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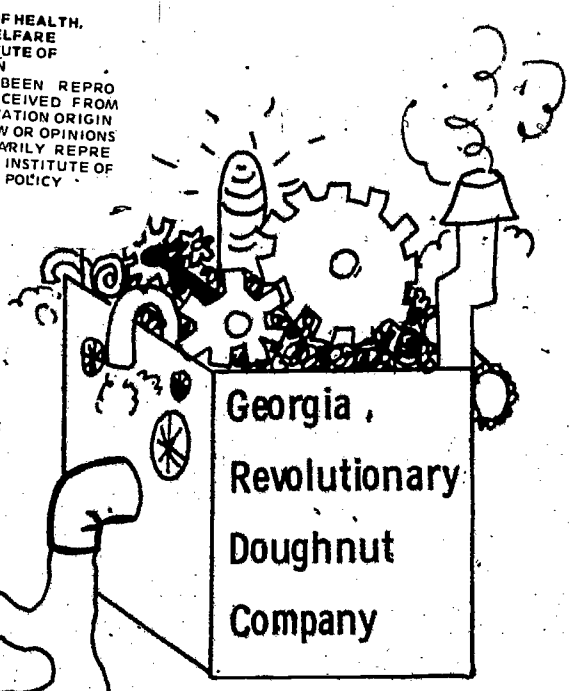
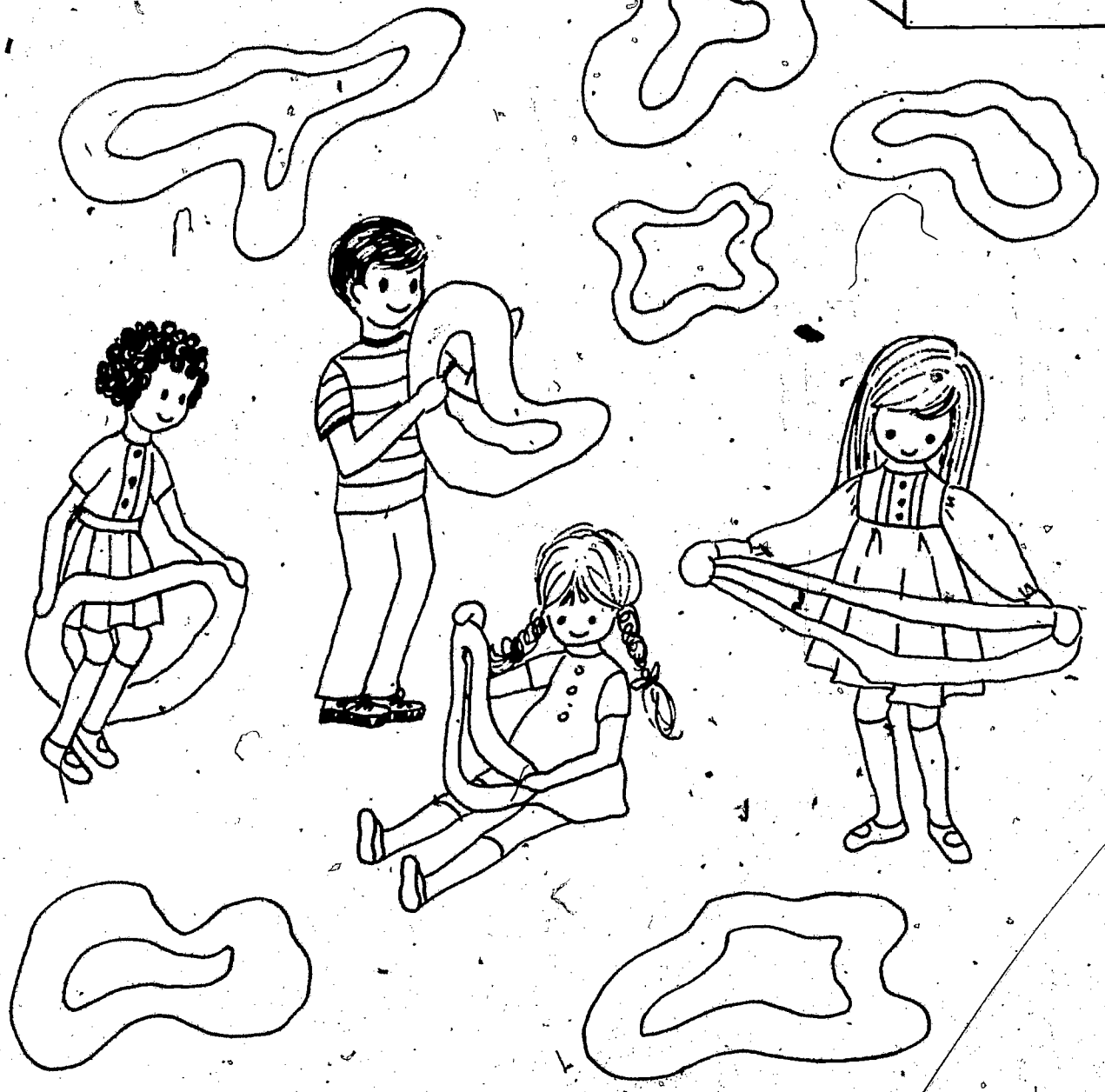
ABSTRACT

This 19-page workbook presents the elementary student with topological concepts through sequences of pictures with related questions. Generally the questions ask, "How are the pictures different?" and "How are they the same?" Several topological concepts are presented in this manner: connectivity, number of holes, closed and open curves, networks, and serial order. (SD)

Bending and Stretching

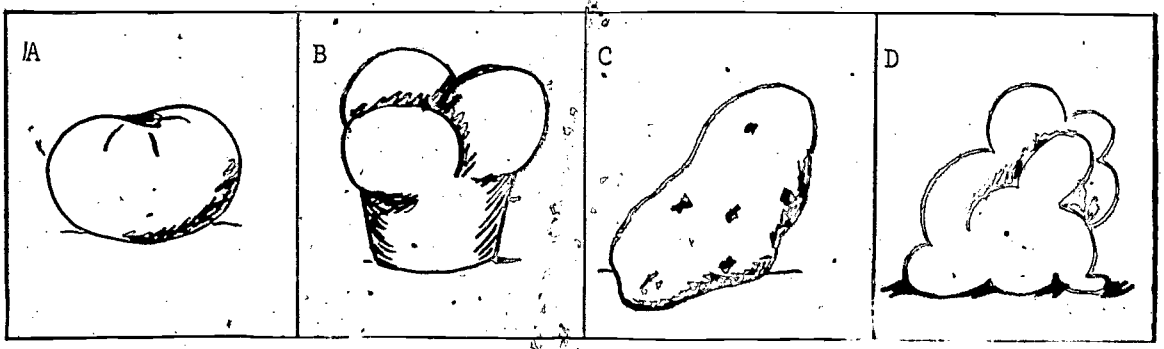




Research and Development Center in Educational Stimulation - University of Georgia

