

ACADEMIC CHALLENGE FOR
ACES
ENGINEERING AND SCIENCE



2024 Academic Challenge

ENGINEERING GRAPHICS TEST – STATE

Engineering Graphics Test Production Team

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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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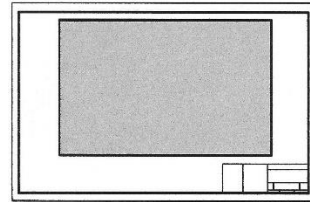
Academic Challenge
Engineering Graphics Test (State) - 2024

1. The first column in the chart below is missing an alphabetical character (for the series) preceding the number. Which series identification letter does ASME use for their drafting series?

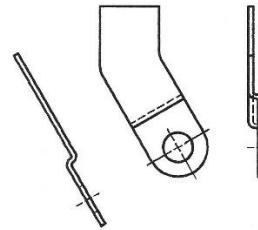
14.6	SCREW THREAD REPRESENTATION
14.5	DIMENSIONING & TOLERANCING
14.3	ORTHOGRAPHIC & PICTORIAL VIEWS
14.2	LINE CONVENTIONS & LETTERING
14.1	DRAWING SHEET & FORMAT
ASME STANDARDS	

- A. B
B. E
C. M
D. S
E. Y
2. Which of the following is a device for measuring distance?
A. Protractor
B. Multimeter
C. Tension gauge
D. Micrometer
E. Flow meter
3. With respect to how the engineer or drafter chooses dimensions and applies them to the views, which of the following is the **least important** factor?
A. Inspection practices
B. Maximum Material Condition (MMC)
C. Functional purpose
D. Manufacturing methods
E. ASME standards

4. A 480 mm x 600 mm metric part is being placed on engineering standard inch-based B-size paper. What scale would allow the part to be drawn as large as possible?



- A. 1:4
B. 1:2
C. 1:1
D. 2:1
E. 4:1
5. Analyze the figure below. What **geometric shape** is used to create an "offset" on a thin sheet metal part, as shown true shape in the auxiliary view?

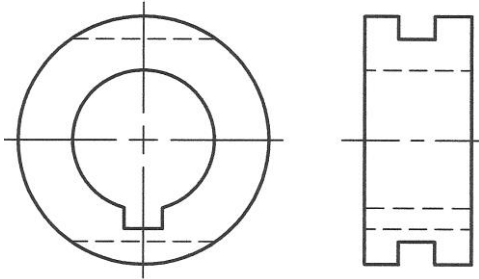


- A. Ogee curve
B. Conventional S-break
C. Double fold
D. Parabolic curve
E. Perpendicular bisector

6. Two given circles, each with a 3" diameter, have centers spaced 8" apart horizontally. A 10" radius arc, with a center point below the 2 circles, is to be created tangent to the two circles. How many positions are possible for the arc?

- A. 2
- B. 3
- C. 4
- D. 6
- E. 8

7. How many **normal** surfaces (flat planar surfaces parallel with the principal planes of projection) does this object possess?

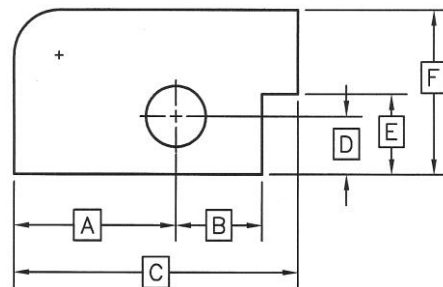


- A. 5
- B. 7
- C. 8
- D. 10
- E. 11

8. Students of orthographic projection theory know certain rules about points (vertices) projecting onto projection planes. In the given statements below, which is a **FALSE** statement with respect to how two different points of an object are projected?

- A. They can project the same distance away from each other as they are on the object
- B. They can project closer together than they are on the object
- C. When using three projection planes, they will project onto all three of the planes
- D. They can project farther away from each other than they are on the object
- E. They can project on top of each other

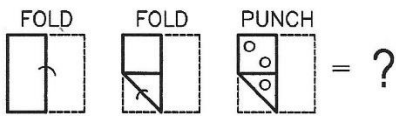
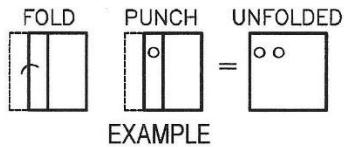
9. Analyze the illustration below. Based on standard dimensioning practice, how many dimensions will still be required to finish defining the shape?



