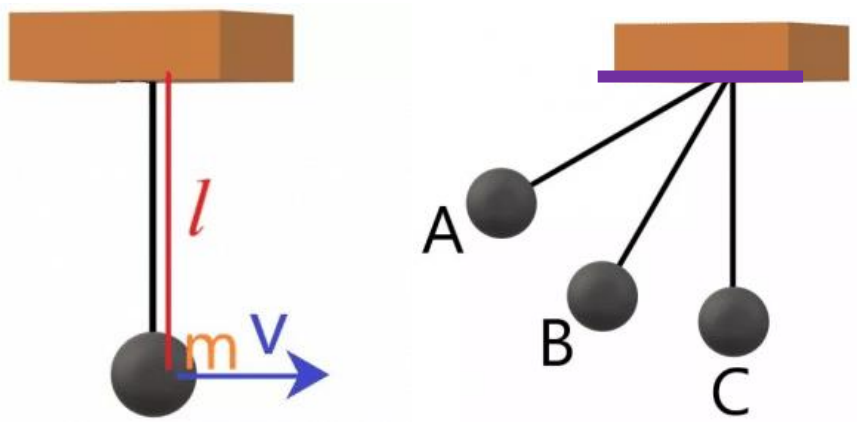
Now, potential, and kinetic energies are given as:

Potential energy = mass (m) * gravitational acc.(g) * height

Kinetic energy = mass (m) * velocity(v)^2 / 2 [mv^2/2]

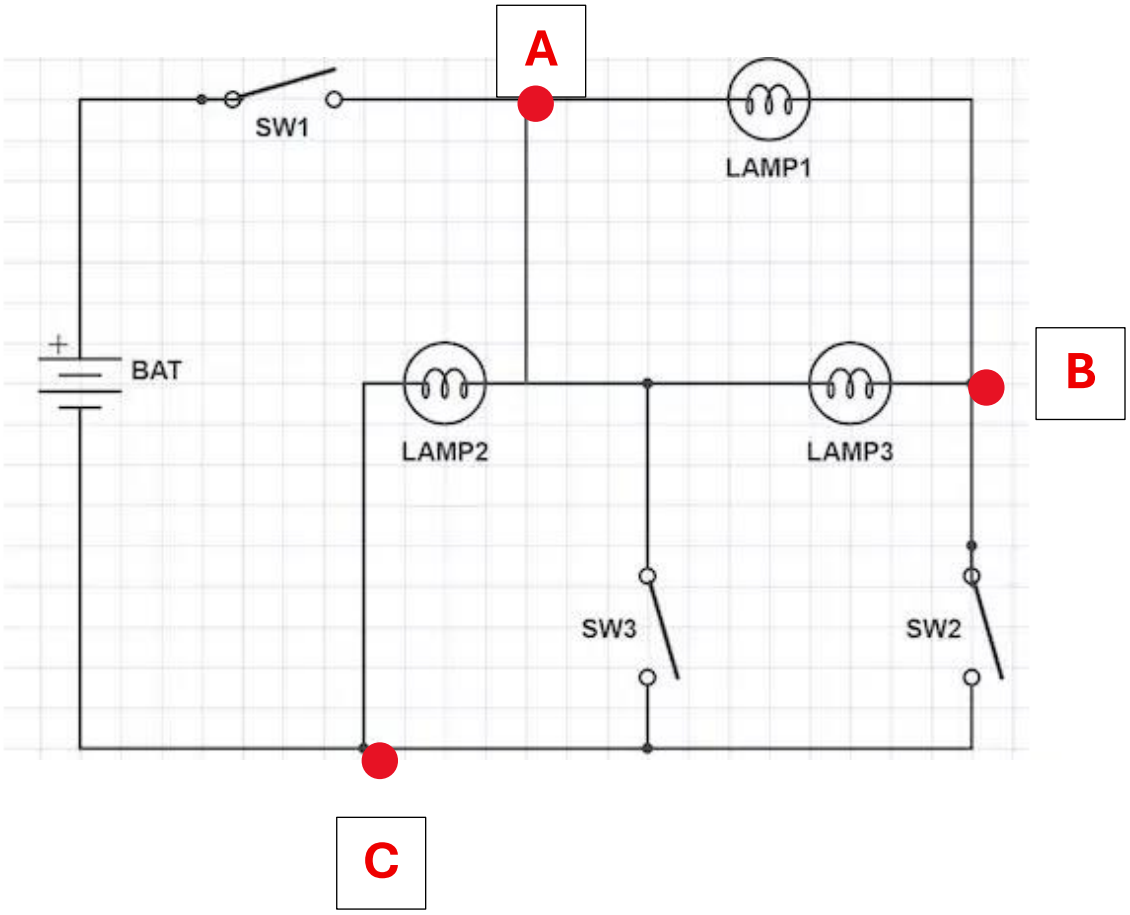
At position A, the pendulum bob will have a greater height than in positions B or C, so its potential energy will be greater, but since the total energy is the same, the kinetic energy will be less than that of the other positions. This means that it will travel slower.

As the bob moves downwards, the potential energy will keep converting to kinetic energy and at position C, all the potential energy will be converted to kinetic energy. Hence the bob will move the fastest at position C.



PE ⟷ KE

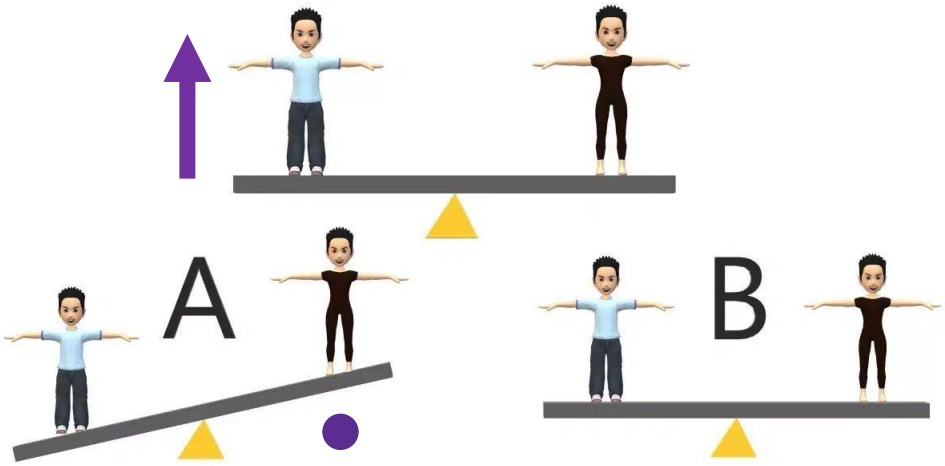
5. The correct answer is: A – 1 Lamp



Explanation

Current only flows between two points if there is a potential difference. To analyze the above circuit, define the nodes in the circuit. When switch 1 is closed, there are only three nodes—A, B, and C—in the circuit. In this case, lamps 1 and 2 are in the series; however, the potential difference across the series is zero since both end terminals are connected to node A. Therefore, lamps 1 and 3 will not light up. Lamp 2 is directly connected to the battery terminals A and C; therefore, lamp 2 will light up. This is why only one lamp will light up.

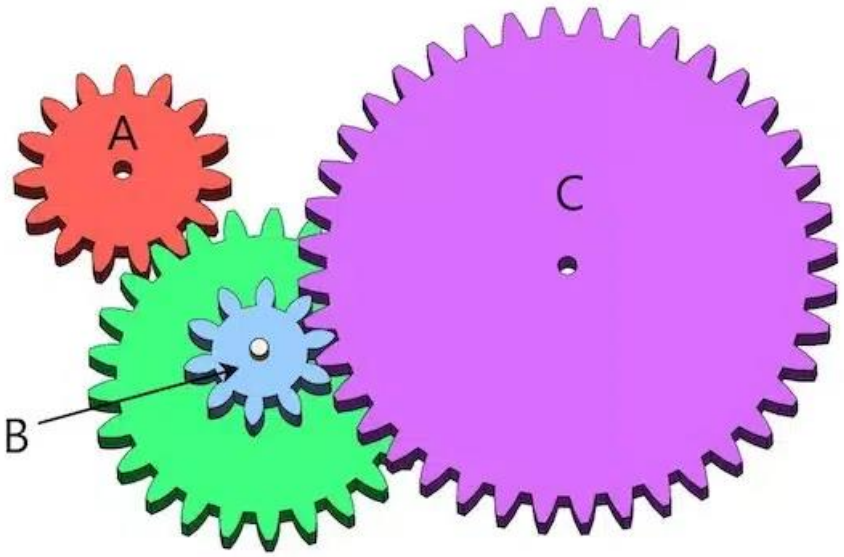
6. The correct answer is A.



Explanation

This is a case of a class 1 lever, where the people on the sides are loads and the fulcrum is in the middle. When the person on the left jumps on a balanced teeter-totter, the weight of the person on the right unbalances the teeter-totter and it falls to the right. When the person on the left lands on the teeter-totter, an effort is exerted due to weight, which lifts the teeter-totter from the right. However, it does not stop right in the middle due to the extra energy from the jump and keeps lifting the person on the right, as can be seen in scenario A.

7. The correct answer is A.



Explanation

The rotational velocities (***ω***) of directly meshed gears are inversely proportional to their number of teeth (***N)*** as:

$\omega_1/\omega_2 = N_2/N_1$. This means that the greater the number of teeth is, the lower the speed is.

We have denoted the green gear as gear D. Now the number of teeth (N) of the gears is in the order: $N_B < N_A < N_D < N_C$.

Gear D directly meshes with gear A, so since gear A has fewer teeth than gear D, it rotates faster ($\omega_A > \omega_D$).

Since gear B and D are connected to the same shaft, they rotate at the same speed, i.e., $\omega_B = \omega_D$.

Gear B directly meshes with gear C, so since gear B has fewer teeth than gear C, it rotates faster ($\omega_B > \omega_C$).

Combining the conclusions above:

$\omega_A > \omega_D = \omega_B > \omega_C$

Gear A rotates the fastest and gear C rotates slowest.

8. **The correct answer is B.** Wire B carries the most weight due to its size.

9. **The correct answer is A.** The Scissors are made of metal; they will not float.

10. **The correct answer is A.** While moving forward, water flows along the side of the boat. This pushes the rudder in the opposite direction of the deflection (downward). This makes the rest of the boat turn its axis, turning the forward section of the boat to the left (upward).

11. **The correct answer is A.** Sand is a better thermal conductor than water, therefore sand is heated much faster. On the other hand, water has a better thermal capacity than sand, therefore water retains the heat for much longer. This is why a sandy beach can be extremely hot at noon but cold at night, while the water temperature stays almost the same.

12. **The correct answer is B.** To solve this problem, you may use the following calculation method: weight 1 x distance 1 = distance 2. If we insert the numbers into the equation we get:

Weight 1 x 4 = 2 x 5

Weight 1 x 4 = 10

Weight 1 = 10/4 = 2.5 lbs.

13. **The correct answer is C.** The two blocks are directly connected by a fixed length steel cable. Regardless of the number of pulleys between the two blocks, the distance moved by one block will be the same distance moved by the other block.

14. **The correct answer is D.** On an inclined plane, acceleration of an object does not depend on the mass of the object but only on the angle of the plane.

15. **The correct answer is C.** When forced down the small plunger will decrease the volume of the liquid in that section of the system, correspondingly increasing the volume of liquid in the larger chamber. However, increasing the volume in a wider chamber will increase the height by a lesser amount due to the larger area.

16. The correct answer is A. Gear A has 5 teeth. The next gear has 10 teeth. The larger gear has 20 teeth. Gear B has 10 teeth. Gear A turns clockwise by 20 rotations. The next gear turns counterclockwise by 10 rotations. The large gear turns clockwise by 5 rotations. Gear B turns counterclockwise by 10 rotations.

General information about gears:

When a gear turns, the adjacent gear will move in the opposite direction. Gears with an equal number of teeth will turn at the same speed. If they have an unequal number of teeth, then the gear with fewer teeth will turn faster. To work out how fast one gear is turning with respect to the other, you need to count the teeth. If the larger gear has 2 times as many teeth, the smaller gear will turn 2 times faster and vice versa.

ARITHMETIC PRACTICE TEST 1

1. 48 + 31 =

2. 79 / 8 =

3. 65 + 43 =

4. 845 + 376 =

5. 34 + 346 + 8 =

6. 74 – 33 =

7. 52 – 14 =

8. 481 – 92 =

9. 424 – 375 =

10. 5682 – 683 =

11. 43 x 3 =

12. 56 x 48 =

13. 507 x 62 =

14. 491 x 240 =

15. 6060 x 7009 =

16. 7/2163 =

17. 8/174 =

18. 45/810 =

19. 37/3850 =

20. 391/71202 =

1._____

2._____

3._____

4._____

5._____

6._____

7._____

8._____

9._____

10._____

11._____

12._____

13._____

14._____

15._____

16._____

17._____

18._____

19._____

20._____

ANSWERS PRACTICE TEST 1

1. 79
2. 87
3. 108
4. 1.221
5. 4,759
6. 41
7. 38
8. 389
9. 49
10. 4,999
11. 129
12. 2,688
13. 31,434
14. 117, 840
15. 42,474,540
16. 302
17. 21 r6 or 3/4
18. 18
19. 104 r2 or 104 r2/37
20. 182 r40

ARITHMETIC PRACTICE TEST 2

1. 8 + 11 =_____

2. 71 - 19 =_____

3. 8 X 5 =_____

4. 9 X 13 =_____

5. 54 / 6 =_____

6. 112 / 4 =_____

7. 1.75 - .017 =_____

8. 72 + 59 =_____

9. 18 X 4 =_____

10. 1.768 + .189 =_____

11. 1.008 X 3.5 =_____

12. 47 - 21 =_____

13. 18 / 4 =_____

14. 1/3 + 1/2 =_____

15. 74 + 113 =_____

16. 9 / .3 =_____

17. .017 + .504 =_____

18. .671 - .659 =_____

19. 1/5 X 1/2 =_____

20. .72 X 1.8 = _____

21. 29/42 + 12/21 =_____

23. 67 + 23 =_____

24. 84 / 4 =_____

25. 1.68 / 1.2 =_____

26. 1/6 / 1/2 =_____

27. 175 – 143 =_____

28. 29/72 – 5/36 =_____

29. 17 X 12 =_____

30. 1.9 X 4.5 =_____

31. 4 / .25 =_____

32. .4 X 1/4 = _____

33. 139 – 67 =_____

34. 4.5 – 6/8 =_____

35. 18 + 76 =_____

36. 1/1000 X 3.616 =_____

37. 7.3 - .017 =_____

38. .6 X .8 =_____

39. 1/3 / 1/6 =_____

40. 76 – 52 =_____

ANSWERS PRACTICE TEST 2

1. 19	11.3,528	21. 1 11/42	31. 16
2. 52	12. 26	22.1,2525 or1 101/400	32. .1 or 1/10
3. 40	13. 4.5	23. 90	33. 72
4. 117	14. 5/6	24. 21	34. 3.75 or 3 3/4
5. 9	15. 187	25. 1.4	35.94
6. 28	16. 30	26. 1/3	36. .003616
7. 1.733	17. .521	27. 32	37.7.283
8. 131	18. .012	28. 19/72	38. .48 or 12/25
9. 72	19. 1/60	29. 204	39. 2
10. 1,957	20. 1,296	30.8.55	40. 24

ARITHMETICE PRACTICE TEST 3

1. 2/3 x 12 = _____.

A. 4 B. 6 C. 8 D. 18 E. None of the Above

2. 83.97

1.78

14.36

+ 9.03

A. 99.13 B.99.24 C. 109.14 D. 109.23 E. 109.24

3. The value of x in the equation 5x = 75 is:_____.

A. 13 B.15 C. 70 D. 80 E. None of the Above

4. 65.13 + .13 = _____.