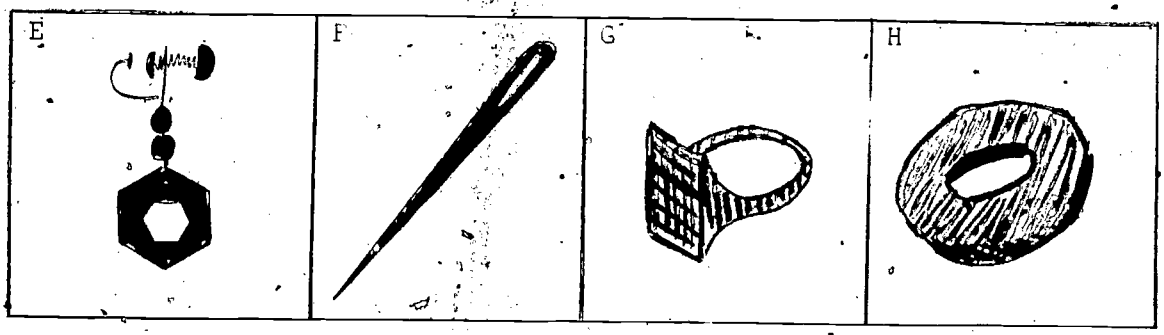
TOPOLOGICAL EQUIVALENCE OF OBJECTS

I. Look at these:



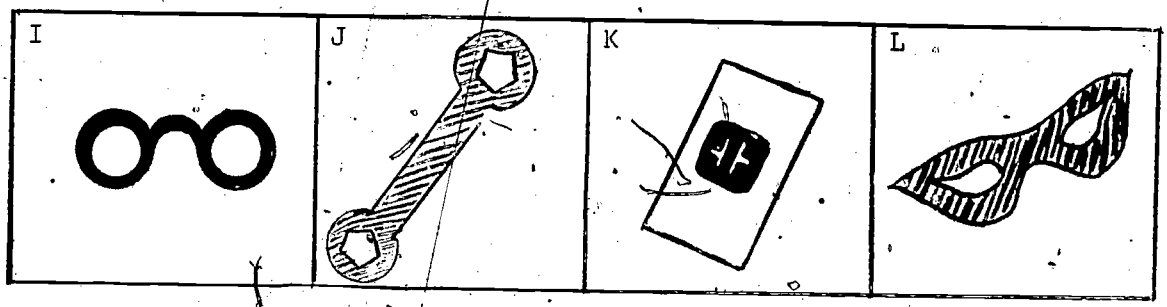
1. How are they alike?
2. How are they different?
3. Do these all look the same?

II. Look at these:



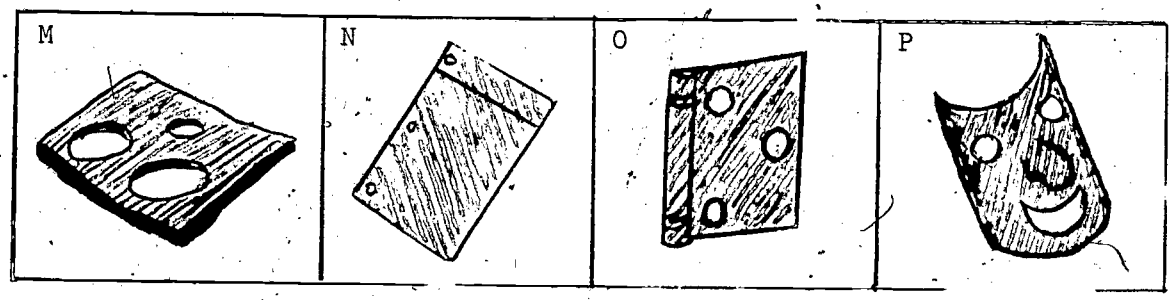
1. How are they alike?
2. How is picture F like picutre H?
3. How are they different?
4. What can you say about all of the pictures E, F, G and H?
5. What must we do to the clay in picture D above to make it look like the doughnut in picture H?

III. Look at these.



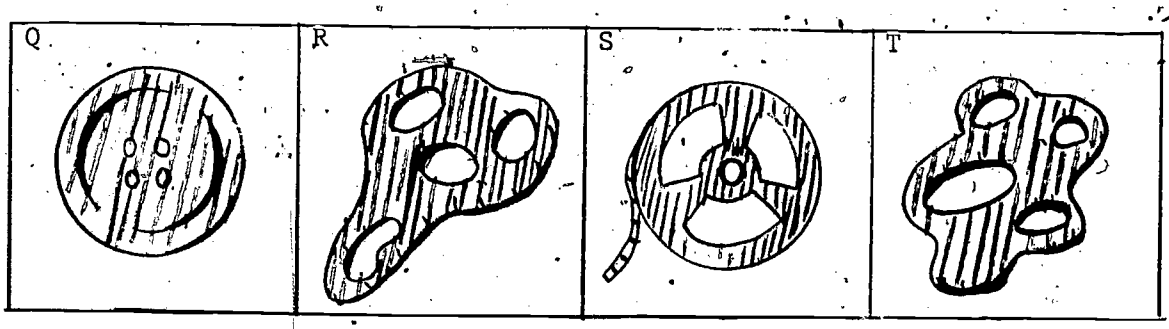
1. How are they alike?
2. How are they different?
3. How is picture I like picture K?
4. What can we say about all of these?

IV. Look at these:



1. How are they alike?
2. How are they different?
3. How is picture M like picture P?
4. What can you say about all of these?

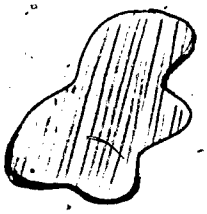
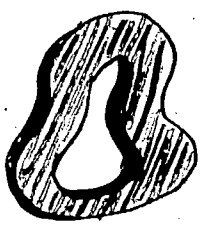
V. Look at these:



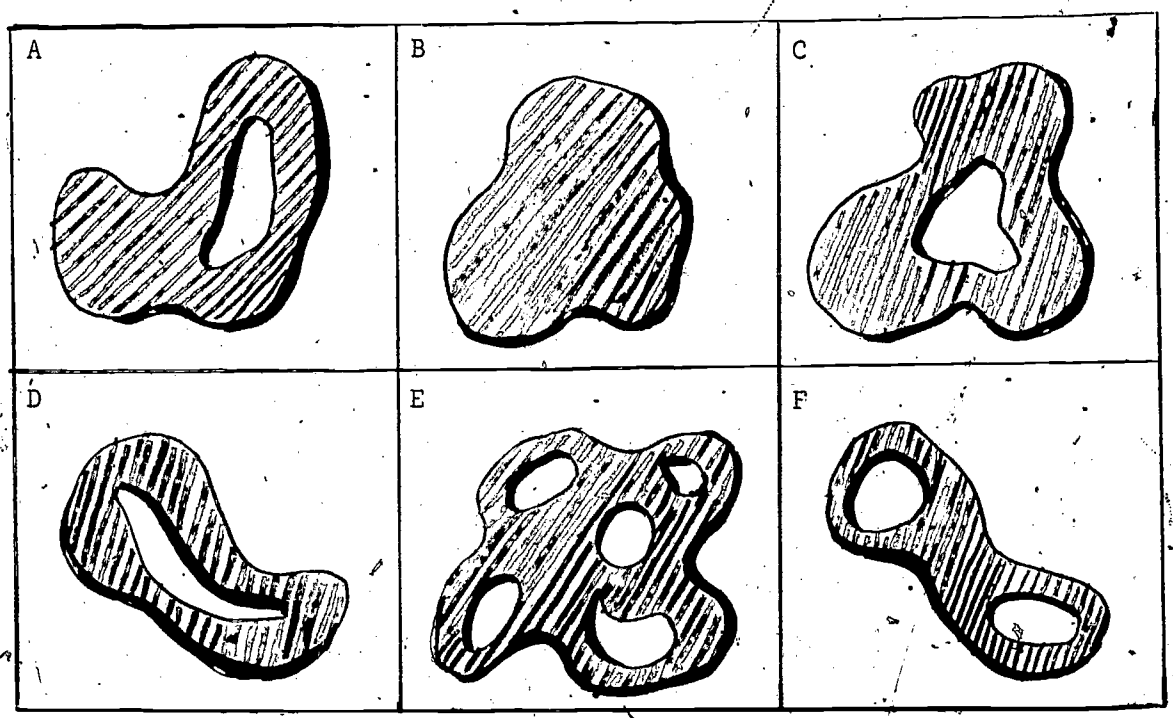
1. How are they alike?
2. How are they different?
3. How is picture R like picture S?
4. What can you say about all of these?

Exercises:

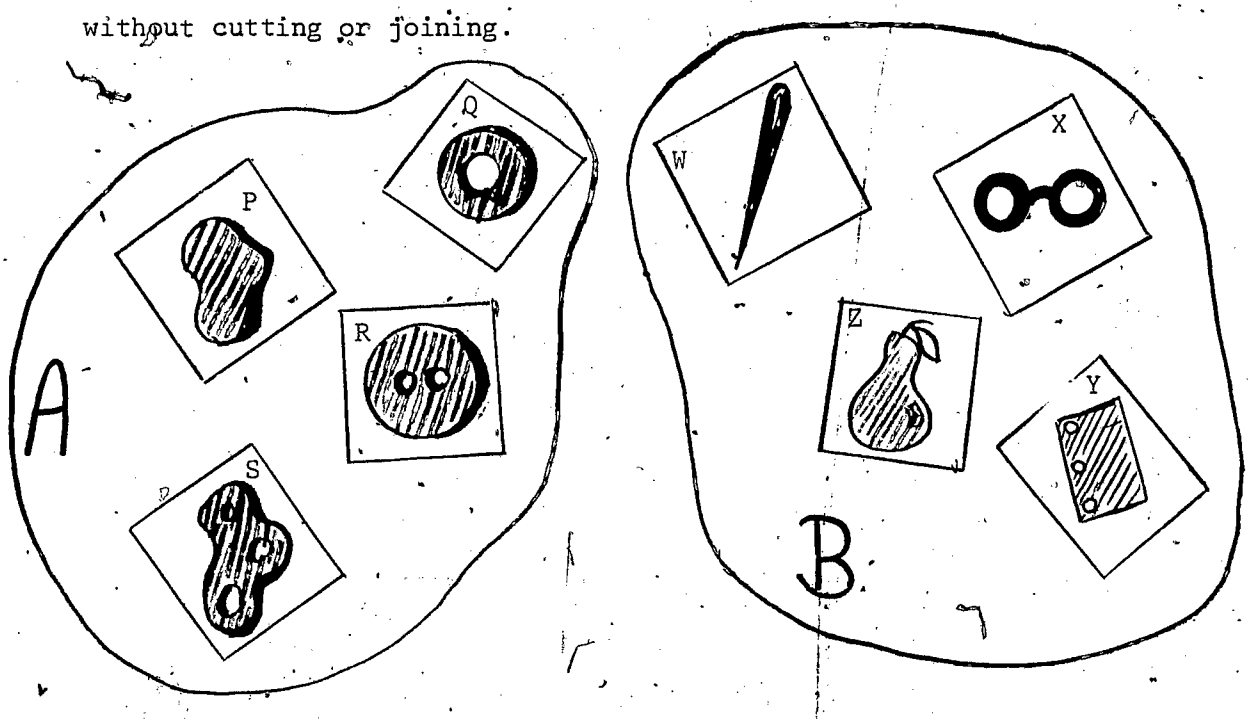
I. Draw different things which we can make from picture A by bending and stretching without cutting or joining.

(a)	A 	B	C	D
(b)	A 	B	C	D

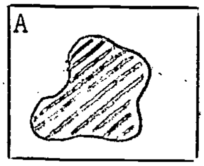
II. Draw a mark around the things which we can make from picture A by bending or stretching without cutting or joining.

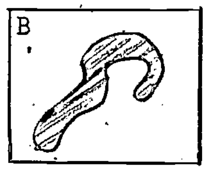


III. Match the one in A to the one in B which you can get by bending or stretching without cutting or joining.



IV. Can you get picture B from picture A by bending or stretching without cutting or joining? Put a ring around your answer.