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

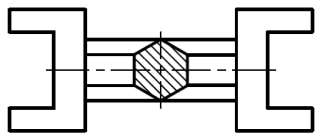
10. Based on a perceptual ability test (even used in admission programs for dental students), the following “folded paper/ punched hole” item tests your spatial visualization.

Imagine a paper is folded, as shown in the example, and then a hole punched, and then the paper is unfolded. Which answer choice is correct?



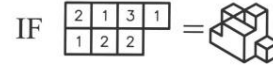
- A.
- B.
- C.
- D.
- E.

11. The _____ section view below is a standard conventional practice for describing the shape of a feature. Break lines could be used on each side of the sectioned shape.



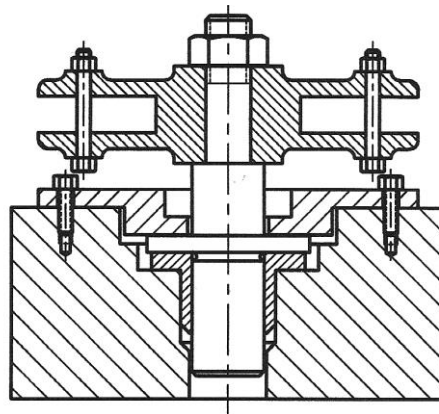
- A. half
- B. aligned
- C. revolved
- D. broken-out
- E. rotated

12. In the illustration below, a pictorial model was created to match the top view with height codes. Select the pictorial model that matches the second set of height codes.



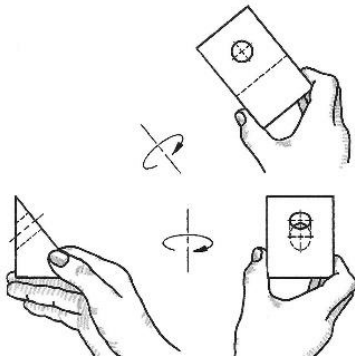
- A.
- B.
- C.
- D.
- E.

13. How many total objects are there in the sectional assembly view below that are **NOT** shown as being cut by the cutting plane?



- A. 4
- B. 6
- C. 8
- D. 10
- E. 12

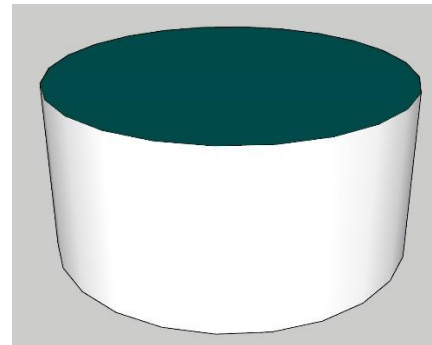
14. The illustration below features a front view, right side view, and an auxiliary view. It is designed to show some auxiliary view principles. Which of the statements below is a **FALSE** statement?



- A. The distance between the thumb and fingers is the **depth** dimension in all three views.
- B. In the auxiliary view, the height of the object is shown in its true size, but the width of the object is not.
- C. Views next to each other are like rotating the object 90° while your line of sight remains constant.
- D. Only in the auxiliary view do you see the true shape of the round hole.
- E. The “axis of rotation” for the auxiliary view is parallel with the inclined surface.
15. With respect to the following five terms: **coincidence**, **concentricity**, **parallelism**, **perpendicularity**, and **equality of diameter**, how might these terms be related to the creation of a 2D profile sketch within a 3D solid modeling program?
- A. Constraints
- B. Standards
- C. Tolerances
- D. Primitives
- E. Boolean operators

16. The figure below was created in a 3D surface modeling program. While the program creates a smooth rendering of the curved surface, upon closer inspection, the circular edges have _____, which can be adjusted in quantity based on the output requirements.

Of the choices below, which is a common and somewhat standard term for this characteristic of 3D CAD models?



- A. segments
- B. facets
- C. vertices
- D. elements
- E. operators
17. On parts that fit together, certain size and location dimensions must be considered concurrently. One example might be a bolt hole on one part that must align, and not conflict, with a post dimension on another part.
- What name is given to these companion dimensions (or sets of dimensions)?
- A. Toleranced dimensions
- B. Contour dimensions
- C. Superfluous dimensions
- D. Principal dimensions
- E. Mating dimensions

18. The chart below assists the designer with standard ASME thread counts for coarse, fine, and extra fine threads for UNIFIED thread series.