A. .501 B. 5.01 C. 50.1 D. 501 E. None of the Above

5. The sum of 6 ft., 8" and 3 ft., 4" is _____.

A. 2ft., 2" B. 9ft C. 10ft. D. 10ft. 12" E. None of the Above

6. 3/4 – 1/2 + 1/8 = _____.

A. 3/10 B. 3/8 C. 5/8 D. 1 3/8 E. None of the Above

7. 4 5/16 – 2 3/8 =_____.

A. 1 15/16 B. 2 1/16 C. 2 ¼ D. 2 15/16 E. None of the Above

8. (-12) + (-3) =_____.

A. -9 B. 15 C. 9 D. -15 E. None of the Above

9. The ratio of the lengths of two lines is 5 to 3. The length of the shorter line is 30 inches. The length of the shorter line is _____inches.

A. 18 B. 48 C. 50 D. 150 E. None of the Above

10. .025 written as a common fraction is _____.

A. 25/10 B. 25/100 C. 25/1000 D. 25/10,000 E. None of the Above

11. In the proportion 5/2 = 9/x, the value of x is _____.

A. 1.8 B. 3.6 C. 22.5 D. 36 E. None of the Above

12. 33 1/3 percent of 3 = _____.

A. 1 B. 10 C. 100/3 D. 100 E. None of the Above

13. $\sqrt{225}$ =_____.

A. 15 B. 20.5 C. 25 D. 112.5 E. None of the Above

14. If 4x/6 – 6 = 10, then x = _____.

A. 15 1/5 B. 5 C. 4 D. 3 1/5 E. None of the Above

15. The difference between 8 hours 0 minutes 6 seconds and 6 hours 4 minutes 15 seconds is _____ Hr. _____ min.

A. 0, 54,51 B. 1, 54, 51 C. 2,4,9 D.2, 54, 45 E. None of the Above

ANSWERS PRACTICE TEST 3

1. C
2. C
3. B
4. D
5. C
6. B
7. A
8. C
9. C
10. C
11. B
12. A
13. A
14. E
15. E

TOOL RECOGNITION

1. What is the electronic version of a tape measure?

A. Laser measuring tool

B. Steel Rule

C. Folding Rule

2. This wrench has both an open-end wrench and a box-end wrench

A. Combination wrench

B. Open-end wrench

C. Box-end wrench

3. This wrench is L-shaped and hexagonal

A. Hex Key wrench

B. Open-end wrench

C. Box-end wrench

4. A tool that uses the force of gravity to make a line hang vertically

A. Plumb bob

B. Chisel

C. Chalk line

5. This tool is used to turn a socket.

A. Ratchet

B. Wrench

C. Pipe wrench

6. This tool is used for marking and measuring to ensure objects are at right angles.

A. Square

B. Spirit level

C. Steel rule

7. Pliers used to get into tight places, grip small objects, and for bending wire.
A. Long-nose (aka Needle-nose) pliers
B. Tongue-and-groove
C. Lineman

8. This tools grips nuts or bolts.
A. Sockets
B. Ratchets
C. Hammer

9. This wrench forms a circle around the head of a fastener.
A. Box-end wrench
B. Open-end wrench
C. Hex key wrench

10. A perfectly horizontal surface is called a _____ surface
A. Level
B. Plumb
C. Straight

11. Pliers that have wide jaws to cut heavy wire and to help grip objects are called
A. Lineman
B. Tongue-and-groove
C. Locking

12. Pliers that have serrated teeth and can grip flat, round, or hexagonal objects are called?
A. Tongue-and-groove
B. Long-node
C. Slip-joint

13. A perfectly vertical surface is called a _____ surface?
A. Plumb
B. Level
C. Crooked

14. Pliers with an adjustable knob that controls width and tension for the jaws.
A. Locking
B. Line-man
C. Slip-joint

15. You should hold the _____ of a torque wrench with one hand to support the bolt and make sure it is properly aligned.
A. Head
B. Handle
C. Bolt

16. A folding rule is best for measuring _____ distances?
A. Horizontal
B. Vertical
C. Circular

17. Name the tool below:

A. Pipe Cutter
B. Wire Cutter
C. Rope Cutter

18. Select the correct name for the tool below:

A. Phillis Screwdriver

B. Phillips Screwdriver

C. Flat Head Screwdriver

19. Select the correct name for the tool below:

A. Nut and Bolt Pliers
B. Slip Joint Pliers
C. Long Handle Pliers

20. Select the correct name for the tool below:

A. Wire Cutters

B. Wire Strippers

C. Cable Strippers

TOOL SAFETY QUIZ

21. What does the abbreviation PPE mean?
A. Personal Protective Equipment
B. Professional Protective Equipment
C. Proper Protective Equipment

22. Check the boxes next to all correct choices: You should never wear what in the shop?
A. Safety Glasses
B. Closed Toed Shoes
C. Loose Jewelry
D. Loose Fitting Clothes
E. Loose Hair

23. When tightening a nut with an adjustable wrench, always pull the wrench toward you; never push the wrench away from you.
A. True
B. False

24. Claw hammers may be used to strike wood chisels
A. True
B. False

25. Screwdrivers may be used for purposes other than driving or removing screws, such as prying open can lids.
A. True
B. False

26. Open-end wrenches may be used to free a frozen nut?
A. True
B. False

27. A proper use of the ball-peen hammer is striking chisels and punches.
A. True
B. False

28. Plastic covered handles on wire-cutting pliers may be used to cut low-voltage live electrical wire?
A. True
B. False

29. Snips are permissible for cutting wire.
A. True
B. False

30. When wood splitting, the flat striking face of an axe may be used to strike a wood splitting wedge.
A. True
B. False

31. Vises should always be secured to the workbench with screws.
A. True
B. False

TOOL RECOGNITION AND TOOL SAFETY ANSWERS

1. A

The electronic version of a tape measure is a laser measuring tool. This tool uses laser technology to accurately measure distances. It is more precise and efficient compared to traditional tape measures. By emitting a laser beam, it can quickly calculate the distance between two points. The laser measuring tool is commonly used in construction, interior design, and other industries where precise measurements are required.

2. A.

A combination wrench is the correct answer because it has both an open-end wrench and a box-end wrench. This means that it can be used for several types of fasteners, providing versatility and convenience for the user. The open-end wrench is typically used for nuts and bolts with a flat surface, while the box-end wrench is used for nuts and bolts with a recessed or enclosed head. Having both options in one tool allows for more efficient and effective work.

3. Hex key wrench

The given statement describes a wrench that is both L-shaped and hexagonal. The term "hex key wrench" is commonly used to refer to a tool that is L-shaped and has a hexagonal shape at the end. This type of wrench is designed to fit into hexagonal-shaped sockets or bolts, allowing for effective tightening or loosening. Therefore, the correct answer is "hex key wrench."

4. A.

A plumb bob is a tool that uses the force of gravity to make a line hang vertically. It consists of a weight attached to a string or cord, and when suspended, the weight aligns itself with

The direction of gravity, creating a straight vertical line. This tool is commonly used in construction, carpentry, and surveying to ensure accurate measurements and alignments.

5. A.

A ratchet is a tool used to turn a socket. It is designed with a handle that can be moved back and forth, allowing the socket to rotate in one direction while preventing it from rotating in the opposite direction. This mechanism is useful for tightening or loosening bolts or nuts in confined spaces where a regular wrench may not fit or where continuous rotation is not possible. The other options, a wrench and a pipe wrench, are also tools used for turning, but they do not have the ratcheting mechanism that allows for one-way rotation.

6. A.

A square is a tool that is specifically designed for marking and measuring right angles. It has a straight edge and a perpendicular edge that allows for accurate alignment and measurement of objects to ensure they are at right angles. A spirit level is used to check if a surface is level or plumb, while a steel rule is a measuring tool with a straight edge for linear measurements.

7. A.

Long-nose pliers (aka Needle-nose pliers) are the correct answer because they are specifically designed to reach tight spaces, grip small objects, and bend wire. The long and slim jaws of long-nose pliers allow for precise and delicate work in narrow areas where other types of pliers might not be able to reach. They are commonly used in electrical work, jewelry making, and other tasks that require fine manipulation and control.

8. A.

Sockets are tools that are specifically designed to grip nuts or bolts. They have a hollow cylindrical shape with a hexagonal or square opening on one end, allowing them to fit over

the nuts or bolts securely. Sockets are commonly used in conjunction with a ratchet, which provides the necessary leverage and allows for easy tightening or loosening of the nuts or bolts. A hammer, on the other hand, is not typically used for gripping nuts or bolts but rather for striking or driving objects.

9. A.

A box-end wrench is the correct answer because it is designed with a closed loop at one or both ends, forming a circle around the head of a fastener. This design allows for a secure grip on the fastener and prevents slipping or rounding of the edges. Open-end wrenches have U-shaped openings and do not form a complete circle, while hex key wrenches have a hexagonal shape and are used specifically for hexagonal fasteners.

10. A.

A perfectly horizontal surface is called a level surface.

11. A.

Lineman pliers are specifically designed for heavy-duty tasks such as cutting heavy wire and gripping objects. They have wide jaws that provide a strong grip and enable them to cut through thick wires with ease. These pliers are commonly used by electricians and linemen for various tasks in their line of work.

12. Tongue-and-groove pliers are the correct answer because they have serrated teeth that can grip objects of different shapes, such as flat, round, or hexagonal. This type of pliers is designed with adjustable jaws that can be locked into various positions, allowing for a secure grip on various objects. The term "tongue-and-groove" refers to the mechanism used to adjust the position of the jaws, making these pliers versatile and suitable for different tasks.

13. A.

Tongue-and-groove pliers are the correct answer because they have serrated teeth that can grip objects of different shapes, such as flat, round, or hexagonal. This type of pliers is designed with adjustable jaws that can be locked into various positions, allowing for a secure grip on various objects. The term "tongue-and-groove" refers to the mechanism used to adjust the position of the jaws, making these pliers versatile and suitable for different tasks.

14. A.

The correct answer is “locking” because pliers with an adjustable knob that controls width and tension for the jaws typically have a locking mechanism that allows the jaws to be locked in place at a desired width and tension. This feature is useful for holding objects securely and preventing them from slipping out of the jaws while working

15. B.

A folding rule is best for measuring vertical distances because it can be easily extended or folded to match the height of an object or the distance between two points in a vertical direction. It provides a convenient and accurate way to measure heights, lengths, or depths that are perpendicular to the ground or floor.

16. A.

To ensure proper alignment and support of the bolt, it is necessary to hold the head of a torque wrench with one hand. The head of the torque wrench is the part that connects to the bolt and applies the torque force. By holding the head, you can ensure that the torque is being applied accurately and prevent any misalignment or damage to the bolt. Holding the handle alone may not provide the necessary control and stability required for proper alignment.

MEASUREMENT PROBLEM PRACTICE

1. What will it cost to carpet a room with indoor/outdoor carpet if the room is 10 feet wide and 12 feet long? The carpet costs 12.51 per square yard.

A. $166.80
B. $175.90
C. $184.30
D. $189.90
E. $192.20

2. If the perimeter of a rectangular house is 44 yards and the length is 36 feet, what is the width of the house?

1. 10 yards
2. 18 yards
3. 28 feet
4. 32 feet
5. 36 yards

3. Camille has three pieces of material. The first piece is 1 yard, 2 feet, and 6 inches long; the second piece is 2 yards, 1 foot, and 5 inches long, and the third piece is 4 yards, 2 feet, and 8 inches long. How much material does Camille have?

A. 7 yards, 1 foot, and 8 inches
B. 8 yards, 4 foot, and 4 inches
C. 8 yards and 11 inches
D. 9 yards and 7 inches
E. 10 yards

4. A can's diameter is 3 inches, and its height is 8 inches. What is the volume of the can?

A. 50.30 in^3
B. 56.55 in^3
C. 75.68 in^3
D. 113.04 in^3
E. 226.08 in^3

5. If the area of a square flower bed is 16 square feet, then how many feet is the perimeter of the flower bed?
A. 4
B. 12
C. 16
D. 20
E. 24

6. Of the following units, which would be more likely used to measure the amount of water in a bathtub?
A. Kilograms
B. Liters
C. Milliliters
D. Centigrams
E. Volts

7. What is the cost in dollars to steam clean a room, yards wide and yards long if the steam cleaners charge 10 cents per square foot?
A. 0.9WL dollars
B. 10WL dollars
C. .09LW dollars
D. (W)(L)(10) dollars

8. If a person is 76 inches tall, how tall are they in centimeters?
A. 20 cm
B. 29.92 cm
C. 193.04 cm
D. 300.04 cm
E. 593.04 cm

9. A room measures 11 ft × 12 ft × 9 ft. What is the volume?
A. 1,188 ft^3
B. 32 ft^3
C. 120 ft^3

D. 1,300 ft^3
E. 1,350 ft^3

10. You need exactly a 1,680 ft^3 aquarium for your fish. At the pet store, you see four choices of aquariums, but the volume is not listed. The length, width, and height are listed on the box. Which of the following aquariums would fit your needs?
A. 12 ft × 12 ft x 12 ft
B. 13 ft × 15 ft × 16 ft
C. 14 ft × 20 ft × 6 ft
D. 15 ft × 16 ft × 12 ft
E. 15 ft × 12 ft × 12 ft

Reading a ruler or a tape measure is an important life skill that is one of the bases of a technical drawing. In America we mainly use the imperial system of measurement which means we measure in inches and feet while the rest of the world uses the metric system comprised of meters. For now, we are going to focus on how to read a ruler made up of inches and what all those tick marks mean. So, to start, a foot, which is the normal length of a ruler is made up of 12 inches. An inch can be broken up into fractional parts, normally the smallest being a 16th but a 32nd is also commonly used. But what does that mean?