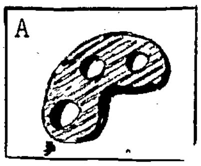


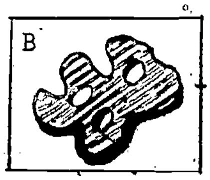


Yes

No

I don't know

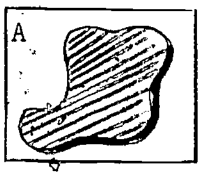


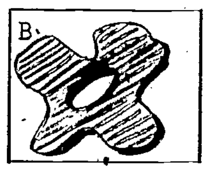


Yes

No

I don't know

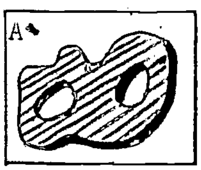


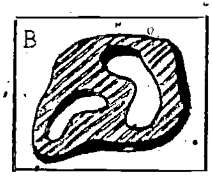


Yes

No

I don't know

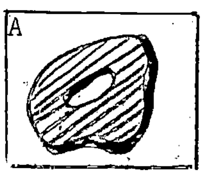


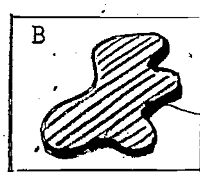


Yes

No

I don't know





Yes

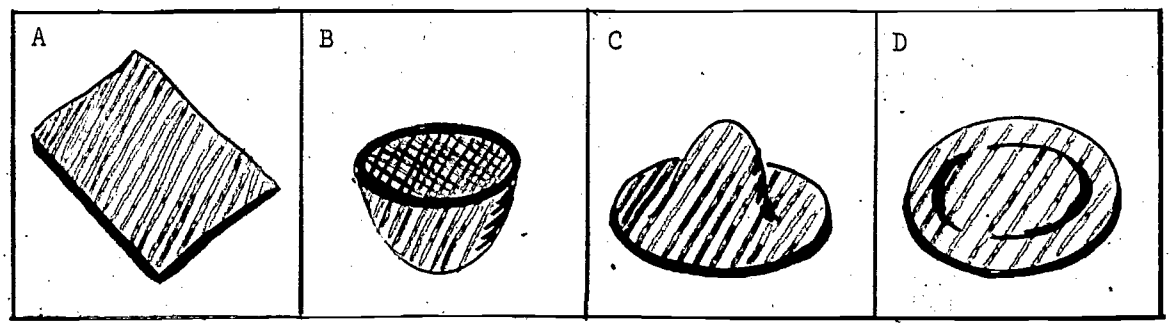
No

I don't know

TOPOLOGICAL EQUIVALENCE

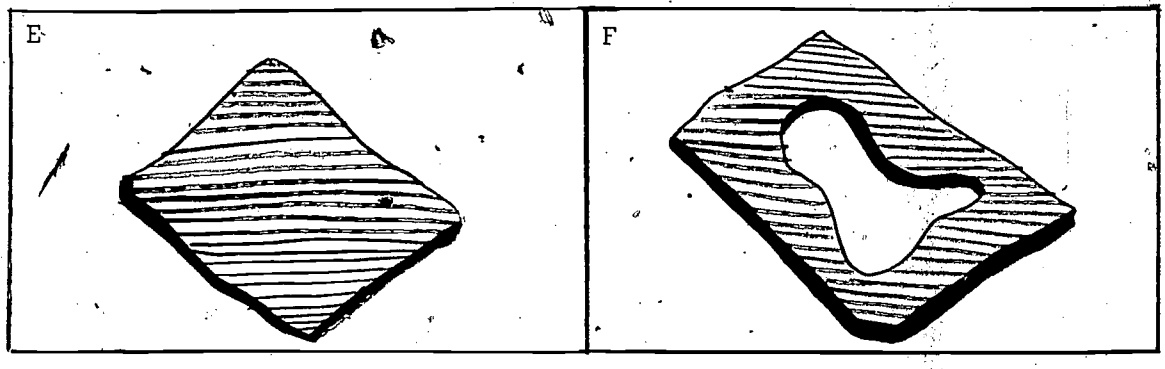
OF SHEETS

I. Look at these:



1. How are they alike?
2. How are they different?
3. How is picture B like picture C?
4. What can we say about all of these?

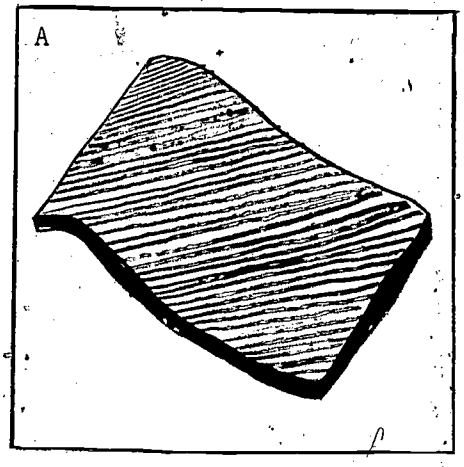
II. Look at these:

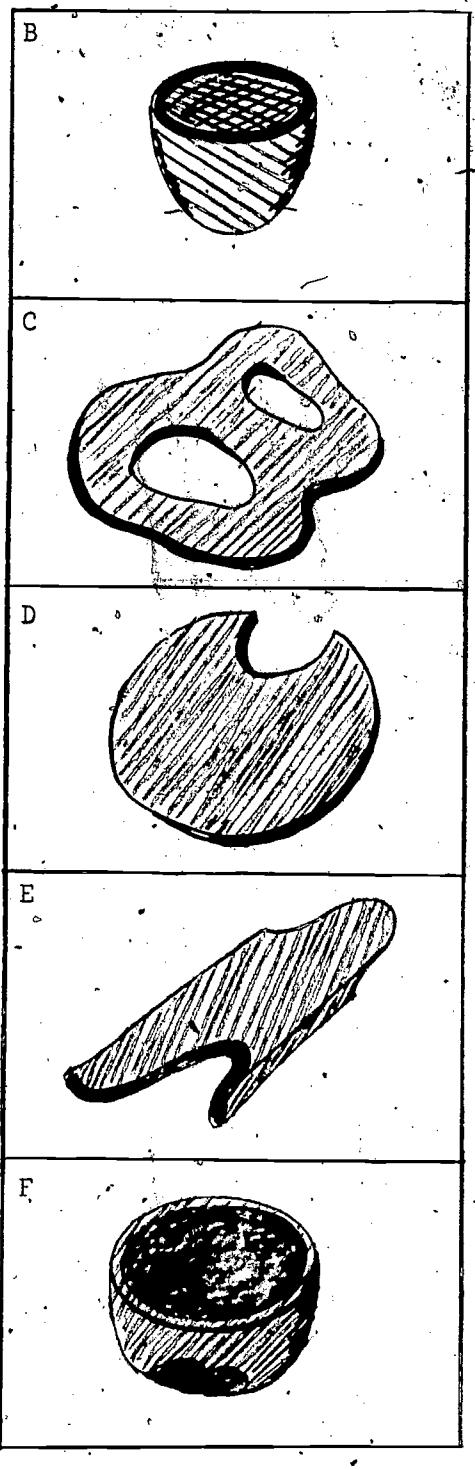


1. Are they the same?
2. Are they different? Why?

Exercises:

I. Draw a line from picture A to all the pictures which you can make by bending or stretching but not cutting or joining.