What is the **pitch** for a UNF thread with a major diameter of .216”?

NOMINAL DIAMETER	BASIC DIAMETER	COARSE UNC		FINE UNF		EXTRA FINE UNEF	
		THDS PER IN	TAP DRILL DIA	THDS PER IN	TAP DRILL DIA	THDS PER IN	TAP DRILL DIA
4	.112	40	No.43	48	No.42		
6	.138	32	No.36	40	No.33		
8	.164	32	No.29	36	No.29		
10	.190	24	No.25	32	No.21		
12	.216	24	No.16	28	No.14	32	No.13
1/4	.250	20	No.7	28	No.3	32	.2189
5/16	.3125	18	F	24	I	32	.2813
3/8	.375	16	.3125	24	Q	32	.3438
7/16	.4375	14	U	20	.3906	28	.4062
1/2	.500	13	.4219	20	.4531	28	.4688
9/16	.5625	12	.4844	18	.5156	24	.5156
5/8	.625	11	.5313	18	.5781	24	.5781
11/16	.6875	24	.6406
3/4	.750	10	.6563	16	.6875	20	.7031

- A. .036”
- B. No. 3
- C. .031”
- D. 28
- E. .042”

20. Standardized **interference** fits are sometimes used to force parts together within an assembly. These are parts where the shaft is always bigger than the hole, even at LMC. This requires high precision tolerances with just a few thousandths of an inch making a difference.

Which one of the fits in this table is not an interference fit, but rather a **clearance** fit?

	HOLE LIMITS	SHAFT LIMITS
A	1.0420–1.0415	1.0424–1.0421
B	.9570–.9560	.9555–.9545
C	1.346–1.344	1.348–1.347
D	.4293–.4285	.4300–.4294
E	.7725–.7700	.7736–.7726

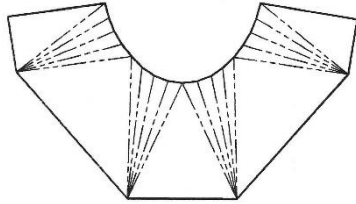
INTERFERENCE FITS

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

19. A drawing for a molded plastic part will likely exhibit **draft**. With respect to molded parts, what is **draft**?

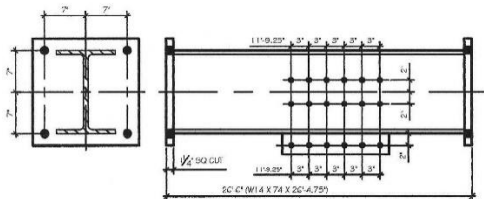
- A. An interior edge that is rounded
- B. A smoother than normal area on a surface
- C. A slight taper applied to the walls that allows the part to more easily come out of the mold
- D. A contact point for a projector pin that pushes the part out of the mold
- E. An exterior edge that is rounded

21. The flat pattern illustrated below was developed manually with a 2D CAD system. Analyze the development and identify the **FALSE** statement below.



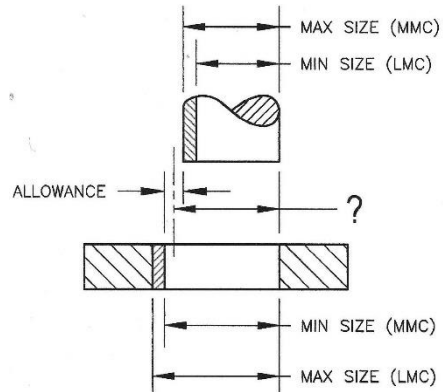
- A. This development represents a ductwork **transition piece** that connects two ducts that are not the same shape
- B. When folded, one end of the piece is a pentagon shape
- C. The finished product has a circular end that was developed with sixteen equal divisions
- D. The phantom lines represent curved elements in the final product, and not sharp edges
- E. This development does not show fold tabs along the edges that will join together, nor tabs that will join with other pieces

22. What term is given to the specialized area of drafting represented by the partial views shown below?

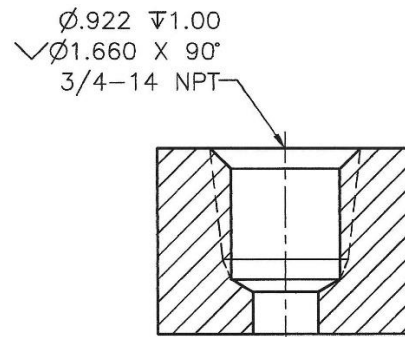


- A. Structural steel drafting
- B. Beam and column drafting
- C. Metalworking drafting
- D. Civil engineering drafting
- E. Bridge drafting

