

ACADEMIC CHALLENGE FOR
ACES
ENGINEERING AND SCIENCE



EASTERN ILLINOIS UNIVERSITY

2023 Academic Challenge

STATE ENGINEERING GRAPHICS EXAM

Engineering Graphics Test Production Team

Ryan Brown, Illinois State University – Author/Team Leader

Ted Branoff, Illinois State University – Reviewer

GENERAL DIRECTIONS

Please read the following instructions carefully. This is a timed test; any instructions from the test supervisor should be followed promptly.

The test supervisor will give instructions for filling in any necessary information on the answer sheet. Most Academic Challenge sites will ask you to indicate your answer to each question by marking an oval that corresponds to the correct answer for that question. One oval should be marked to answer each question. Multiple ovals will automatically be graded as an incorrect answer.

Be sure ovals are marked as  , not  ,  ,  , etc.

If you wish to change an answer, erase your first mark completely before marking your new choice.

You are advised to use your time effectively and to work as rapidly as you can without losing accuracy. Do not waste your time on questions that seem too difficult for you. Go on to the other questions, and then come back to the difficult ones later if time remains.

Time: 40 Minutes

Number of Questions: 40

DO NOT OPEN TEST BOOKLET UNTIL YOU ARE TOLD TO DO SO!

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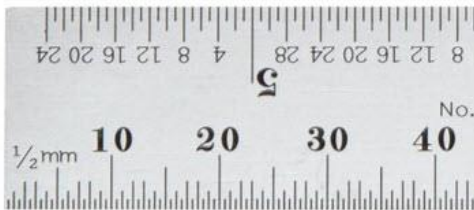
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2023 Academic Challenge
State Engineering Graphics Exam

1. In general, which of the following terms is the most synonymous with **engineering graphics**?
- A. Geometry
 - B. Drafting
 - C. Specifications
 - D. Analytics
 - E. Trigonometry

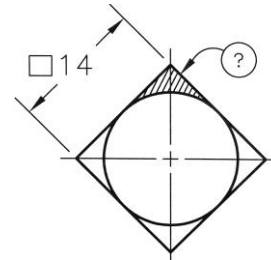
2. Which of the following model railroad scales is nearest in scale factor to the architectural scale of $3/16'' = 1'0''$?
- A. Z scale (1:1220)
 - B. N scale (1:160)
 - C. HO scale (1:87)
 - D. S scale (1:64)
 - E. O scale (1:48)

3. This is an enlarged view of one end of a Starrett™ steel rule featuring both Imperial and Metric units. On the inch edge, the numeral 5 is 5" away from the other end of the scale (not shown). What numeral metric value would be found at the far right end of the scale on the metric edge?



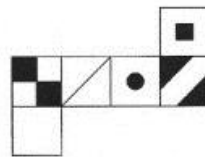
- A. 120
- B. 150
- C. 180
- D. 210
- E. 240

4. Calculate the area of the hatched area above the circle, and select an answer nearest your calculation:



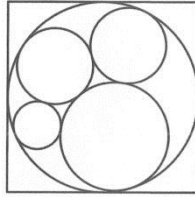
- A. 5.1 in^2
- B. 7.6 in^2
- C. 10.5 in^2
- D. 21.0 in^2
- E. 42.1 in^2

5. In this test of spatial visualization, which of the cubes is a correct match of the flat pattern foldout?



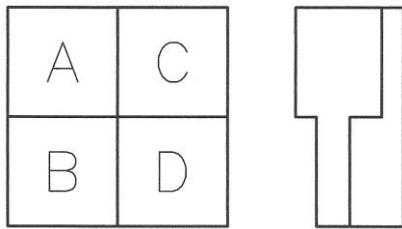
- A.
- B.
- C.
- D.
- E.