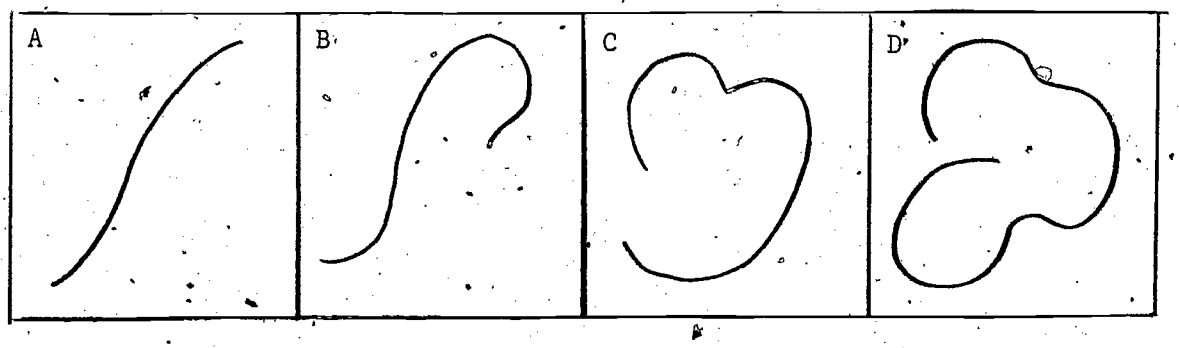




TOPOLOGICAL EQUIVALENCE

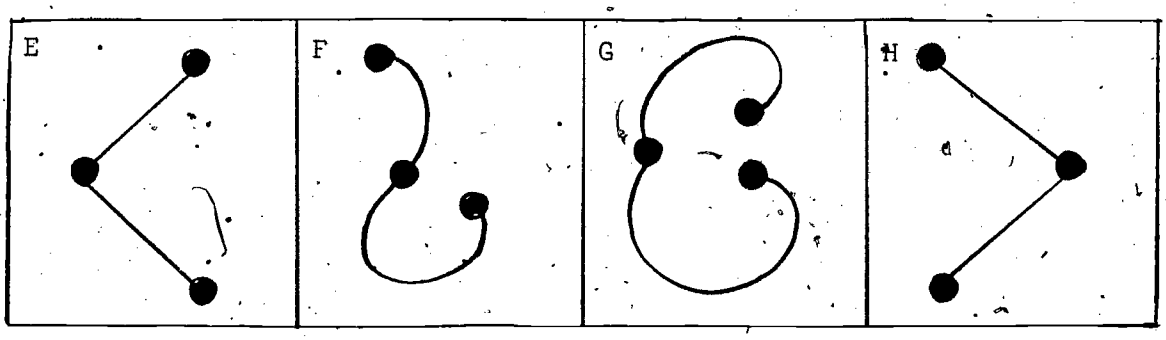
OF LINES AND NETS

I. Look at these:



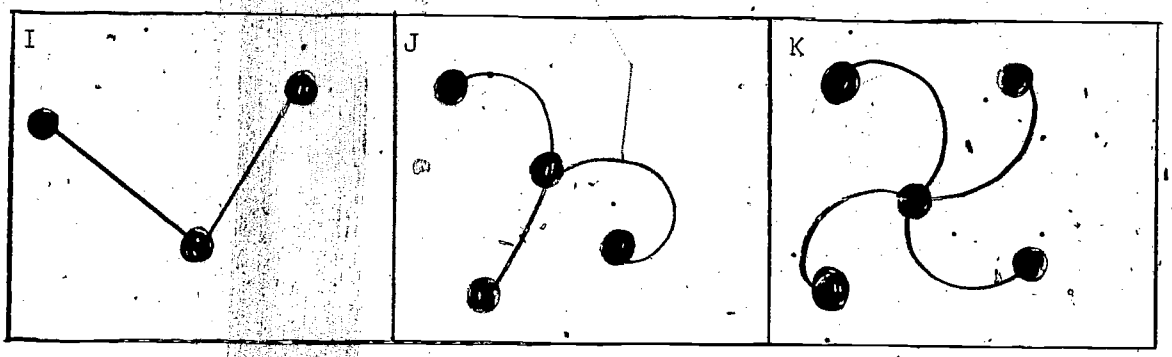
1. How are they alike?
2. How are they different?
3. How is picture A like picture C?
4. What can we say about all of these?

II. Look at these:



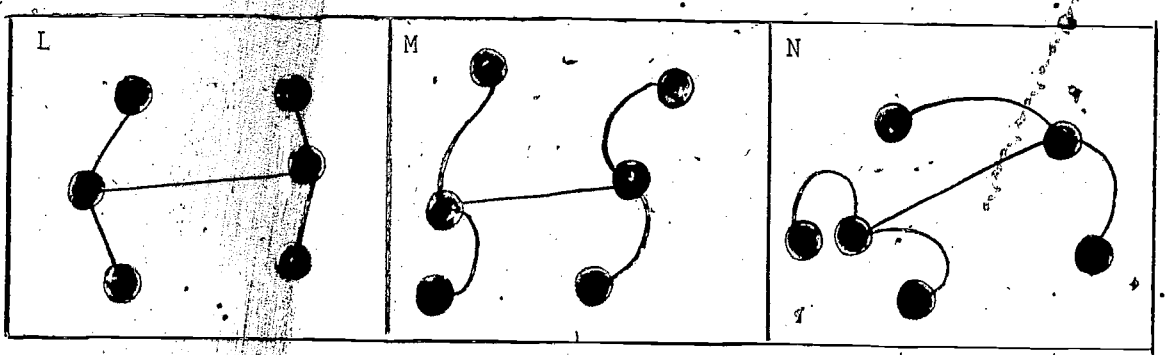
1. How are they alike?
2. How are they different?
3. How is picture F like picture H?
4. What can we say about all of these?

III. Look at these:



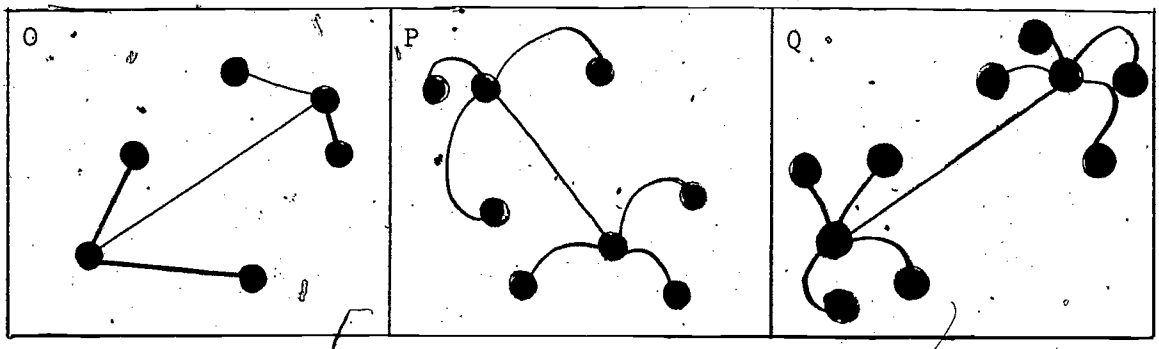
1. Are these the same?
2. Why are they not the same?
3. Can we say anything about all of these?

IV. Look at these:



1. How are they alike?
2. How are they different?
3. How is picture L like picture N?
4. What can we say about all of these?

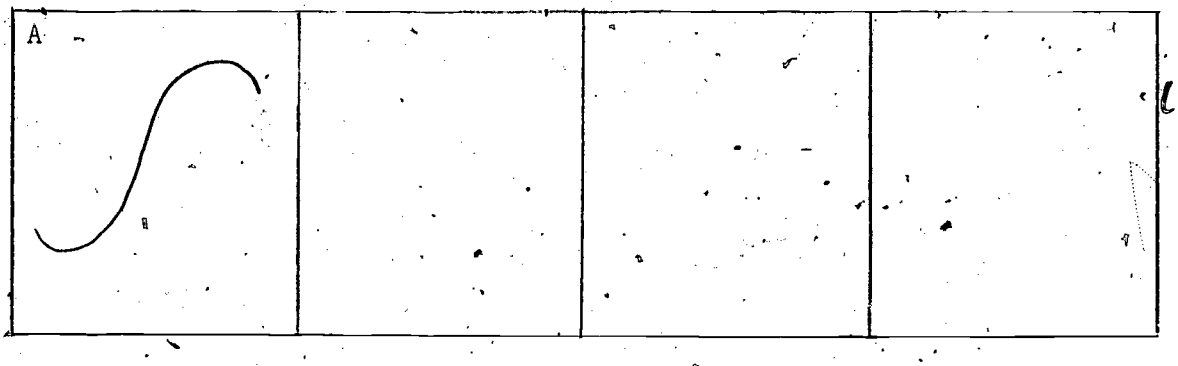
V. Look at these:



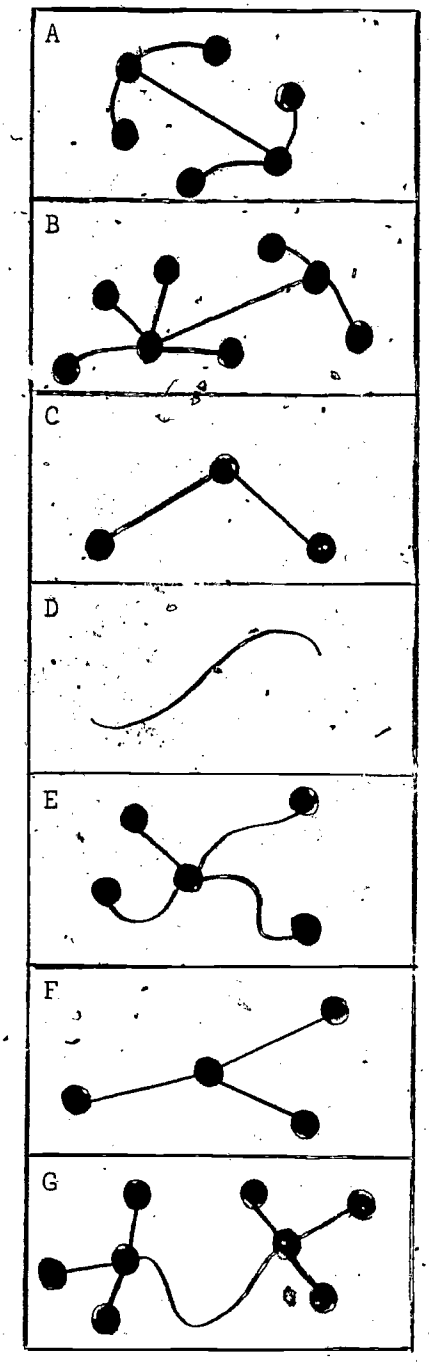
1. Are they the same?
2. Why are they not the same?
3. Can we say anything about all of these?

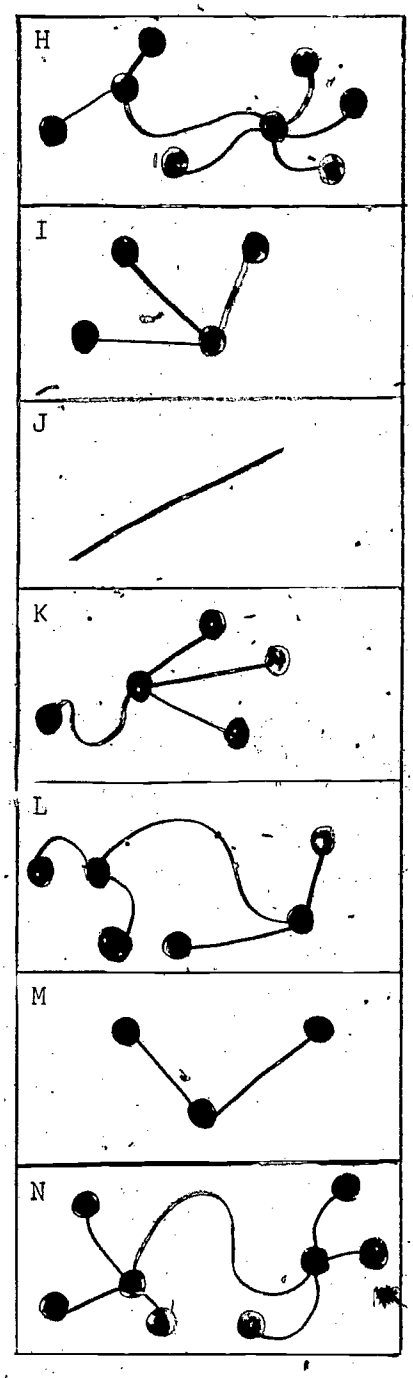
Exercises:

I. Draw three things which you can make by bending or stretching picture A, but not cutting or joining.

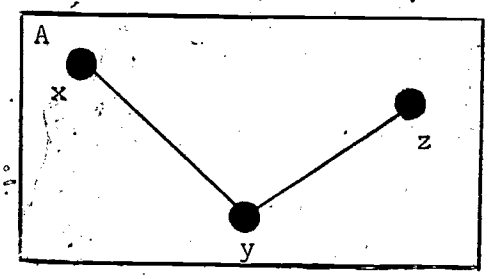


II. Match the pictures which are the same, by drawing a line.





III.



1. In picture A, how many string ends are there at vertex x? ____

   at vertex y? ____

   at vertex z? ____

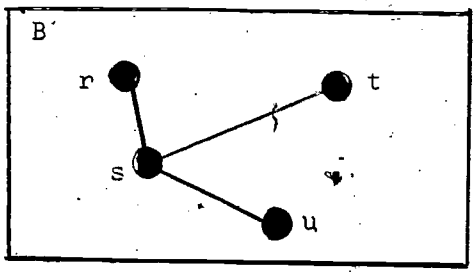
2. Let's write this down so that we can see it more clearly.

vertex	number of string ends
x	1
y	
z	

3. (a) If you put your pencil at vertex x, can you trace each part to vertex z without lifting your pencil?

   (b) Can you put your pencil at vertex x and trace each part to vertex z without tracing any part twice?

IV.



1. In picture B, how many string ends are there at vertex r? ____

   at vertex s? ____

   at vertex t? ____

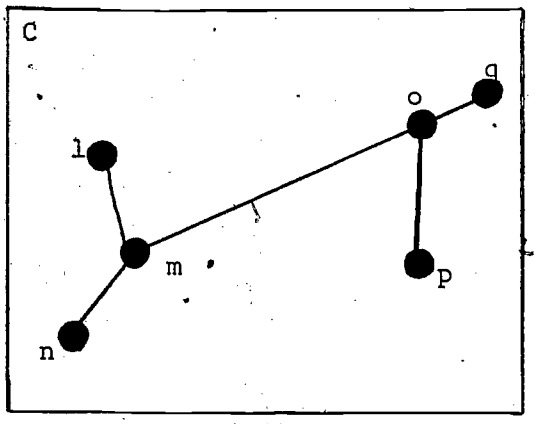
   at vertex u? ____

2. Let's write this down so that we can see it more clearly.

vertex	number of string ends
r	
s	3
t	
u	

3. If you put your pencil at vertex r, can you trace each part to vertex u without lifting your pencil and without tracing any part twice?

V.



1. In picture C, how many string ends are there at vertex l? _____

   at vertex m? _____

   at vertex n? _____

   at vertex o? _____

   at vertex p? _____

   at vertex q? _____

2. Let's write this down so that we can see it more clearly.

vertex	Number of string ends
l	_____
m	_____
n	1
o	_____
p	1
q	_____

3. If you put your pencil at vertex l, can you trace each part of the picture to vertex q without lifting your pencil and without tracing any part twice?