23. What term is missing in the illustration below, as indicated by the question mark?

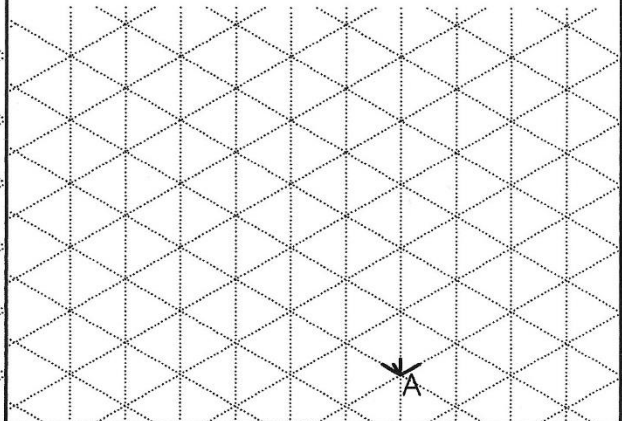
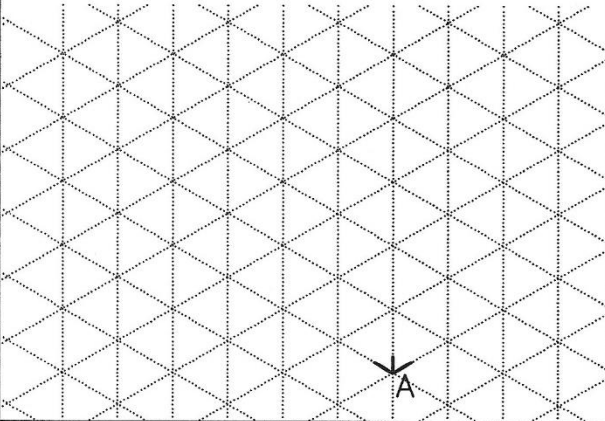
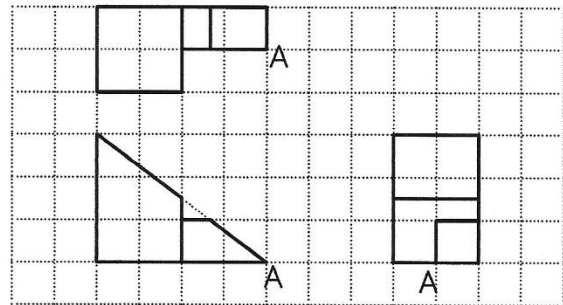
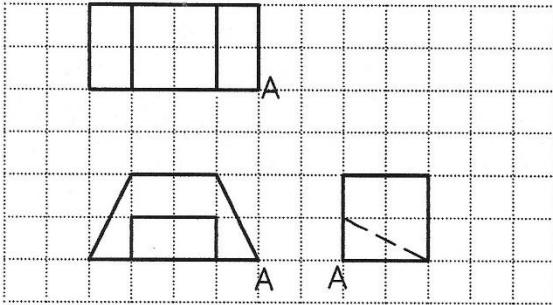


- A. Loosest fit
 - B. Range of fit
 - C. Basic size
 - D. Tolerance
 - E. Deviation
24. Analyze the engineering drawing figure below, and identify the **TRUE** statement ?



- A. The counterbore diameter is 1.660"
- B. The depth of the smallest hole is .75"
- C. The thread pitch is 14
- D. The small through hole has a .750" diameter
- E. Based on the NPT note, the threaded portion is a standard tapered pipe thread