6. How many “points of tangency” can be identified within this graphic logo?



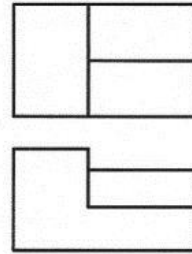
- A. 9
- B. 10
- C. 11
- D. 12
- E. 13

7. With respect to a viewer in front of the object looking at the front view (the one with labels), which of the following statements is **TRUE**?



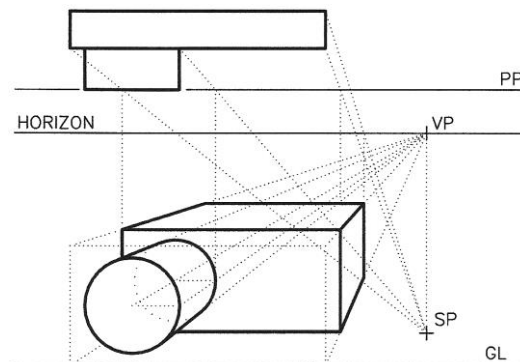
- A. Surface A is closest to viewer
 - B. Surface B is closest to viewer
 - C. Surface C is closest to viewer
 - D. Surface D is farthest from viewer
 - E. Surface A and D are the same distance from viewer
8. Which of the following terms is a common 3D CAD function that creates a model by giving height or thickness to a 2D region or closed shape?
- A. REAM
 - B. SPREAD
 - C. UNION
 - D. MOUNT
 - E. EXTRUDE

9. Assuming only flat planar surfaces, either normal or inclined, how many objects could exhibit a front and top view as illustrated below?



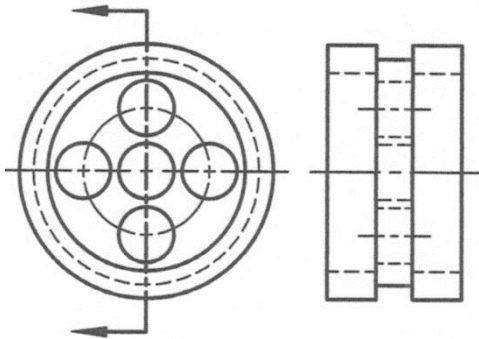
- A. 1
- B. 2
- C. 3
- D. 4
- E. More than 4

10. Specifically, what type of pictorial drawing is being constructed in the illustration below?



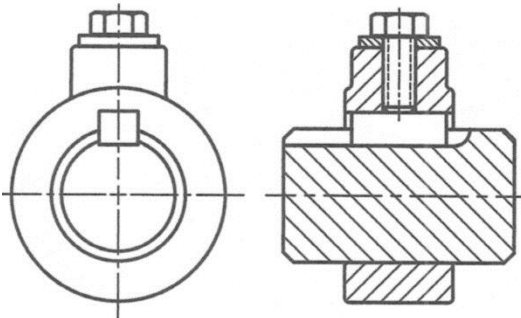
- A. Dimetric
- B. Oblique
- C. 1-point perspective
- D. 2-point perspective
- E. 3-point perspective

11. If the right side view of this drawing is converted into a full section view, how many "bounded areas" will the section view have that feature section lines?



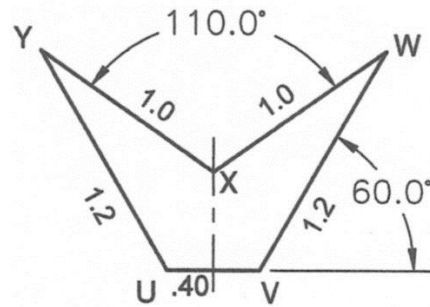
- A. 1
- B. 2
- C. 3
- D. 4
- E. 5

12. In the assembly section below, how many parts in the right side sectional view are shown as "cut" by a central cutting plane, and how many are shown as "not cut"?



- A. 3 cut – 2 not cut
- B. 2 cut – 3 not cut
- C. 4 cut – 2 not cut
- D. 4 cut – 1 not cut
- E. 5 cut – 1 not cut

13. A CAD system has a relative polar input syntax: " $=$ distance \langle direction", and angles increase counter-clockwise. (For example, to draw a vertical line up the page 3 inches, enter " $=3\langle 90$ ".) Which of the sequences will draw line segments from U to X.