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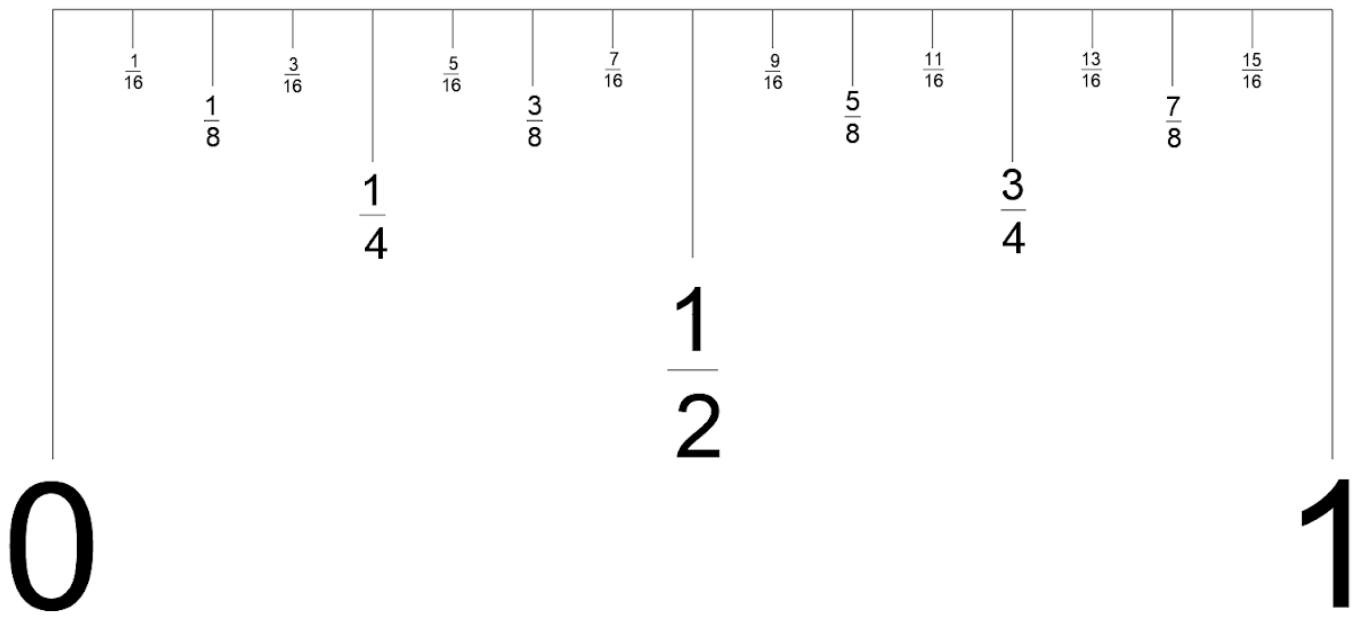
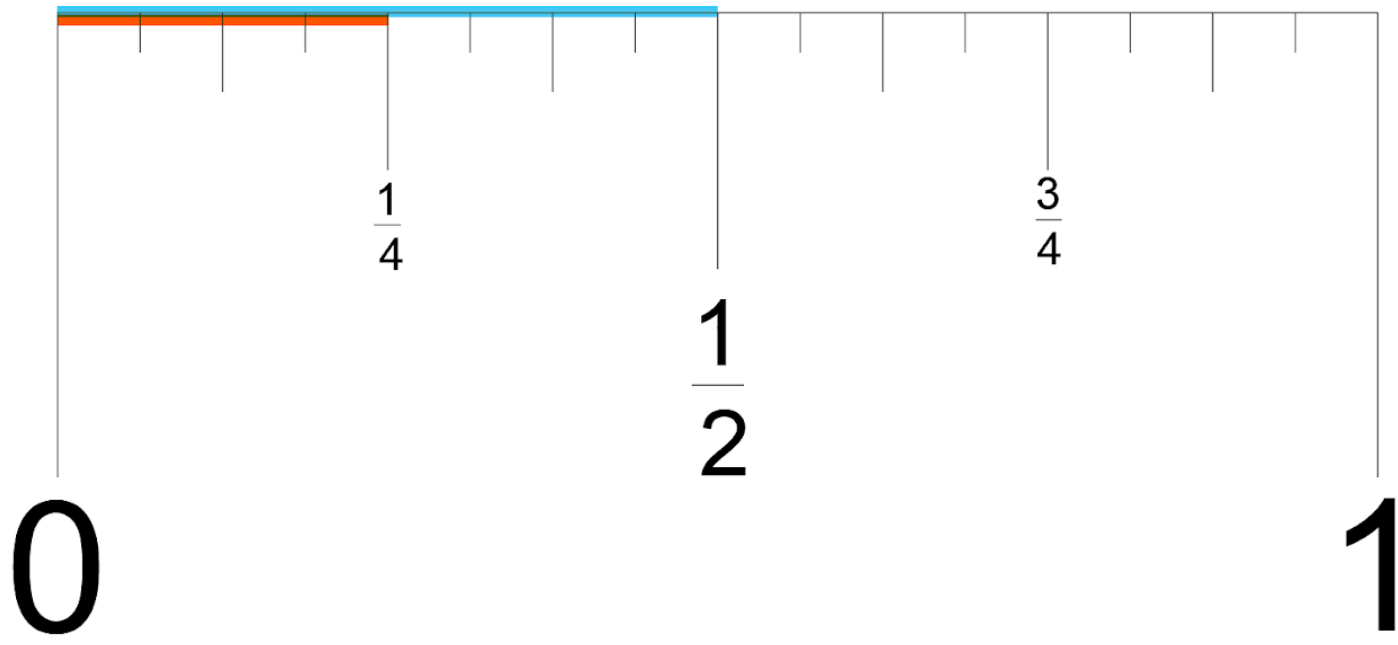
For now, we are going to focus on how to read a ruler made up of inches and what all those tick marks mean. So, to start, a foot, which is the normal length of a ruler is made up of 12 inches. An inch can be broken up into fractional parts, normally the smallest being a 16th but a 32nd is also commonly used. But what does that mean?

Let us look at ruler and break down the inch:



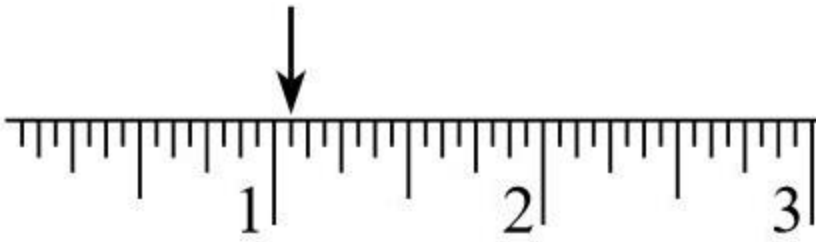
When we look at a ruler the whole numbers represent whole inches. While the tick marks of varying lengths correspond to fractions of an inch. The longest tick mark splits the inch into two halves and represents 1/2 an inch. When we split a half an inch by half again we have 1/4 of an inch, breaking the inch into four parts. When we add two fourths together they add up to one half. You will notice that there is also 3/4 represented on the ruler below. This tick mark shows three quarters of an inch, one quarter more than half an inch.

This pattern continues, splitting the previous fraction in half to get the next fractional value represented on the ruler. Half of a fourth is an eighth, half of an eighth is a sixteenth, and so on. We can count the tick marks to get the measurement we are looking for, but it is a good idea to start to recognize the tick mark lengths, so we know the fraction with which we are working. Also, you will never have an even numerator if you do that it means you can simplify down to a larger fractional denominator. Below is a ruler with multiple-colored marks, find the measurements for each and do not forget about the whole number inches.



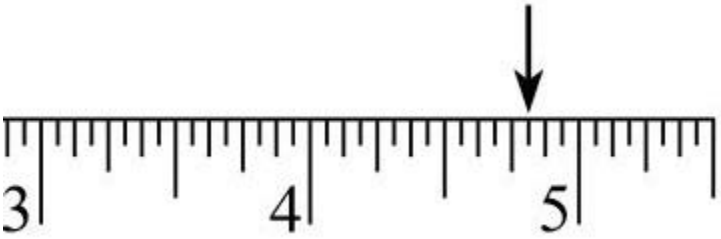
Now let us practice. You can check your answers for accuracy after completing the exercises. Good Luck!

11. What measurement does the arrow indicate?



A. 1 1/16" B. 1 1/8" C. 2 7/8" D. 1 1/16 '

12. What measurement does the arrow indicate?

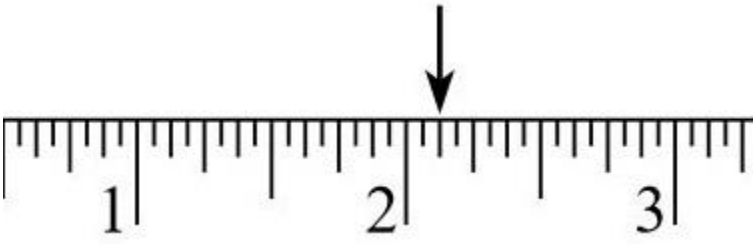


A. 5 3/16" B. 4 3/4" C. 13/16" D. 4 3/4 '

13. What measurement does the arrow indicate? the arrow indicates what measurement?

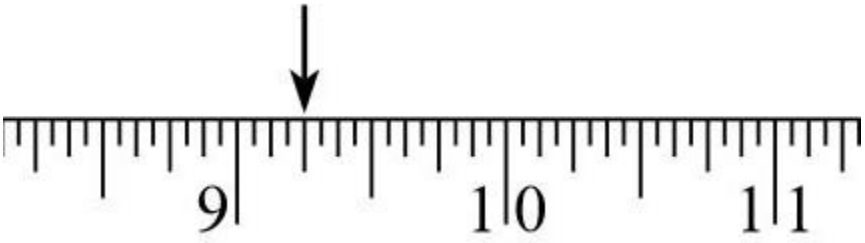
A. 11 1/16" B. 11 1/8" C. 11 1/4" D. 11 1/2"

14. What measurement does the arrow indicate?



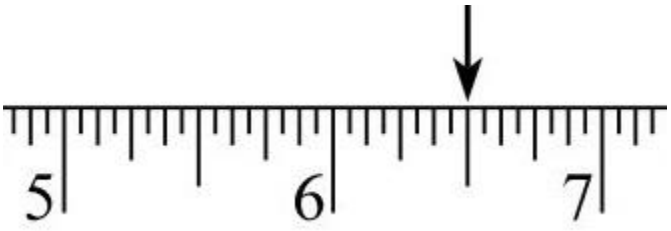
A. 1 2/4" B. 2 1/8" C. 3 7/8" D. 2 1/16"

15. What measurement does the arrow indicate?



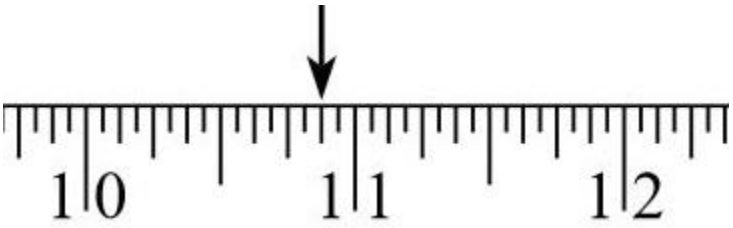
A. 9 1/4" B. 9 1/8” C. 9 1/16” D. 9 ½”

16. What measurement does the arrow indicate?



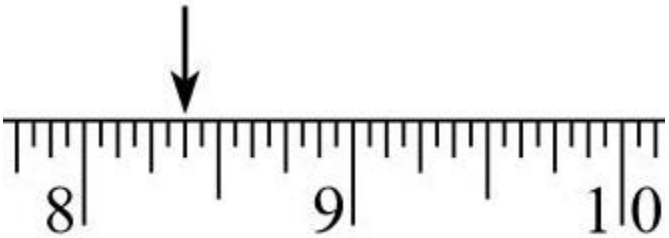
A. 6 1/16" B. 7 1/2" C. 6 1/2” C. 6 1/4”

17. What measurement does the arrow indicate?



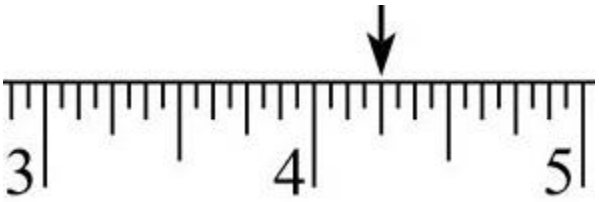
A. 11 1/8" B. 11 1/16” C. 10 3/4" D. 10 7/8”

17. What measurement does the arrow indicate?



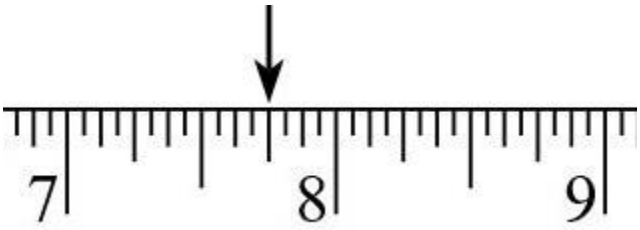
A. 8 1/4” B. 8 1/2" C. 9 3/8” D. 8 3/8"

18. What measurement does the arrow indicate?



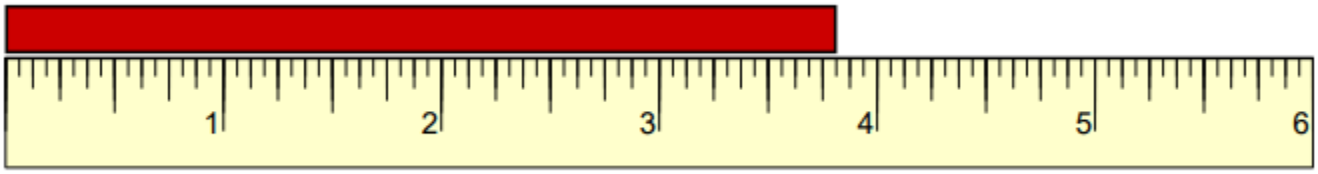
A. 4 1/8" B. 4 1/4" C. 5 1/4" D. 4 1/2"

19. What measurement does the arrow indicate?



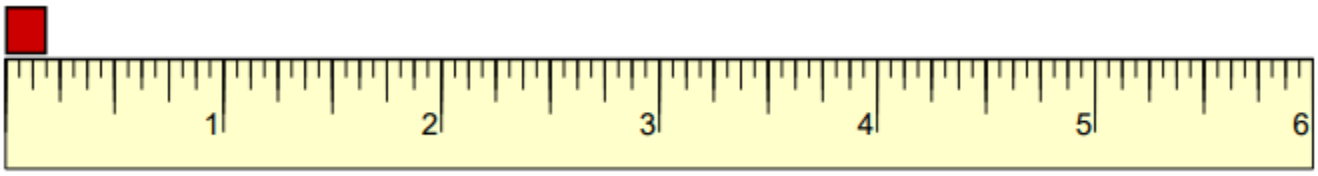
A. 7 3/4" B. 7 1/2" C. 8 1/4" D. 8 1/2"

20. Measure the red line to the nearest sixteenth of an inch.



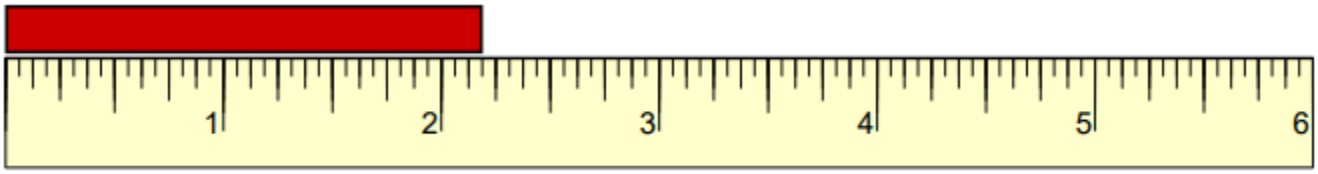
A. 3 13/16” B. 3 1/2 “ C. 3 in D. 3 1/4”