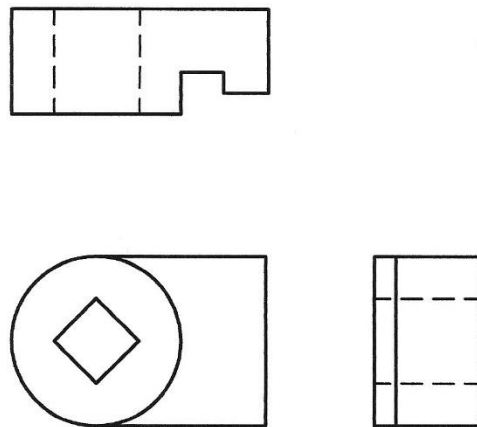
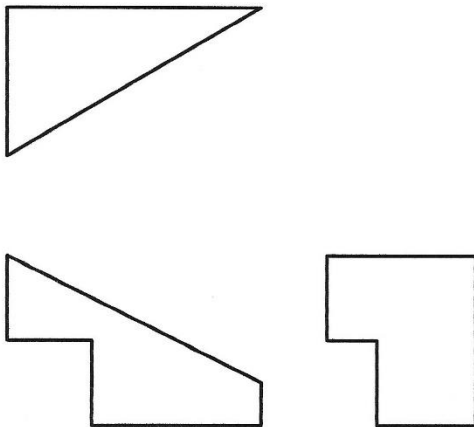
PROBLEMS 25 & 26: CREATE ISOMETRIC SKETCHES
 SELECT AN ANSWER THAT REPRESENTS THE NUMBER OF SEGMENTS REQUIRED



25. NUMBER OF LINE SEGMENTS:
 A. 12 B. 13 C. 14 D. 15 E. 16

26. NUMBER OF LINE SEGMENTS:
 A. 14 B. 15 C. 16 D. 17 E. 18

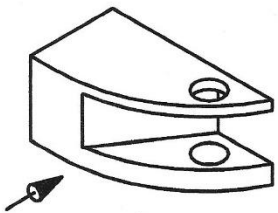
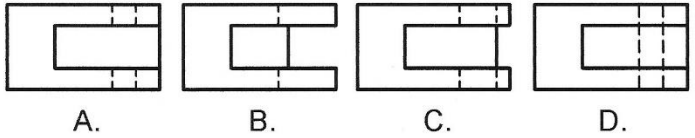
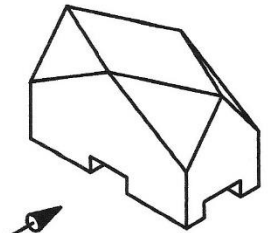
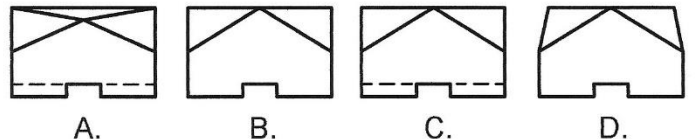
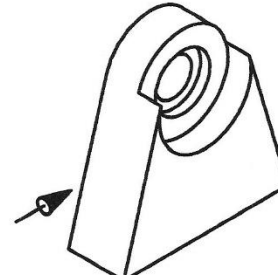
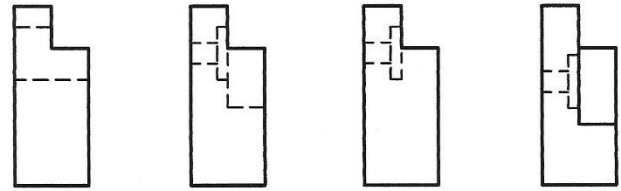
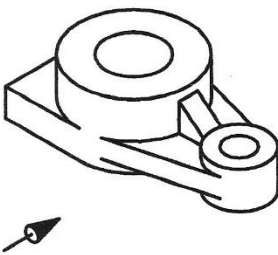
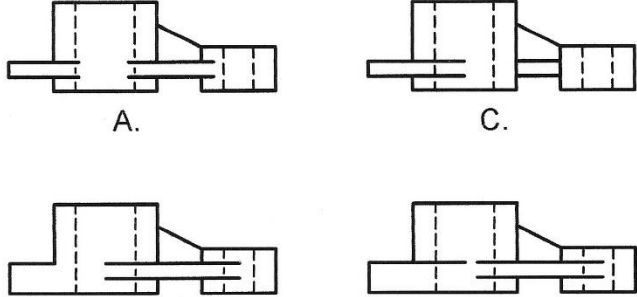
PROBLEMS 27 & 28: MISSING LINE PROBLEMS: SELECT AN ANSWER THAT
 CORRESPONDS WITH THE LEAST NUMBER OF MISSING LINE SEGMENTS (VISIBLE
 AND HIDDEN) IT WILL TAKE TO COMPLETE A CORRECT MULTIVIEW DRAWING