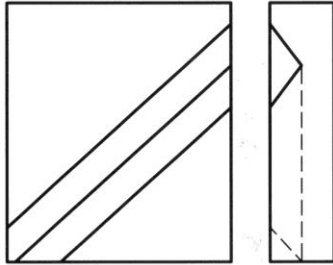
- A. $=.4\langle 0$; $=1.2\langle 60$; $=1\langle 110$
- B. $=.4\langle 0$; $=1.2\langle 60$; $=1\langle 215$
- C. $=.4\langle 0$; $=1.2\langle 50$; $=1\langle 185$
- D. $=.4\langle 0$; $=1.2\langle 30$; $=1\langle 35$
- E. $=.4\langle 0$; $=1.2\langle 30$; $=1\langle 60$

14. What manufacturing process is illustrated by the part on the right side of this illustration, as created by the tool on the left?

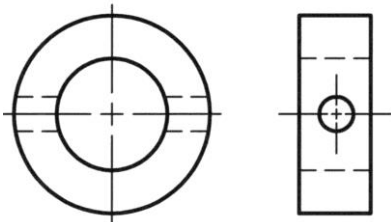


- A. Broaching
- B. Tapping
- C. Knurling
- D. Pressing
- E. Forging

15. The object illustrated below has a V-groove. With respect to a view that would be a good option for dimensioning that dihedral angle, which of the statements below is **TRUE**?

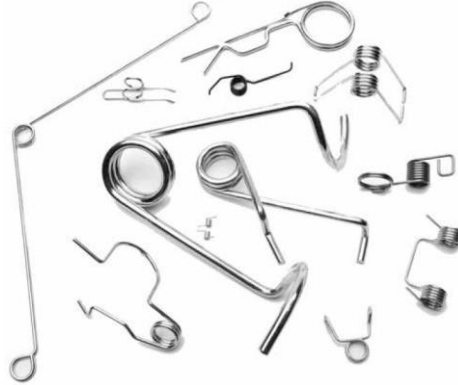


- A. The side view could be moved over, and would be a good option
 - B. A full section left side view would be a good option
 - C. A full section top view would be a good option
 - D. An auxiliary view projected adjacent to the side view would be a good option
 - E. An auxiliary view projected adjacent to the front view would be a good option
16. Using standard practices for dimensioning, including the “cylinder rule”, how many dimensions should be placed on the right side view?

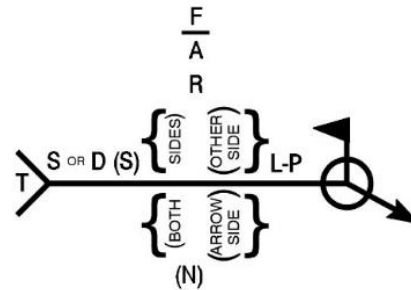


- A. 2
- B. 3
- C. 4
- D. 5
- E. 6

17. What type of springs are featured in the catalog illustration below?

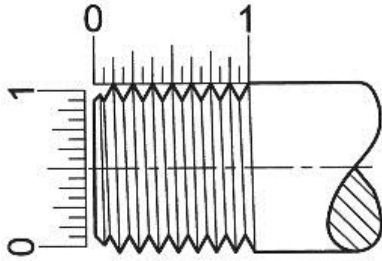


- A. Extension
 - B. Compression
 - C. Coil
 - D. Torsion
 - E. Barrel
18. Which organization would have a standard that explains the proper use of the symbol shown below?