VI. 1. How many vertices have 1 string end or 3 string ends from the chart for picture A? _____

for picture B? _____

for picture C? _____

2. (a) In part III, remembering that you could not lift your pencil or trace any part twice, could you trace picture A? _____

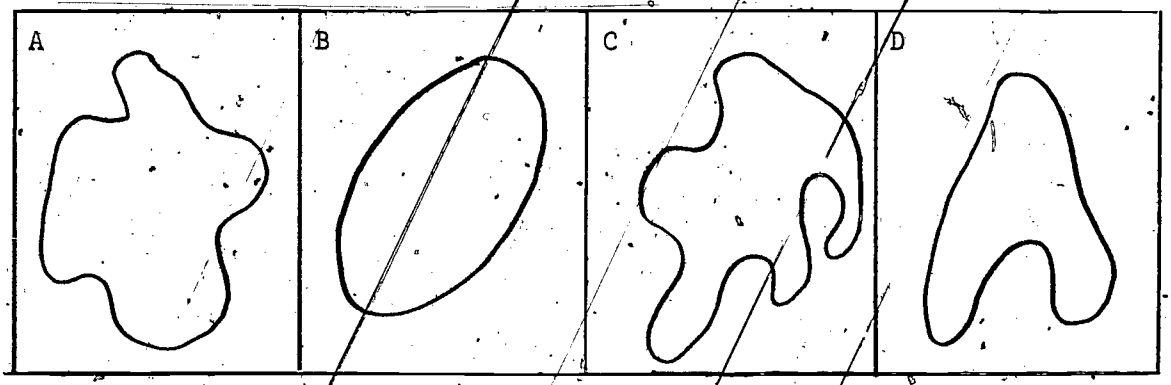
(b) In part IV, could you trace picture B? _____

(c) In part V, could you trace picture C? _____

3. What does the number of vertices with 1 or 3 string ends tell you about being able to trace around a figure without lifting your pencil or going over any part twice?

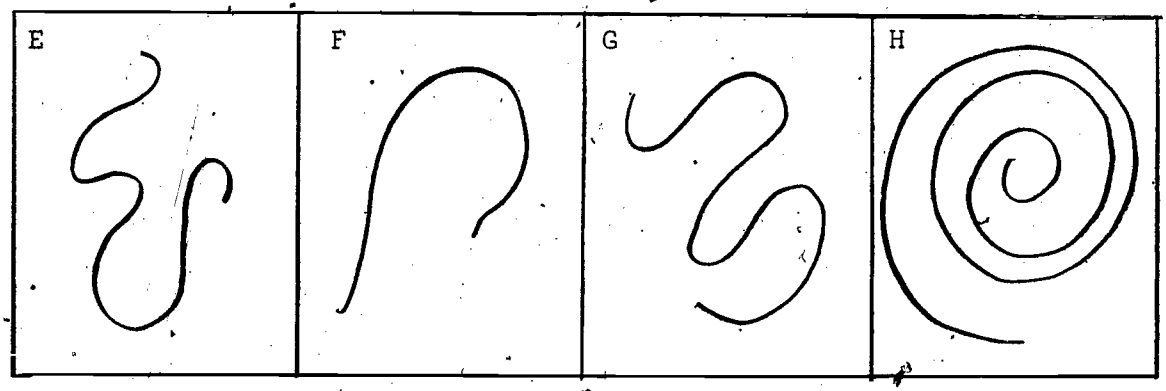
OPEN AND CLOSED FIGURES

I. Look at these:



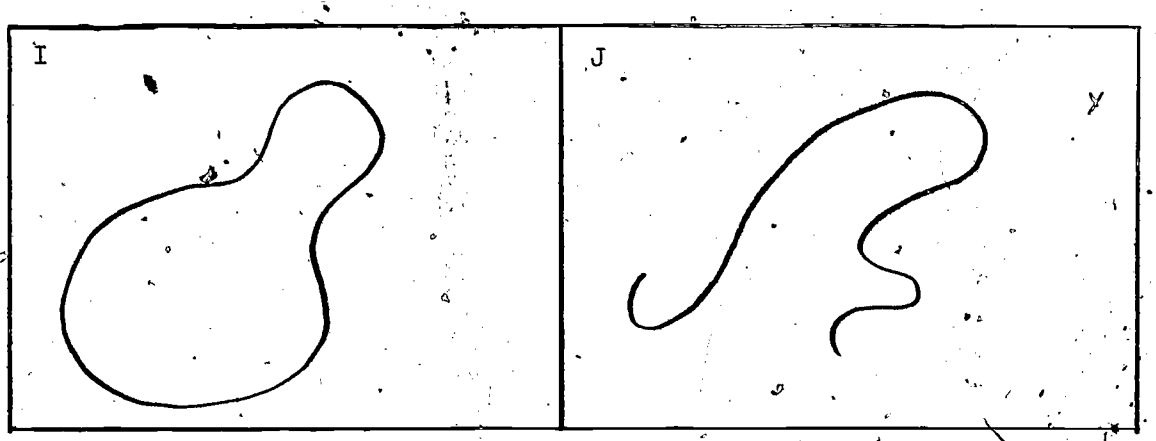
1. How are they alike?
2. How are they different?
3. What can we say about all of these?

II. Look at these:



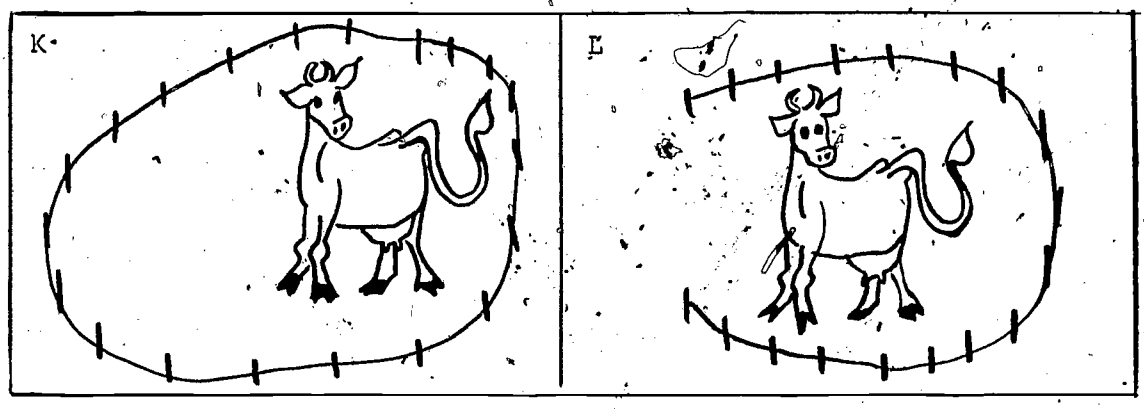
1. How are they alike?
2. How are they different?
3. What can you say about all of these?