21. Measure the red line to the nearest 16th of an inch.



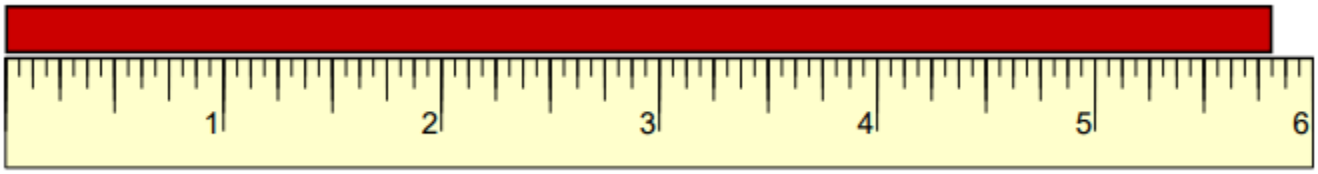
A. 3/16” B. 1 in C. 4/16” D. ¼ “

22. Measure the red line to the nearest sixteenth of an inch.



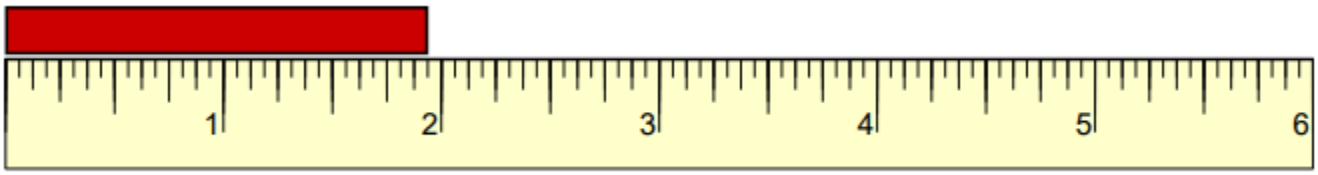
A. 2 1/8” B. 1 1/2" C. 2 3/16” D. 4 “

23. Measure the red line to the nearest sixteenth of an inch.



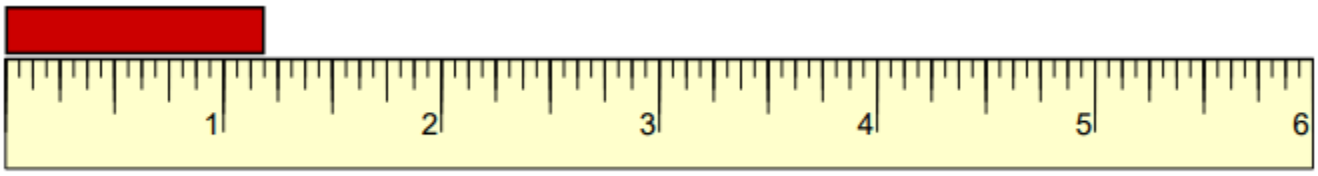
A. 6” B. 5 3/4 “ C. 5 13/16” D. 5 12/16”

24. Measure the red line to the nearest sixteenth of an inch.



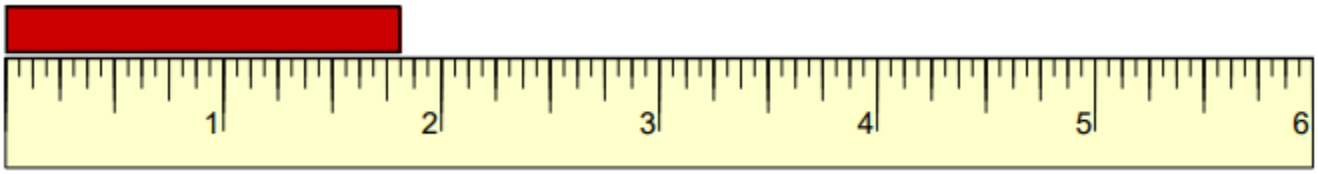
A. 1 7/8” B. 2” C.1 16/16” D. 1 6/16”

25. Measure the red line to the nearest sixteenth of an inch.



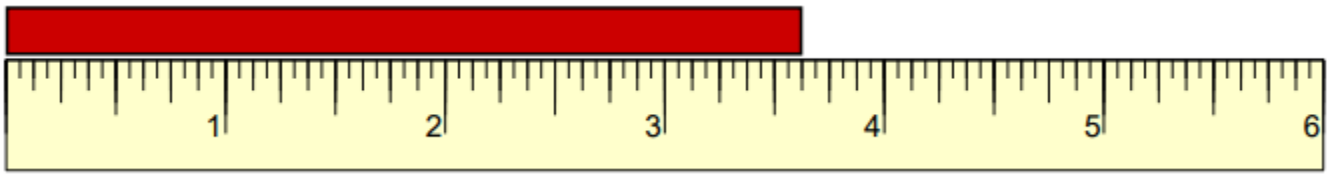
A. 1 4/16” B. 3/16” C. 1 1/4" D. 1 3/16”

26. Measure the red line to the nearest sixteenth of an inch.



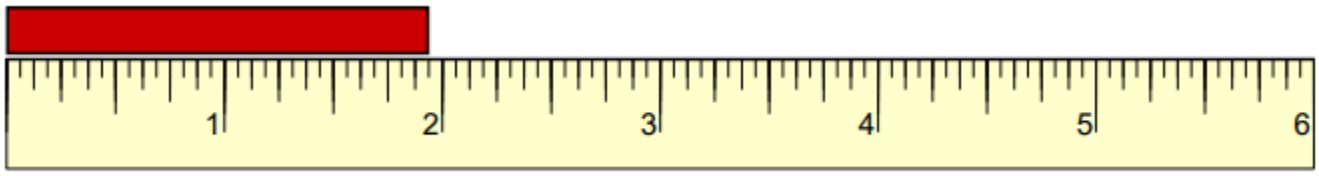
A. 1 13/16” B. 1 2/6” C. 1 3/4” D. 1”

27. Measure the red line to the nearest sixteenth of an inch.



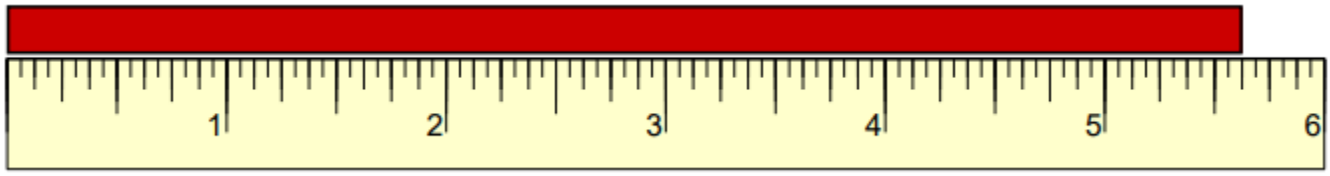
A. 3 10/16” B. 3 3/8” C.3” D. 3 5/8”

26. Measure the red line to the nearest sixteenth of an inch.



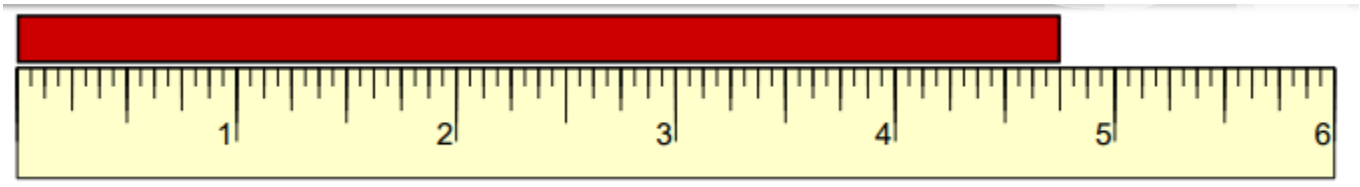
A. 1 7/8” B. 1 1/2" C. 2” D. 1 15/16”

27. Measure the red line to the nearest sixteenth of an inch.



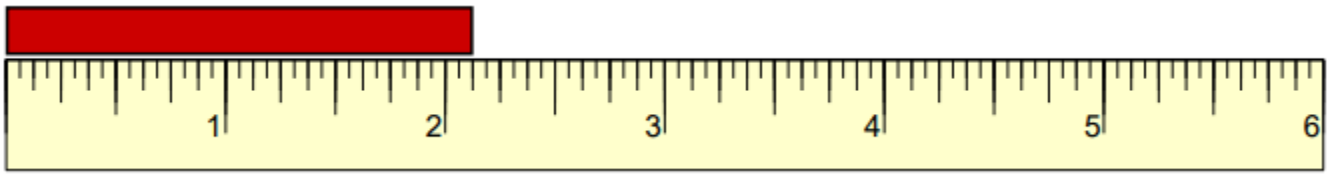
A.5 1/8” B. 5 1/2" C. 5 6/8” D. 5 10/16”

28. Measure the red line to the nearest sixteenth of an inch.



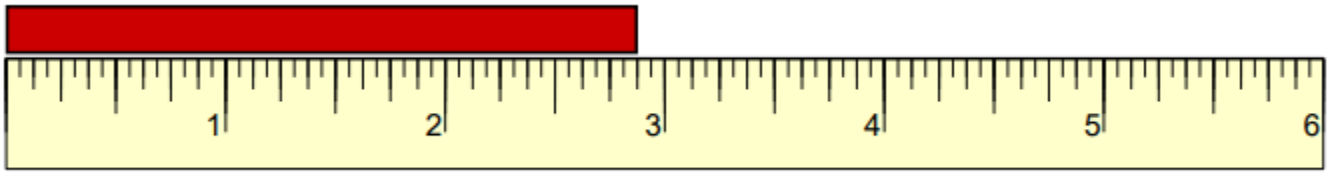
A. 5” B. 4 12/16” C. 4 3/4" D. 4 1/2”

29. Measure the red line to the nearest sixteenth of an inch.



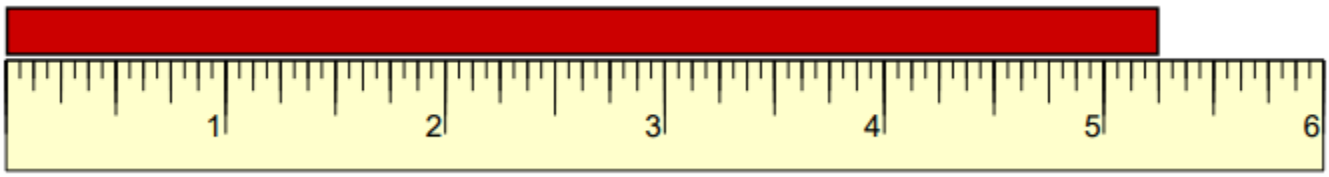
A. 2 1/4” B. 2 1/8” C. 2 2/16” D. 2 “

30. Measure the red line to the nearest sixteenth of an inch.



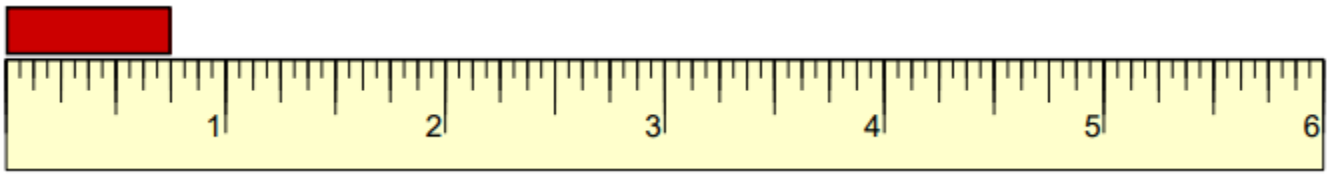
A. 2 13/16” B. 2 1/2” C . 2 7/8” D. 2 14/16”

31. Measure the red line to the nearest sixteenth of an inch.



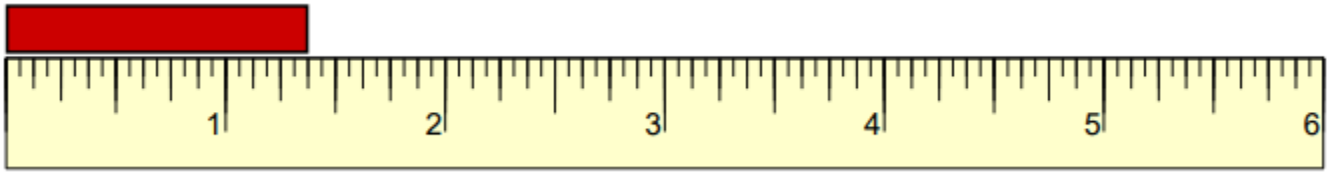
A. 5 4/16” B. 5 1/4" C. 5 3/8” D. 4 1/4"

32. Measure the red line to the nearest sixteenth of an inch.



A. 3/4" B. 6/12” C. 12/16” D. 5/16”

33. Measure the red line to the nearest sixteenth of an inch.



A. 1 1/2" B. 1 3/8” C.2” D. 1 6/16”

MEASUREMENT ANSWERS

1. A - $166.80

The area of the room is equal to the product of 10 ft and 12 ft, or 120 ft2. Since 120 ft2=13.3 yd2, the total cost is equal to the product of the area of the room and $the cost per square yard. Therefore, it will cost $166.80 to carpet the room.

2. A -10 yards

The correct answer is A!

The perimeter of the house is equal to 132 feet, since there are 3 feet in 1 yard. The perimeter of the house may be represented by the equation 2l+2w=132. Substituting 36 for l gives 2(36)+2w=132. Solving for w gives w=30, which is measured in feet. Since 30 feet is the same as 10 yards, the width of the house is also equal to 10 yards.

3. D - The sum of the material is equal to 7 yards, 5 feet, and 19 inches, which equals 9 feet and 7 inches.

4. B- The volume of a cylinder is represented by the equation V=πr2h, where r represents the radius and h represents the height. Substituting 1.5 for rand 8 for h

gives V=π(1.5)2(8)=18π. Thus, the volume is approximately 56.55 cubic inches.

5. C - The area of a square is represented by the formula gives shows each side length to be 4 feet. Thus, the perimeter is equal to the product of 4 and 4, which 16.

6. B - Liter's measure capacity and are appropriate for the size of a bathtub. Milliliters are also a measurement of capacity but are too small a measurement for such a large container.

7. A - The area may be represented as measured in yards or measured in feet. Thus, the charge is equal to the product of 0.10, which is 0.9WL dollars.

First, Calculate the area in square feet. Convert the dimensions of the room from yards to feet. 1 yard = 3 feet, the W (width) becomes 3W and the L (length) becomes 3L feet.

Area = (3W) x (3L) = 9WL square feet

Next, Determine the cost in cents: The cleaner charges 10 cents per square foot. Multiply the total area by this rate:

Cost in cents = 9WL x 10 = 90WL cents

Lastly, Convert the total cost to dollars.

Since there are 100 cents in 1 dollar, divide the total cents by 100:

Cost in dollars = $\frac{90WL}{100} = 0.9WL$

Therefore, the total cost to steam clean the room is 0.9WL dollars.

8. C - The following proportion may be used to find the measurement in centimeters:

$\frac{1}{2.54} = \frac{76}{x}$

Solving for x gives x=193.04. Therefore, the man is 193.04 cm tall

9. A - The volume of a rectangular prism is equal to the product of the length, width, and height. Thus, the volume of the room may be represented as V=11×12.9, which equals 1,188 ft3.

10. C - The product of these dimensions is 1,680 ft3 (14 ft x 20 ft x 6 ft), thus this aquarium meets the required volume.

11. A

12. C

13. D

14. B

15. A

16. C

17. D

18. D

19. B

20. A

21. D or A Simplified

22. C or A Simplified

23. C

24. C

25. D

26. A

27. A or D Simplified

28. D

29. D or C Simplified

30. C

31. A

32. D or C Simplified

33. B

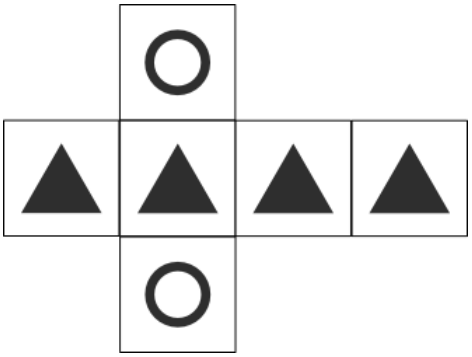
SPATIAL REASONING PRACTICE TEST

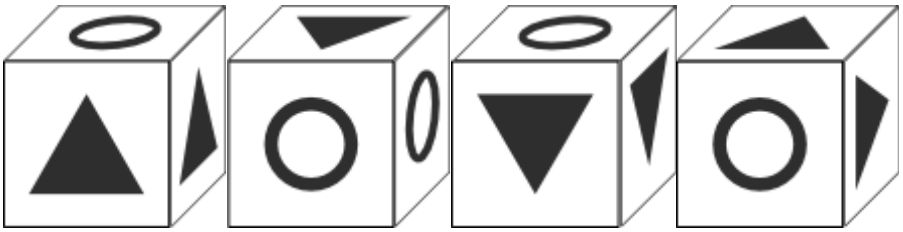
Test your spatial abilities with this spatial reasoning test.