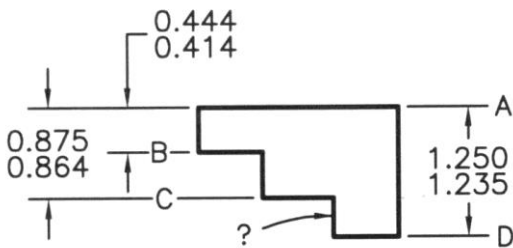
- A. (ASCE) American Society of Civil Engineers
- B. (ASHRAE) American Society of Heating, Refrigerating and Air-Conditioning Engineers
- C. (ASME) American Society of Mechanical Engineers
- D. (AWS) American Welding Society
- E. (IEEE) Institute of Electrical and Electronics Engineers

19. What is the pitch of the screw thread illustrated below?



- A. .062"
- B. .093"
- C. .125"
- D. .188"
- E. .250"

20. Based on the dimensions and tolerances given on this part, what is the resulting range of vertical distance from surface C to surface D?

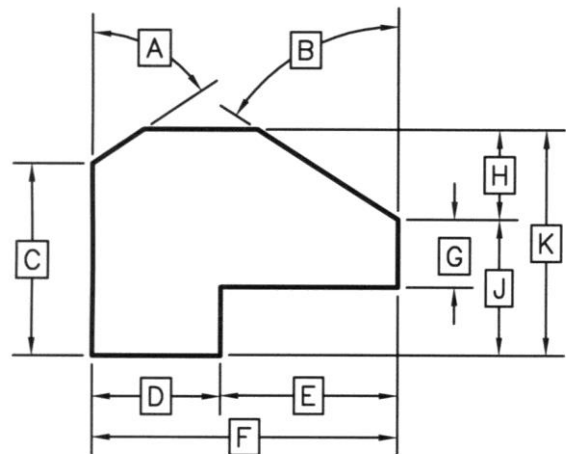


- A. .360" – .386"
- B. .375" – .386"
- C. .375" – .391"
- D. .371" – .375"
- E. .360" – .375"

21. In standard dimensioning practice, lines used in dimensioning may or may not have "gaps" as they associate with other lines. Identify the situation described below that **does require** a gap?

- A. Where an extension line connects to the visible line corner
- B. When two extension lines cross each other
- C. When an extension line crosses a visible line
- D. When a leader line crosses a visible line
- E. When a center line "becomes" an extension line

22. The shape dimensioned below has too many dimensions. Of the choices below, which is a solution that removes two superfluous dimensions?

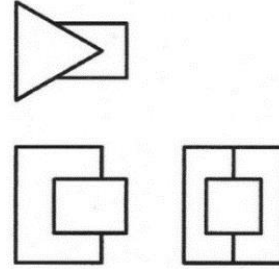


- A. E & G
- B. K & C
- C. F & B
- D. A & H
- E. J & D

23. A shaft with a diameter dimension of $.7770 \pm .0001$ mates with a hole with a diameter dimension of $.7766 + .0002$. Which of the following is **FALSE** about these mating features?
- A. This is an interference fit
 - B. The allowance, or tightest fit, is negative $.0005$ " (a force fit)
 - C. These parts cannot be assembled together under any circumstance
 - D. The shaft is always larger than the hole
 - E. The "least tightest fit" is when the shaft is $.0001$ " larger than the hole