27. MINIMUM NUMBER OF LINES:
 A. 1 B. 2 C. 3 D. 4 E. 5

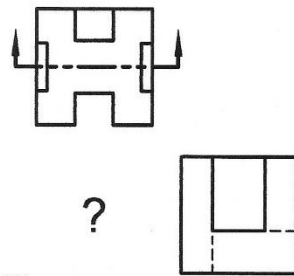
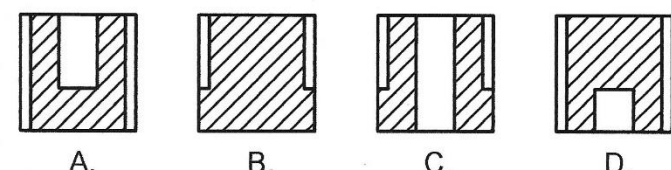
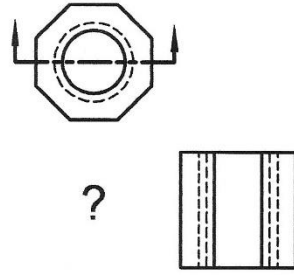
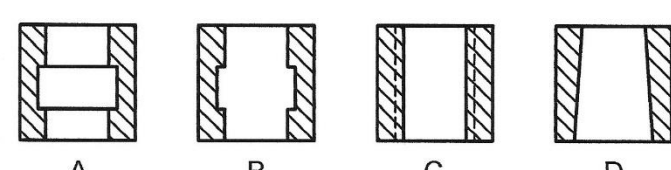
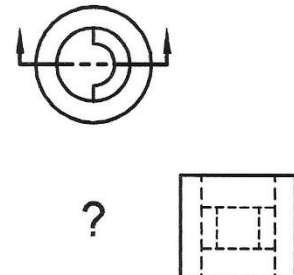
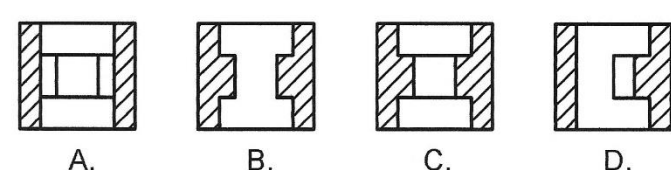
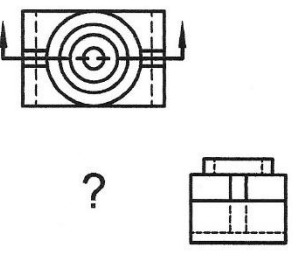
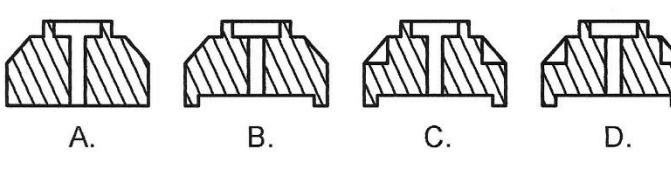
28. MINIMUM NUMBER OF LINES:
 A. 4 B. 5 C. 6 D. 7 E. 8

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

<p>29.</p> 	 <p>A. B. C. D.</p> <p>NONE OF THESE</p> <p>E.</p>
<p>30.</p> 	 <p>A. B. C. D.</p> <p>NONE OF THESE</p> <p>E.</p>
<p>31.</p> 	 <p>A. B. C. D.</p> <p>NONE OF THESE</p> <p>E.</p>
<p>32.</p> 	 <p>A. C.</p> <p>B. D.</p> <p>NONE OF THESE</p> <p>E.</p>

		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.</p>				<p>NONE OF THESE E.</p>	
<p>34.</p> <p>?</p>	<p>A. B. C. D.</p>				<p>NONE OF THESE E.</p>	
<p>35.</p> <p>?</p>	<p>A. B. C. D.</p>				<p>NONE OF THESE E.</p>	
<p>36.</p> <p>?</p>	<p>A. B. C. D.</p>				<p>NONE OF THESE E.</p>	

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

<p>37.</p> 	 <p>A. B. C. D. E. NONE OF THESE</p>
<p>38.</p> 	 <p>A. B. C. D. E. NONE OF THESE</p>
<p>39.</p> 	 <p>A. B. C. D. E. NONE OF THESE</p>
<p>40.</p> 	 <p>A. B. C. D. E. NONE OF THESE</p>

SCRATCH PAPER