Need practice?

Spatial reasoning is a category of reasoning skills that refers to the capacity to think about objects in three dimensions and to draw conclusions about those objects from limited information. Someone with good spatial abilities might also be good at thinking about how an object will look when rotated. These skills are valuable in many real-world situations and can be improved with practice.

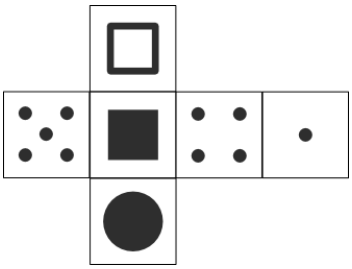
1. Which cube cannot be made based on the unfolded cube?

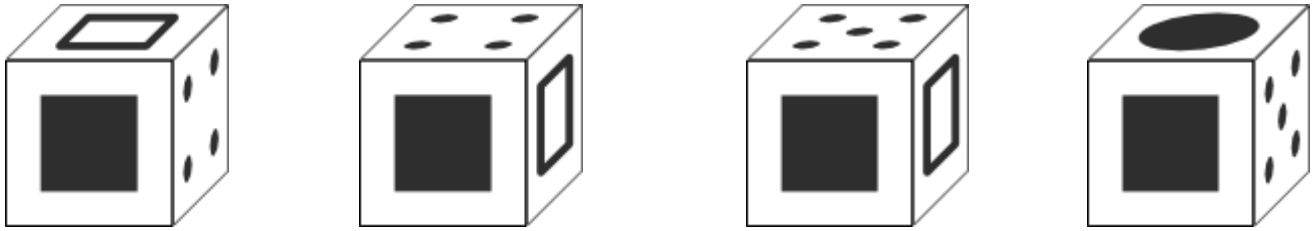




A	B	C	D

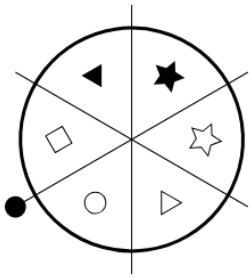
2. Which cube cannot be made based on the unfolded cube?

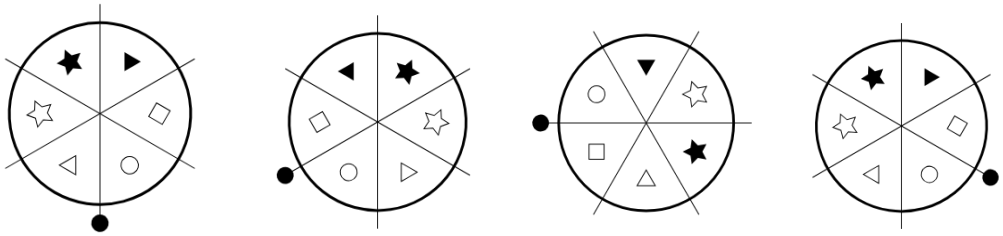




A	B	C	D

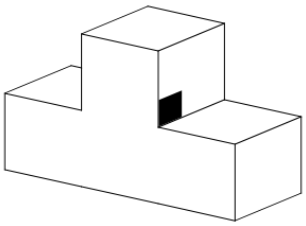
3. Which figure is a rotation of the object?

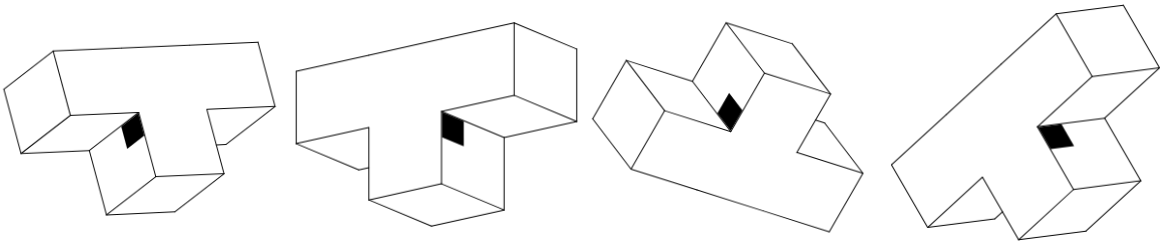




A	B	C	D

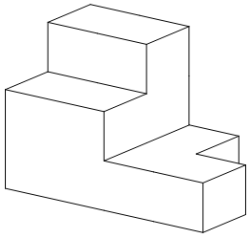
4. Which figure is the rotation of the object?

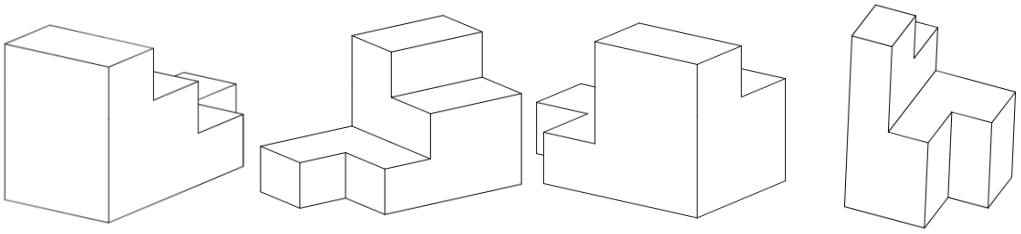




A	B	C	D

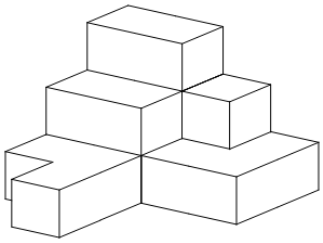
5. Which figure is a rotation of the given object?

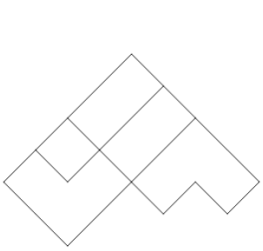


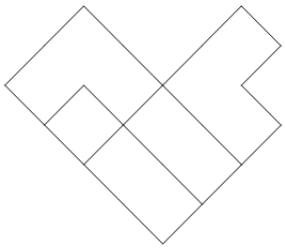


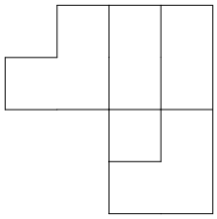
A	B	C	D

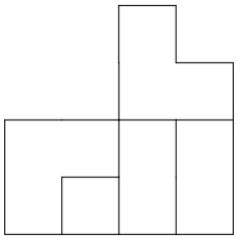
6. Which figure is a top-down view of the given shape?





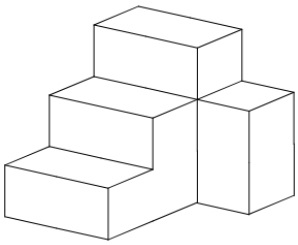


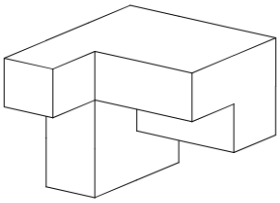


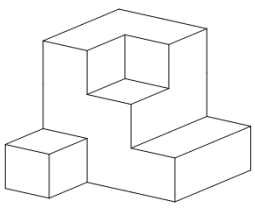


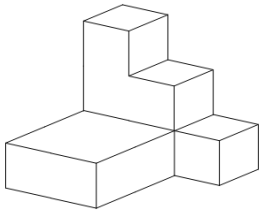
A	B	C	D

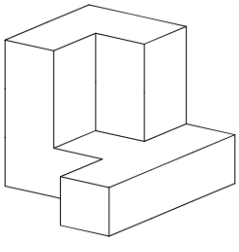
7. Which figure fits the given object, to make a cube?





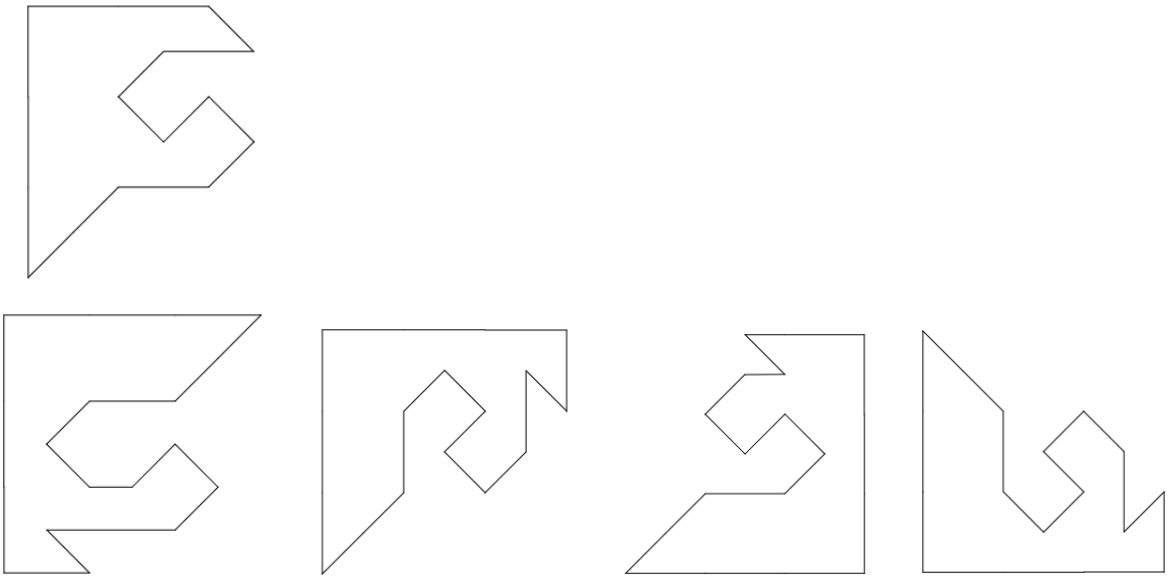






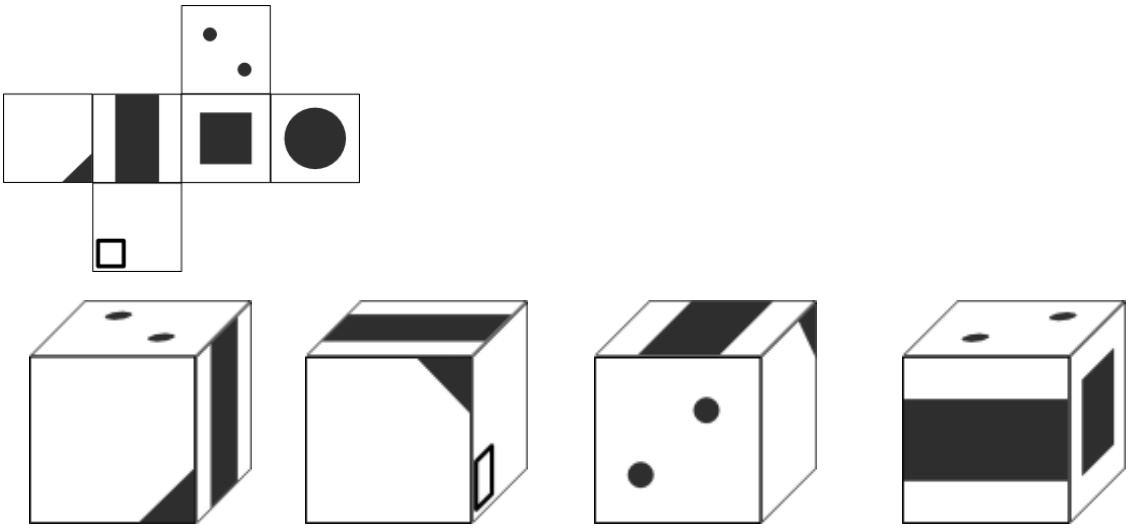
A	B	C	D

8. Which figure fits the given object using rotation only, to make a square?



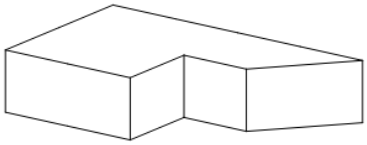
A	B	C	D

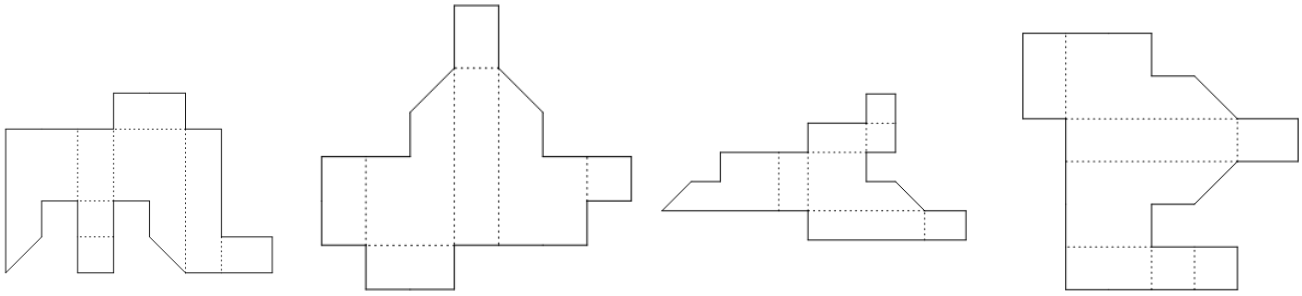
9. Which cube cannot be made based on the unfolded cube?



A	B	C	D

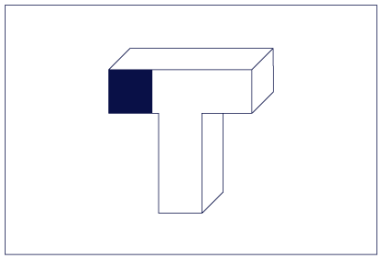
10. Which piece corresponds to the given solid?