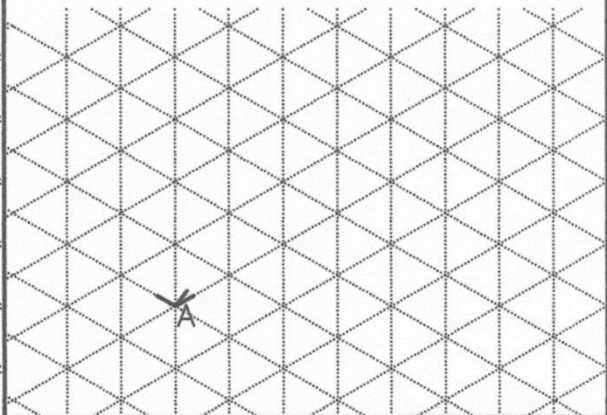
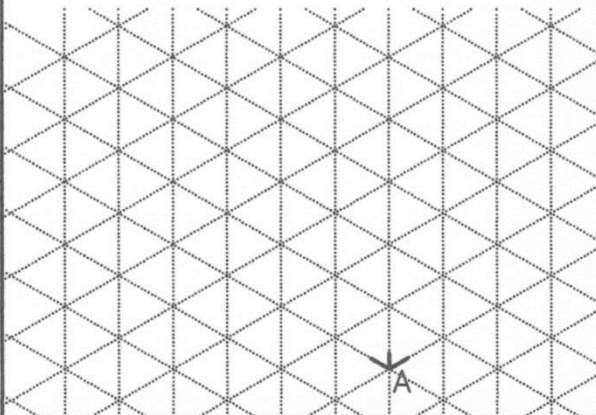
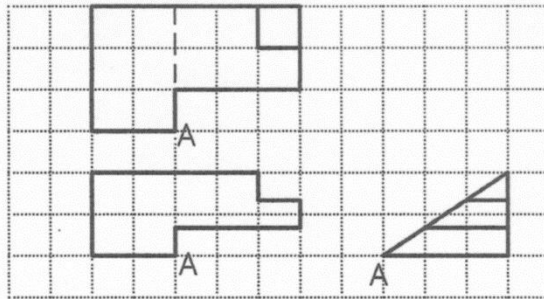
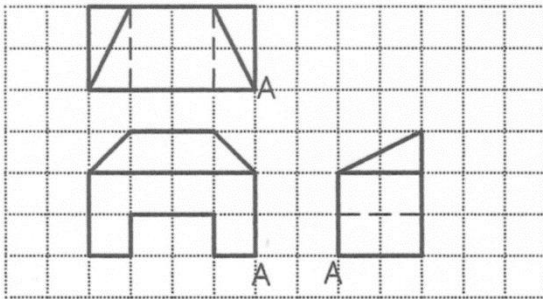
24. The illustration below shows an intersection drawing of a square duct connected to a triangular duct, with three "open" ends for air flow through and between the ducts.

The prototype will be created with true size and shape developments for each metal surface. How many **unique** surface patterns will be required for the project?



- A. 4
- B. 5
- C. 6
- D. 7
- E. 8

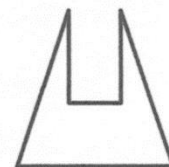
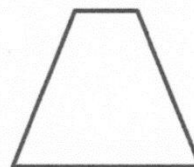
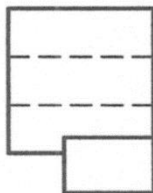
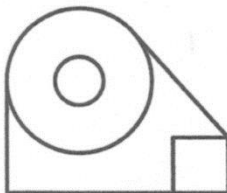
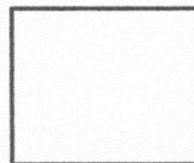
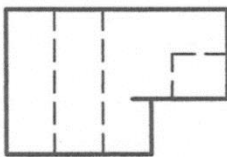
**PROBLEMS 25 & 26: CREATE ISOMETRIC SKETCHES
SELECT AN ANSWER THAT REPRESENTS THE NUMBER OF SEGMENTS REQUIRED**



25. NUMBER OF LINE SEGMENTS:
A. 16 B. 17 C. 18 D. 19 E. 20

26. NUMBER OF LINE SEGMENTS:
A. 11 B. 12 C. 13 D. 14 E. 15

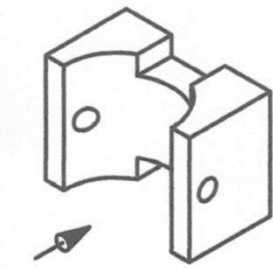
**PROBLEMS 27 & 28: MISSING LINE PROBLEMS: SELECT AN ANSWER THAT
CORRESPONDS WITH THE LEAST NUMBER OF MISSING LINE SEGMENTS (VISIBLE
AND HIDDEN) IT WILL TAKE TO CREATE A CORRECT MULTIVIEW DRAWING**



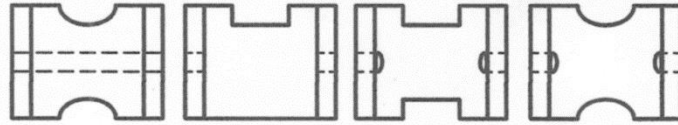
27. MINIMUM NUMBER OF LINES:
A. 2 B. 3 C. 4 D. 5 E. 6

28. MINIMUM NUMBER OF LINES:
A. 6 B. 7 C. 8 D. 9 E. 10

FOR EACH PROBLEM, SELECT THE CORRECT FRONT VIEW
 NOTE: CENTER LINES OMITTED ON THIS TEST PAGE



29.



A.

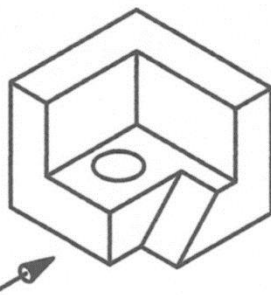
B.

C.

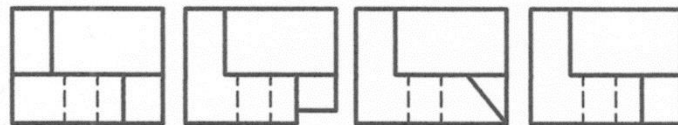
D.

NONE
OF
THESE

E.



30.



A.

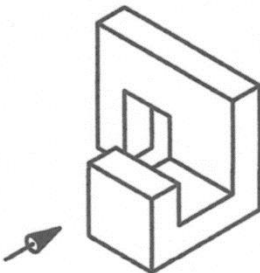
B.

C.

D.

NONE
OF
THESE

E.



31.



A.

B.

C.

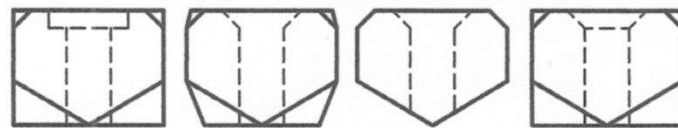
D.

NONE
OF
THESE

E.



32.



A.

B.

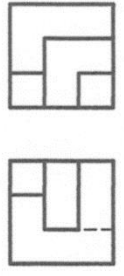
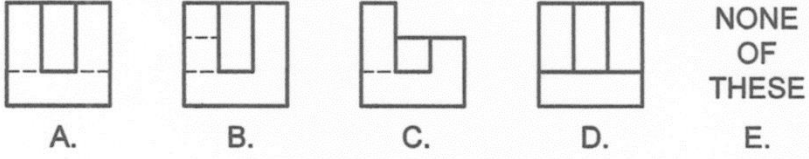

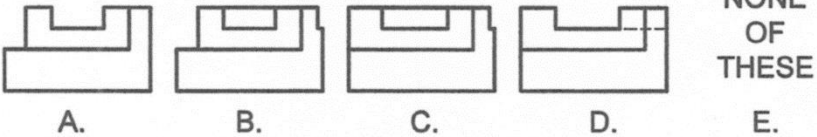
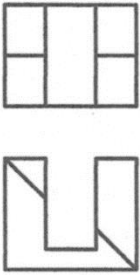
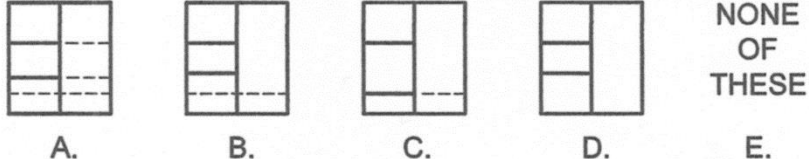

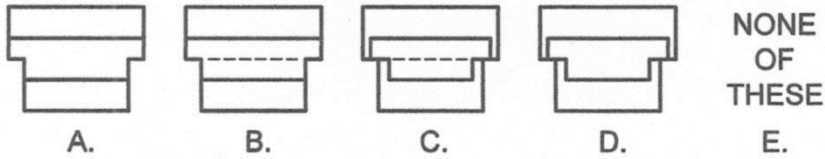
C.