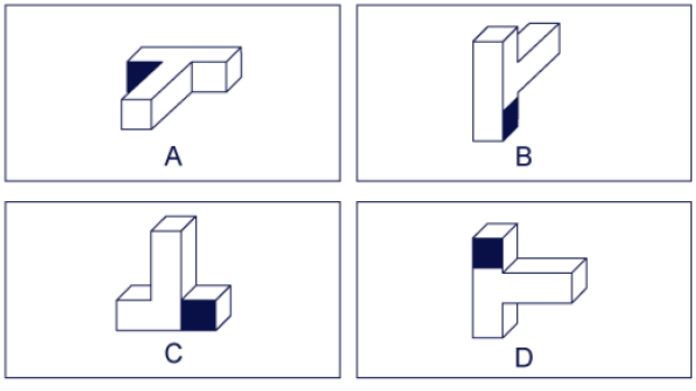




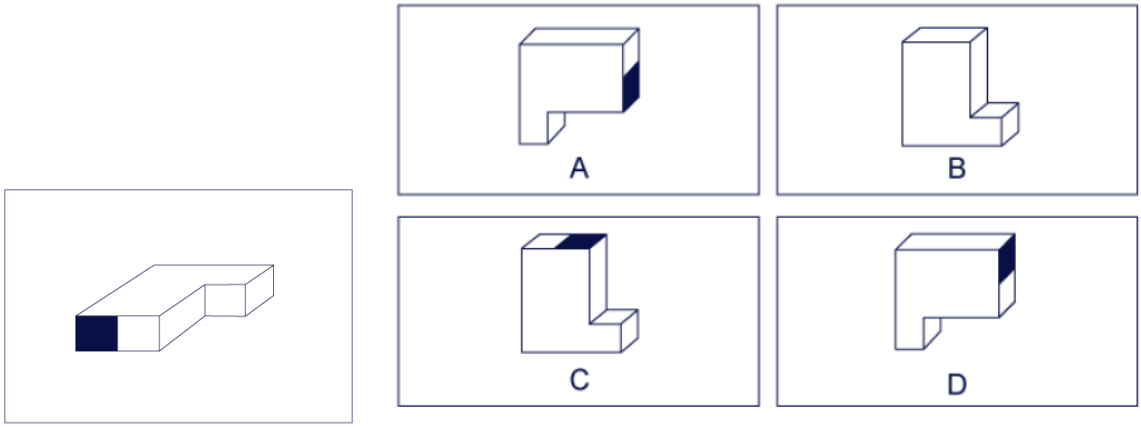
A	B	C	D

11. Which figure is the rotation of the object?

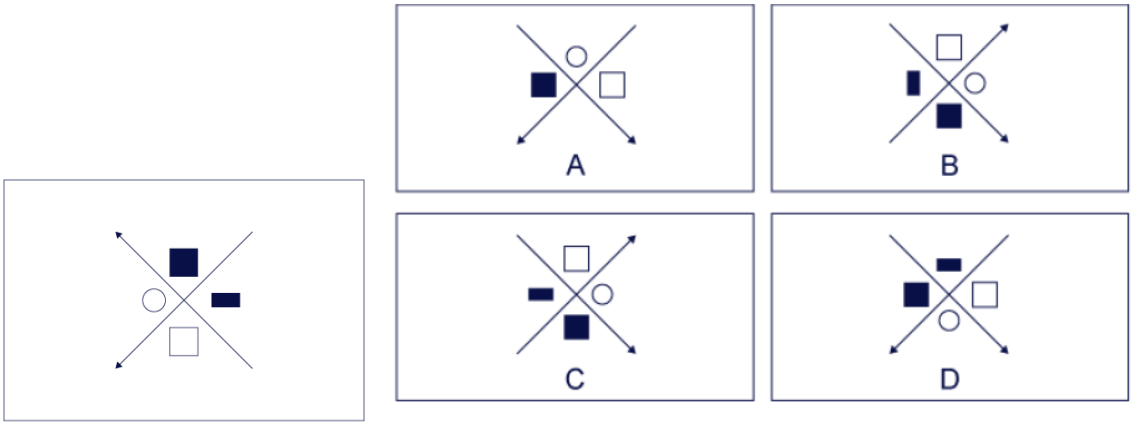




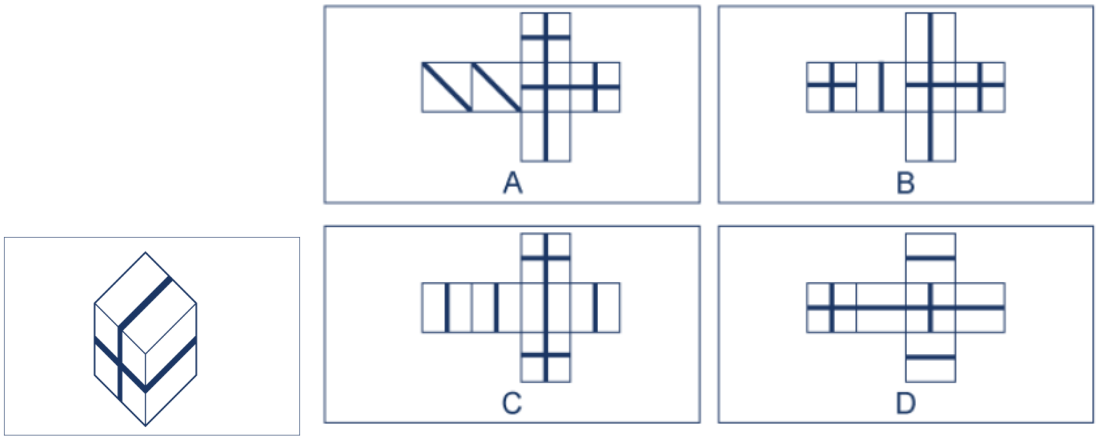
12. Which figure is the rotation of the object?



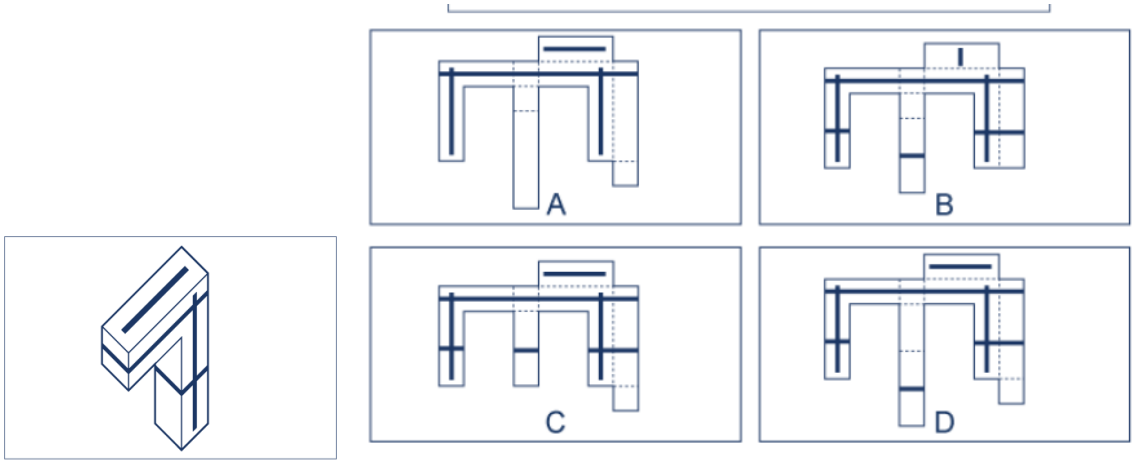
13. Which of the 4 figures presented is a rotation of the first?



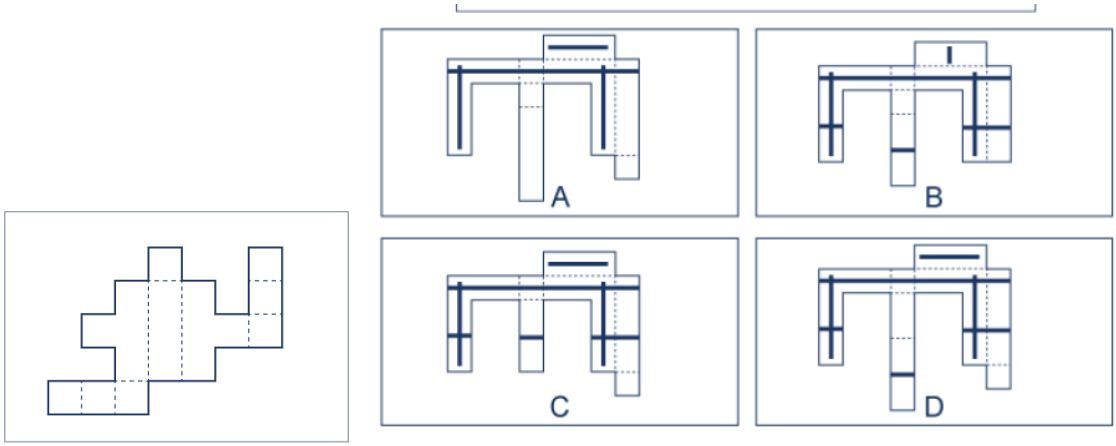
14. Which piece corresponds to the given solid?



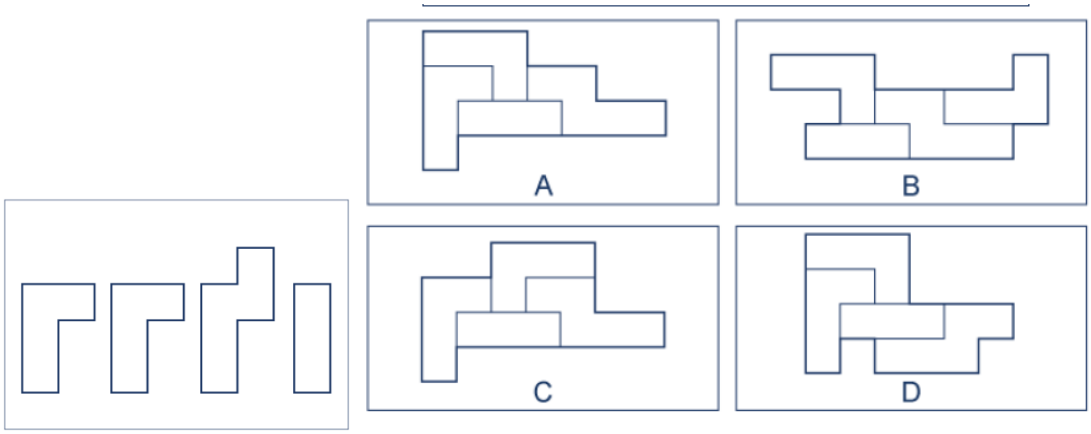
15. Which piece corresponds to the given solid?



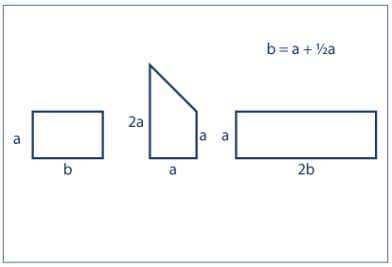
16. Which object can be made by folding the given shape?

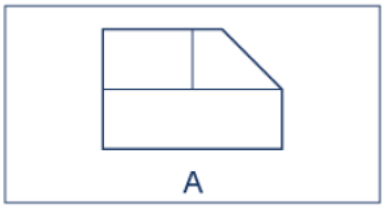


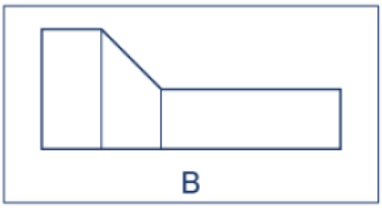
17. Which figure can be formed with the given pieces?

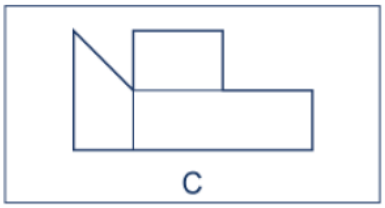


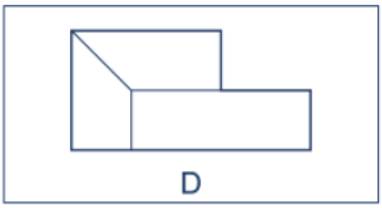
18. Which figure can be formed with the given pieces?



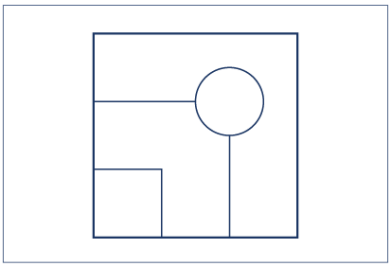


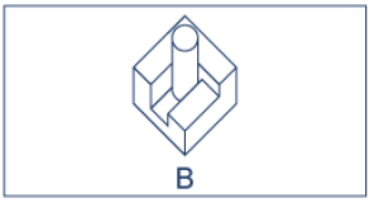


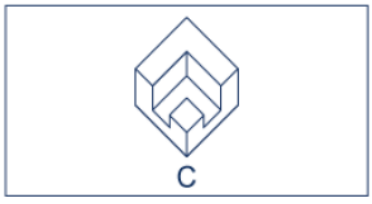


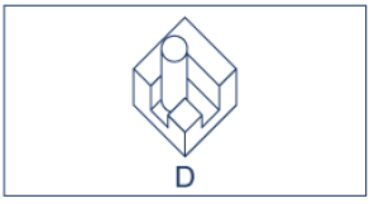


19. To which object does the given top view correspond?

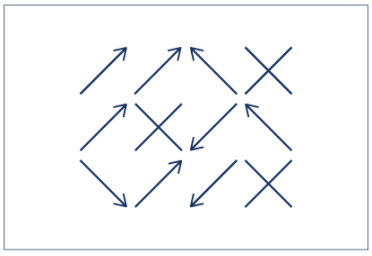


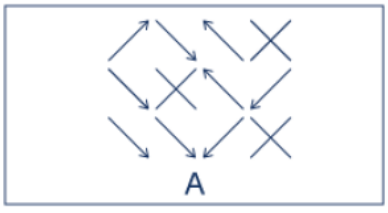


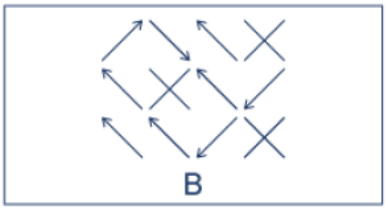


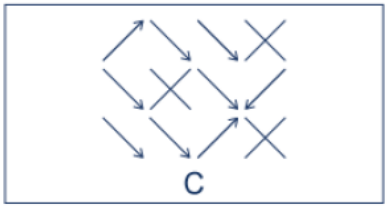


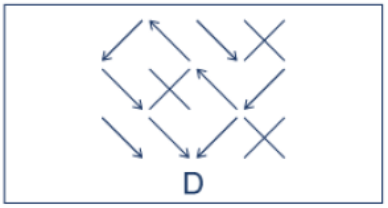
20. Which figure is a vertical reflection across the x axis?



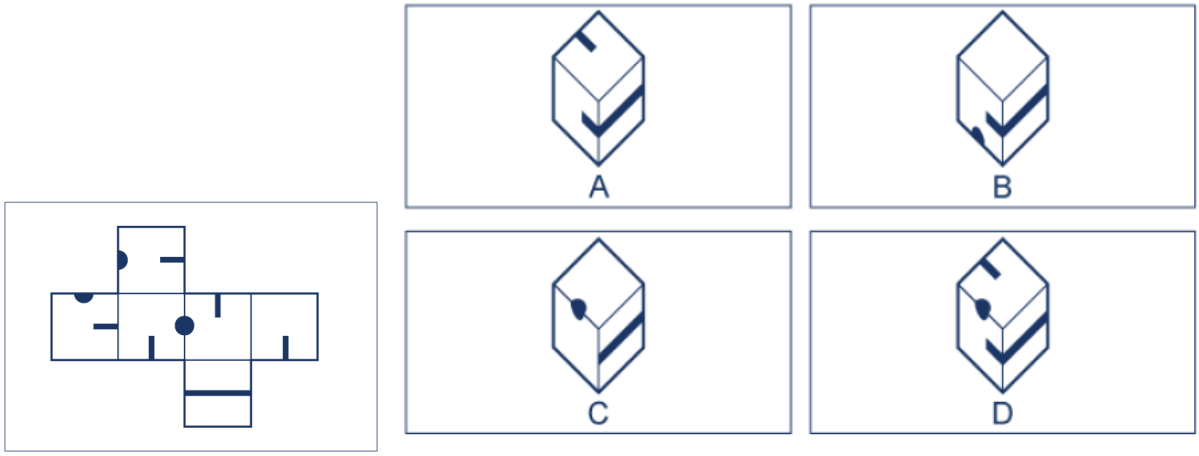




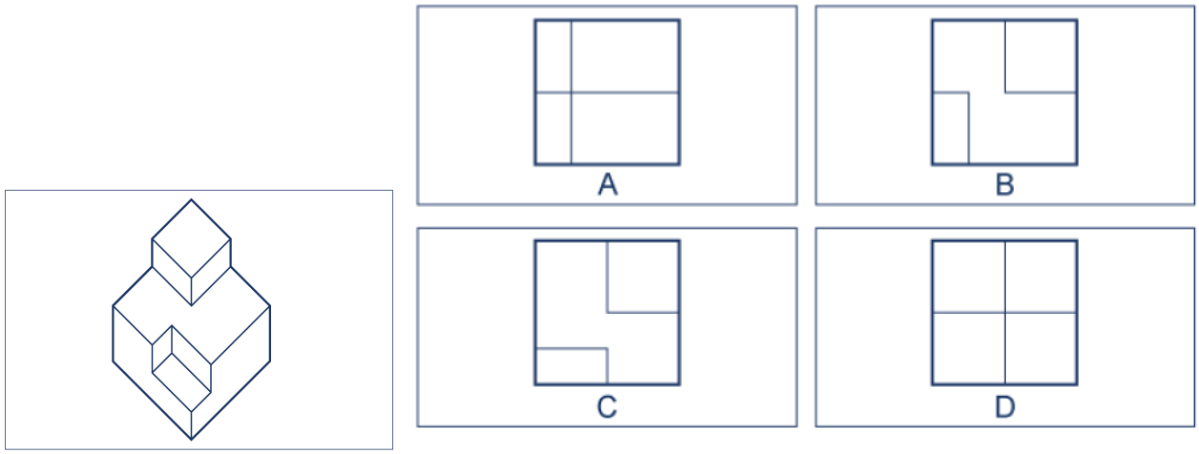




21. Which cube can be formed by folding the given shape?



22. Which of these images is the top view of the given object?



SPATIONAL REASONING ANSWERS

1. B,

2. C,

3. D,

4. A,

5. C,

6.B,

7. A,

8. D,

9. D,

10. C

11. B

12. D

13. C

14. C

15. D

16. C

17. A

18. C

19. A

20. A

21. D

22. C

READING PRACTICE 1

The success of most construction projects depends on using the right nails. Read the following paragraphs and study the chart before answering questions 1 through 6.
A common nail is used most often in wood construction when two pieces must be fastened together. The nail size and shape are important. The shaft of the common nail is thick, making it easy to drive without bending; the head is broad, preventing the nail from pulling through and groves on the shaft keep the nail from pulling loose.

When ordering common nails, you use the term "penny" for length. The symbol "d" stands for penny. A tradesperson ordering eight-penny nails will write "8d nails". Each penny designation refers to the length, shaft, diameter, head size, and weight. For example, an order for 10 pounds of 20d common nails will always mean 300 nails that are 4 inches long.

The chart below can be used to obtain length, estimate the number of nails per pound, and determine the proper nail for the job. The length of the nail should be at least two times the thickness of the board being nailed. A board that is one inch thick requires a nail that is at least two inches long. For structural integrity and safety, it is important that the nail does not protrude through the pieces being fastened together. The chart below shows that anything less than a 6d nail would be too short to nail a one-inch-thick board.

Table of Common Nails

Size	Length	Guage	# per lb.
2d	1"	15	840
3d	1 1/4"	14	540
4d	1 1/2"	12 1/2	290
5d	1 3/4"	12 1/2	250
6d	2"	11 1/2	160
7d	2 1/4"	11 1/2	150
8d	2 1/2"	10 1/4	100
9d	2 3/4"	10 1/4	90
10d	3"	9	65
12d	3 1/4"	9	60
16d	3 1/2"	8	45
20d	4"	6	30
30d	4 1/2"	5	20
40d	5"	4	16
50d	5 1/2"	3	12
60d	6"	2	10

Answer the following questions.

Questions

1. How many nails would you get in two pounds of 8d nails?
a. 167 nails
b. 202 nails
c. 61 nails
d. 1,010 nails

2. When ordering ten penny nails, would you write?
a. 10 nails
b. 10 pounds of nails
c. 10 common nails
d. 10d nails

3. You need to nail a board that is 1" thick. What size nails would be best?
a. 2d
b. 4d
c. 6d
d. None of the above

4. Which word best describes a common nail?
a. Inexpensive
b. Scarce
c. Foreign
d. None of the above

5. Grooves in a common nail are important because:
a. They do not bend easily
b. The head is broad
c. they prevent the nail from pulling loose
d. All the Above

6. A 10d nail should be used to fasten a _____ " board
a. 3"
b. 4"
c. 1 ½ "
d. 1"

1. B, 2. D, 3. C, 4. D, 5. C, 6. C.

READING PRACTICE 2

Where does electricity come from?

Some of you may reply, “Electricity comes from the outlet in the wall.” If only it were that simple! Let us dig deeper into the making of the electrical power that we take for granted. Electricity is a property of atoms, so to understand where electricity comes from, you will need a general knowledge of atoms.

Atoms are the building blocks of all matter. Everything from the book you are reading to the air you are breathing is made up of millions of tiny atoms. Atoms contain several types of electrically charged particles whose structure can be compared to a miniature solar system. An atom contains a large central core (like our sun) called the nucleus. Orbiting around the nucleus are tiny negatively (-) charged particles called electrons. There is a lot of empty space between the nucleus and the orbiting electrons. The nucleus contains two types of particles; neutrons which have no electrical charge (thus the name neutrons for neutral), and protos which have on unit of positive (+) charge each. The electrons orbiting the nucleus are much smaller in size than the neutrons and protons but have equally as strong a negative electrical charge as the proton has in positive charge. When equal numbers of protons and electrons are found in an atom their charges cancel or balance each other’s effect to give the atom an overall zero charge. Atoms can be made to lose or gain electrons, which offsets the electrical balance of charges. Atoms with more electrons than protons are said to have a negative overall charge, and atoms with fewer electrons than protons are said to possess a positive charge. Materials made with these charged atoms have electrical potential, which means that they could produce electricity.

So how do you make atoms give up electrons? There are three ways to make an atom lose electron(s) and thus, gain an overall electrical positive charge.

The first method is friction; rub off the outer orbiting electron(s). The term static means stationary or non-moving, so static electricity is non-moving electricity. Static electricity is produced by friction. As two materials rub together electrons are rubbed off from one substance and are picked up by the other substance.

You have probably used this technique as a child to make a rubber balloon “stick” to a wall by rubbing it on your hair (your hair picked up a charge also). Sliding across leather car seats in a nylon suit or walking across a wool rug also generates static electricity from friction. Walking across a wool rug generates friction between your shoes and the rug. Electrons are rubbed off

the carpet, so the carpet takes on a positive charge. Your body picks up the electrons removed from the carpet, so your body gains a negative charge. Your body holds that charge (static) until it can be transferred by contact with another object. The sudden release of charge from your body is the static discharge or shock. Lightning is another form of static discharge when vast numbers of atoms become charged. Lightning is generated when rain clouds move rapidly through the atmosphere. The lightning bolt is the immense release of static charge.

The second method is chemical action. Dry cells, lead storage batteries, and all sorts of chemical batteries use chemical action to produce large numbers of free electrons at the negative pole. When the negative pole of a battery is connected to the positive terminal via a conductor (wire), electrical current “flow” through the circuit due to the attraction of unlike charges and the imbalance of charges (electromotive force) of the poles from the chemical action. Batteries produce a current that flows in one direction. Electrical current that flows in one direction is known as direct current or DC.

The third method involves the use of magnets and wire.

Motors, meters, generators, transformers, and electromagnets all produce electricity from magnet and wires. As the magnetic fields of the magnet “cut” across a coil of wire the atoms in the wire become electrically charged and flow in the wire. In the devices mentioned one of two methods are applied; either a coil of wire rotates around a stationary magnet, or a magnet rotates inside a coil of wire. In either case the north pole of the magnet generates electrical current in one direction, and the south pole causes the current to reverse and flow in the opposite direction. The direction of the flow of atoms in the conductor alternates as the north then the south magnetic fields cut the coil of wire. This is called alternating current. The electricity in your home is probably generated using a magnetic core surrounded by a coil of wire.

These are the three methods used to generate electrical power.

Questions

After reading about electricity, answer the following questions.

1. What are the 3 types of particles found in an atom?
a. Orbits, core, and charges
b. Protons, nucleus, and electrons
c. Matter space and nucleus
d. Protons, neutrons, and electrons
e. None of the above

2. A proton has a single unit of ____ charge, and an electron has a single unit of _____ charge.
a. Neutral, positive
b. Negative, positive
c. Positive, negative
d. Negative, neutral
e. None of the above

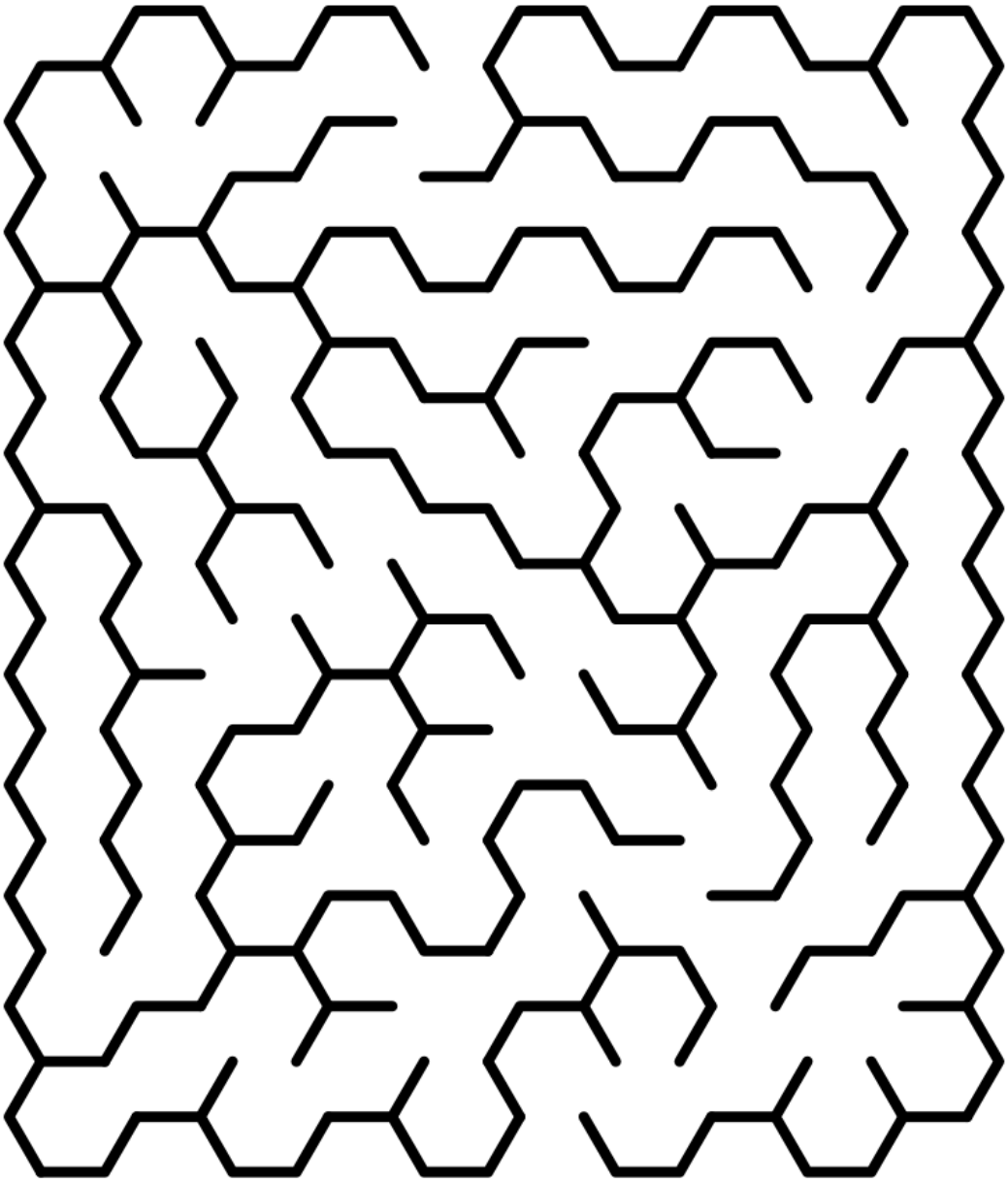
3. Lightning is a form of _____ electricity.
a. Chemical
b. Solar
c. Alternating
d. Magnetic
e. None of the above

4. Batteries generate electricity from _____.
a. Chemical action
b. Friction
c. Magnet and wires
d. Transformers
e. All the above

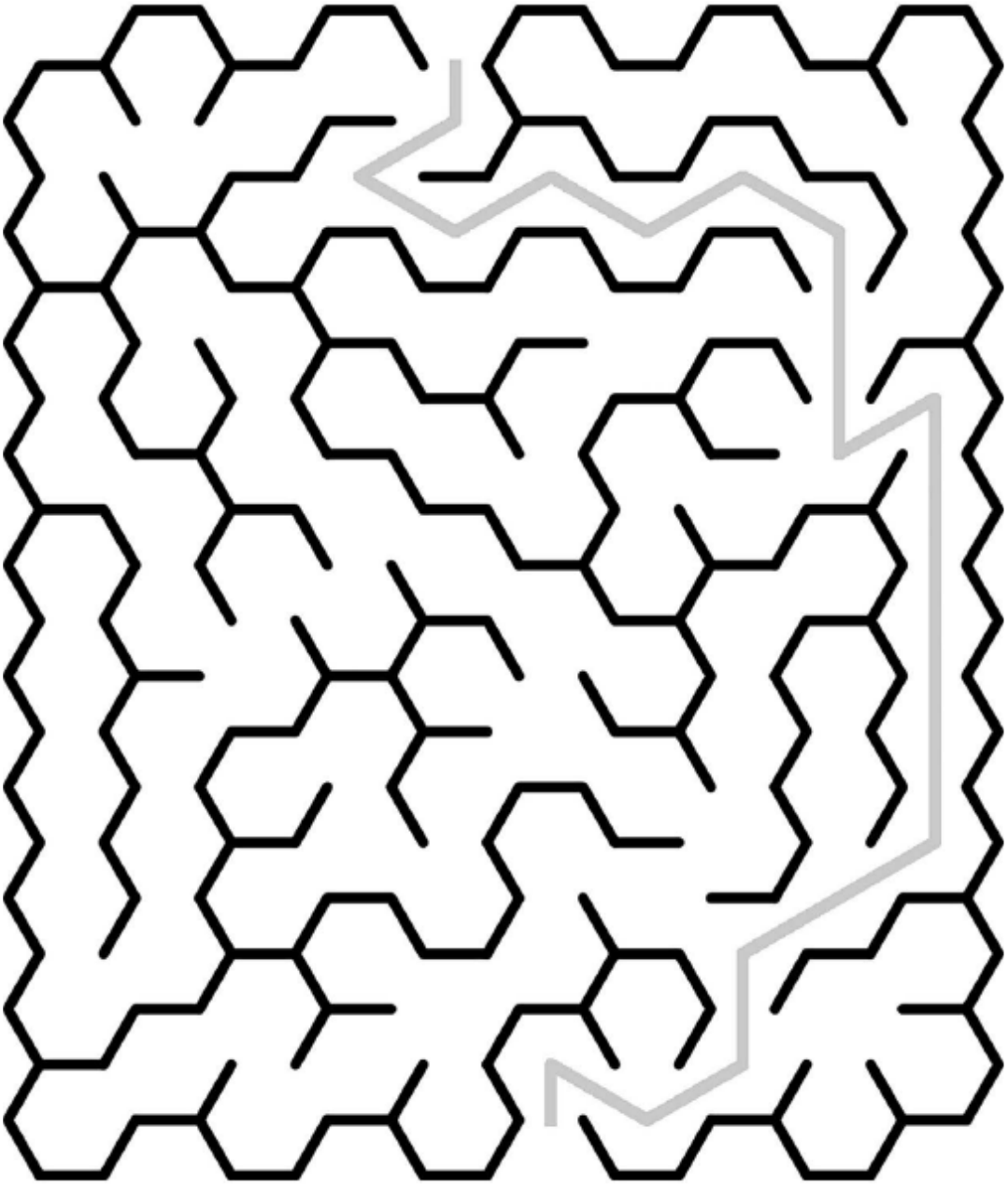
5. The article mentioned three methods commonly used to separate electrons from atoms to generate electrically charged particles
a. Chemical, nuclear, and atomic
b. solar, magnetic, and lightning
c. Hydraulic, static, and nuclear
d. Friction, chemical, and magnets and wires
e. All the above