D.

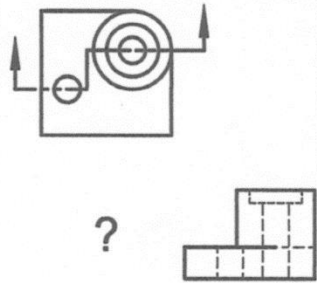
NONE
OF
THESE

E.

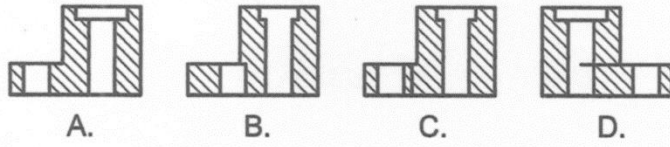
FOR EACH PROBLEM, SELECT THE CORRECT SIDE VIEW
 NOTE: CENTER LINES OMITTED ON THIS TEST PAGE

<p>33.</p>  <p>?</p>	 <p>A. B. C. D. E.</p>
<p>34.</p>  <p>?</p>	 <p>A. B. C. D. E.</p>
<p>35.</p>  <p>?</p>	 <p>A. B. C. D. E.</p>
<p>36.</p>  <p>?</p>	 <p>A. B. C. D. E.</p>

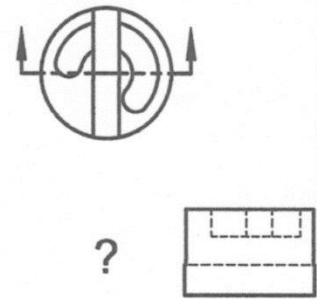
FOR EACH PROBLEM, SELECT THE CORRECT FRONT SECTIONAL VIEW
 NOTE: CENTER LINES OMITTED ON THIS TEST PAGE



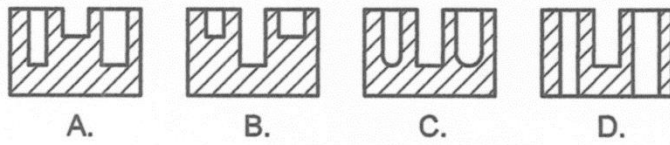
37.



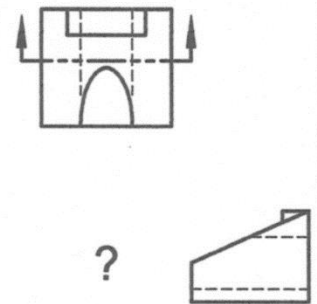
NONE OF THESE
E.



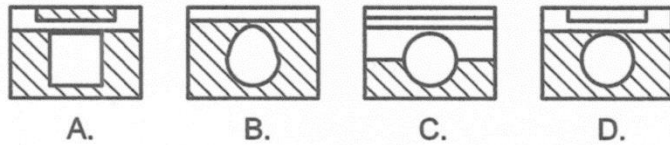
38.



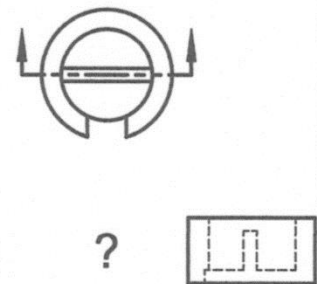
NONE OF THESE
E.



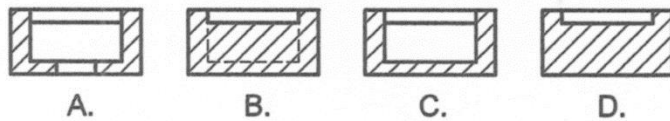
39.



NONE OF THESE
E.



40.



NONE OF THESE
E.