1.D 2.C 3.E 4.A 5.D

LABYRINTH PRACTICE EASY



ANSWER EASY



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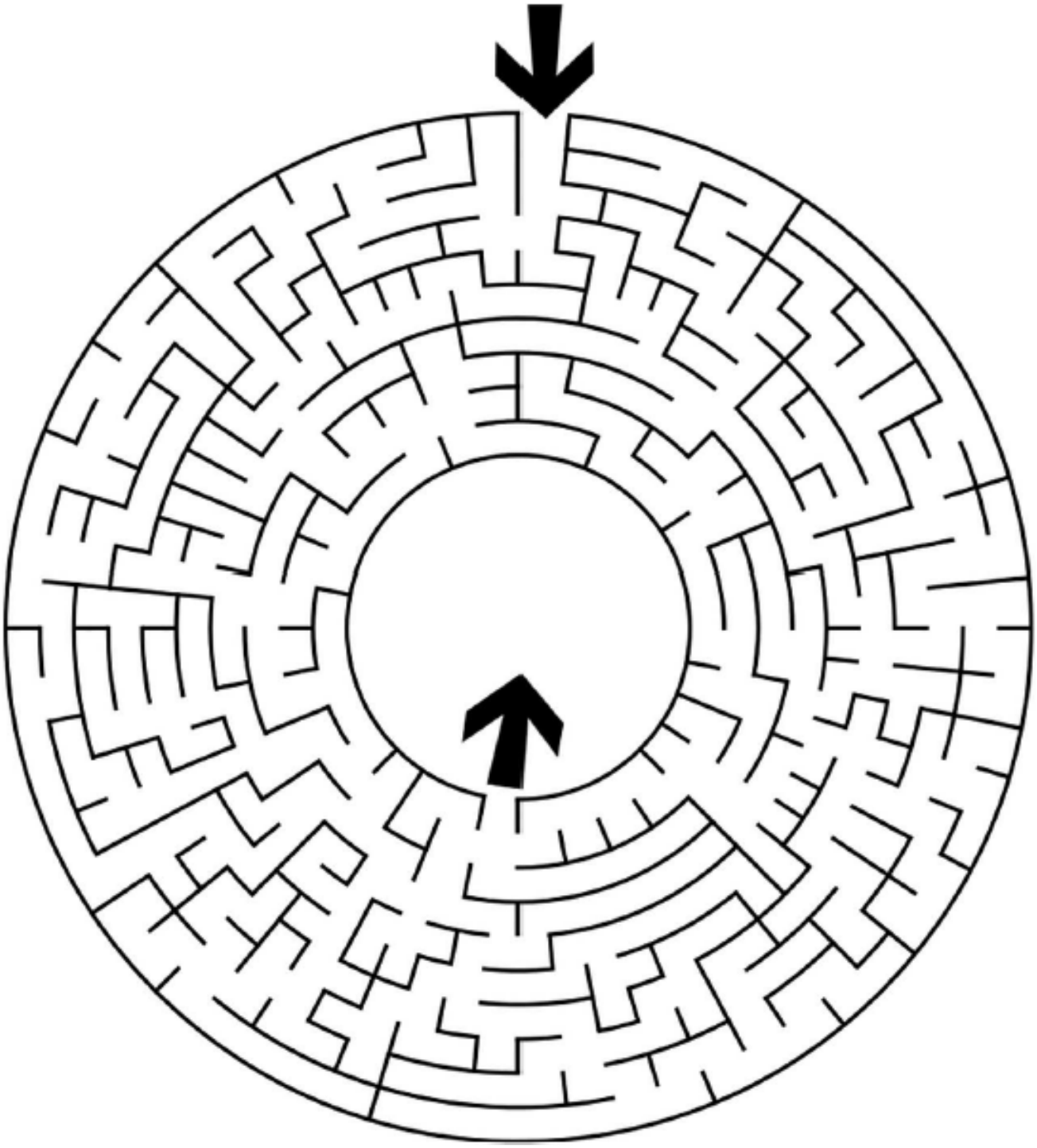

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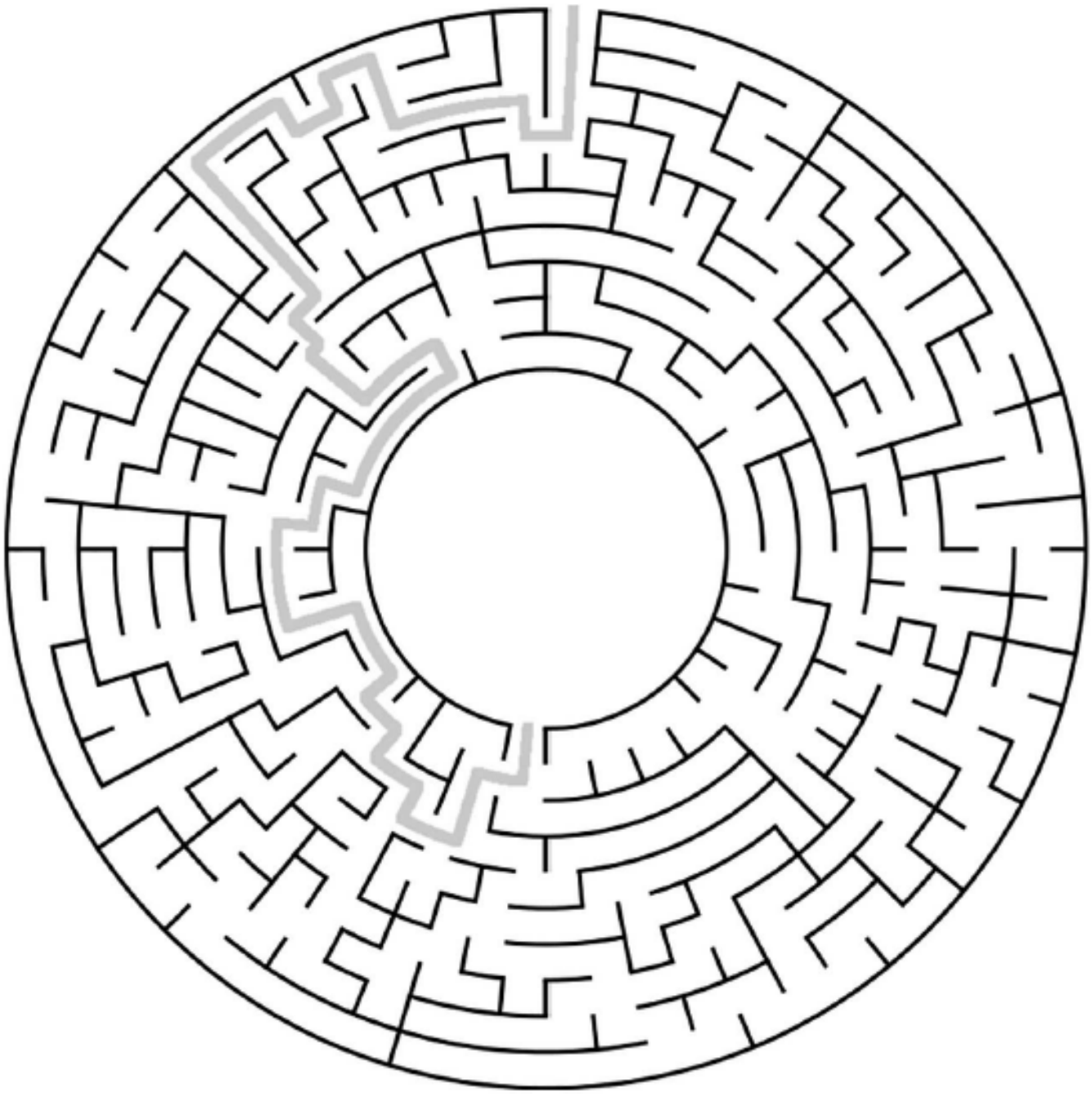

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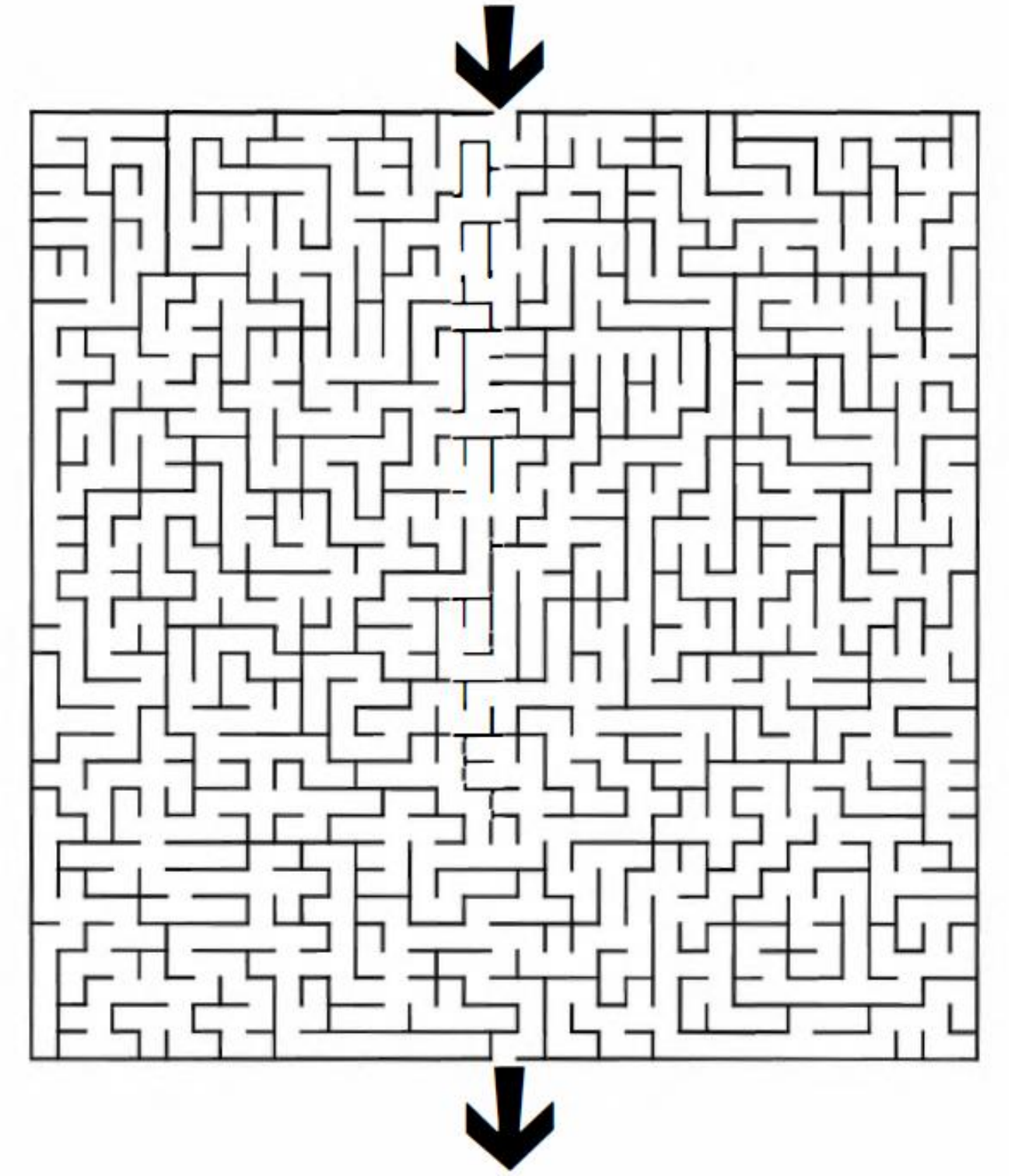

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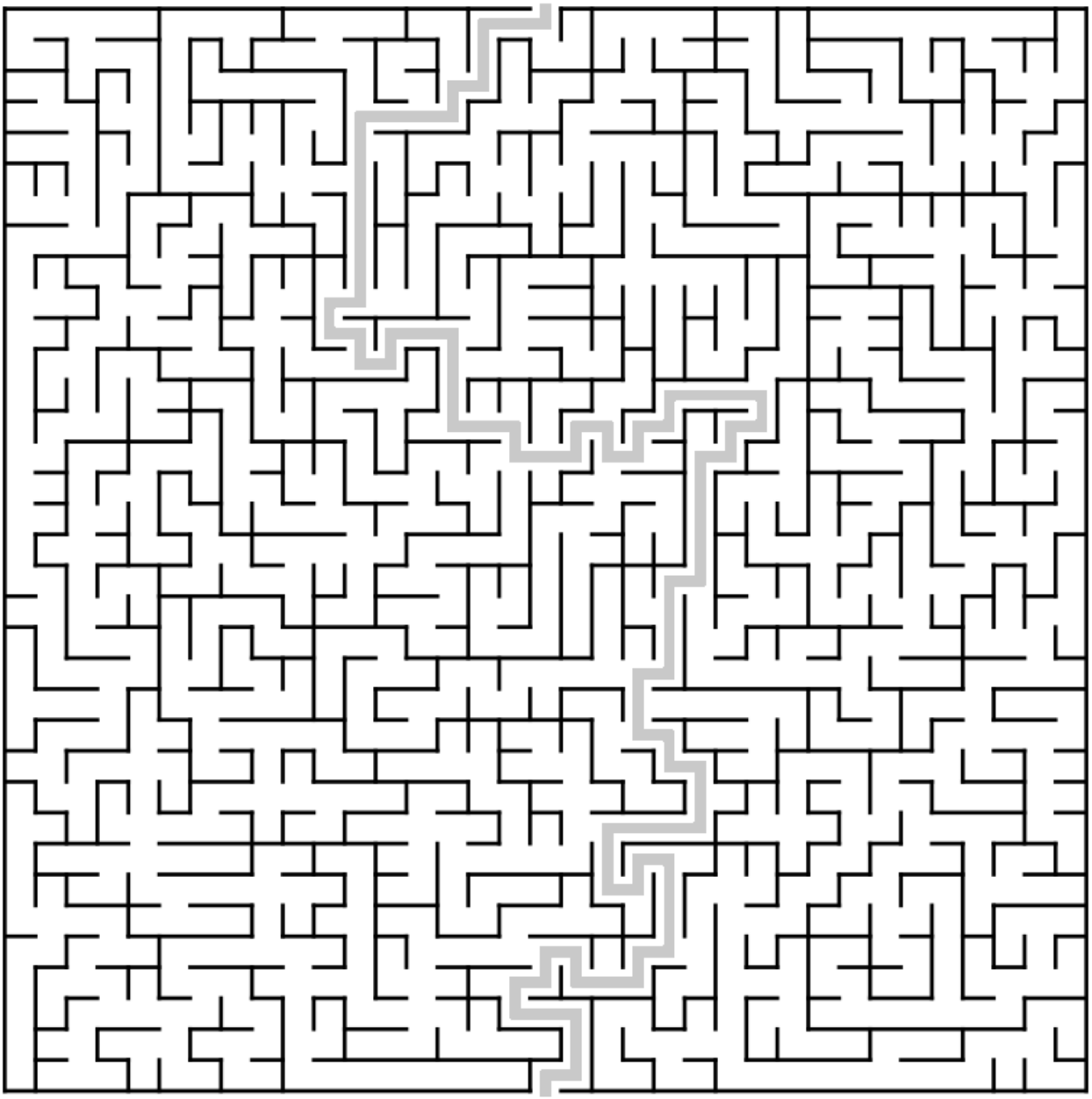

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