III. Look at these:



1. Are they the same?
2. Are they different? Why?

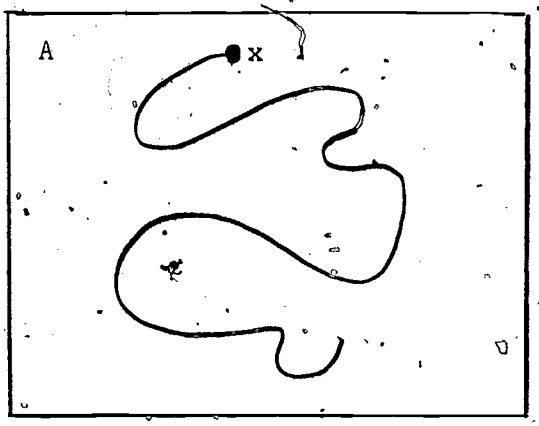
IV. Look at these:



1. Where is the cow in picture K?
2. How could he get out?
3. Where is the cow in picture L?
4. How could he get out?
5. How is the fence in picture K different from the fence in picture L?

Exercises:

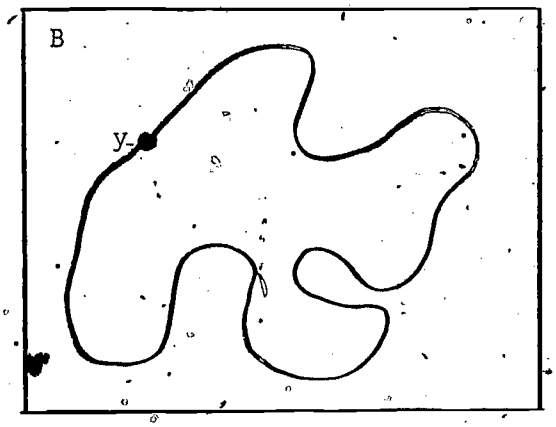
I. (a)



In picture A, put your pencil at the dot x and "drive around" the line. Can you get back to dot x without turning back (around)?

_____

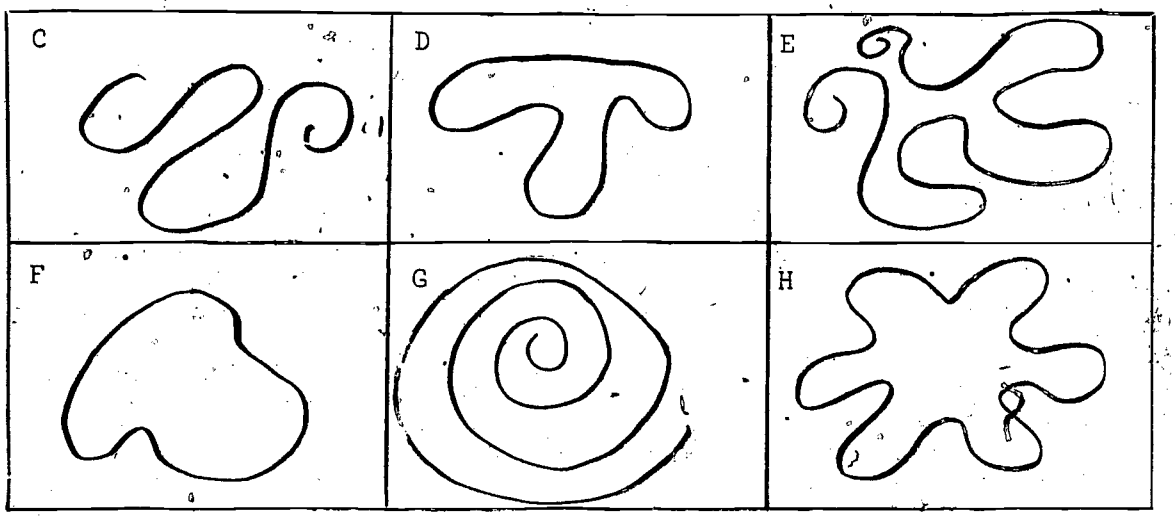
(b)



In picture B, put your pencil at the dot y and "drive around" the line. Can you get back to dot y without turning back (around)?

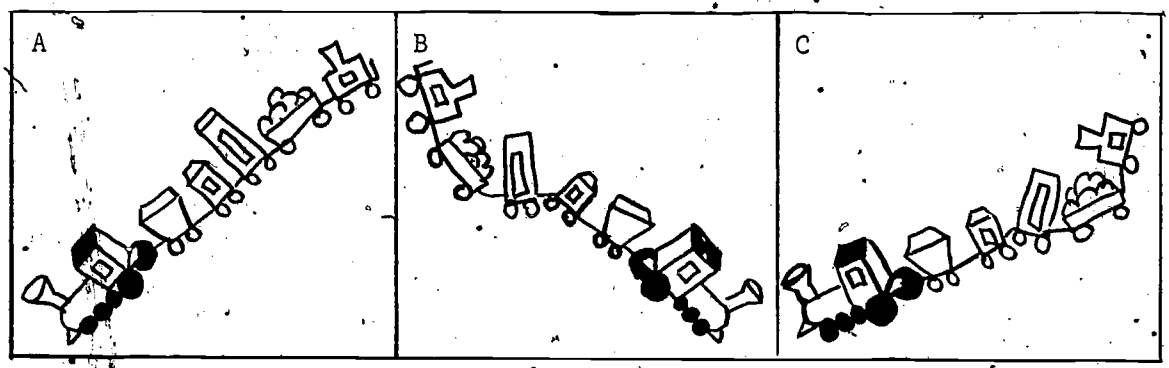
(c) Are picture A and picture B the same or different? _____ Why?

II. Draw a mark around the pictures which are like figure B above (closed).



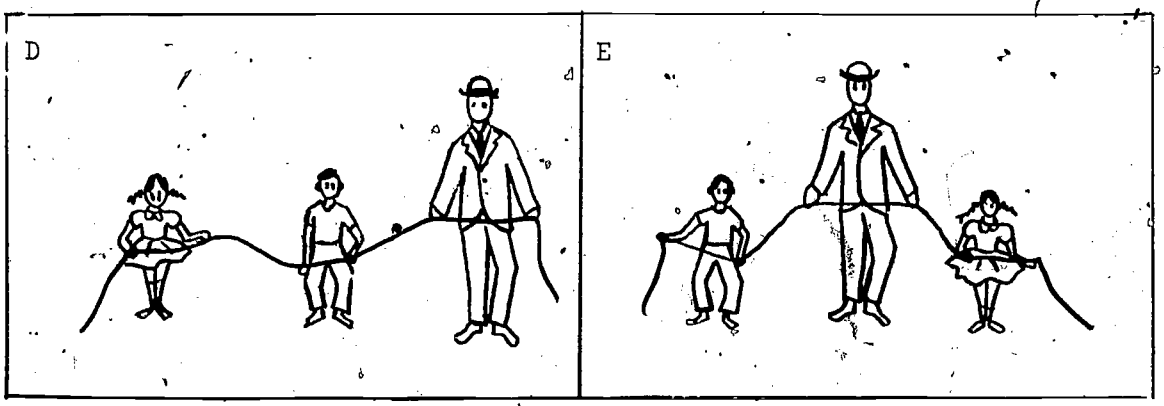
ORDER OF THINGS ON A STRING

I. Look at these:



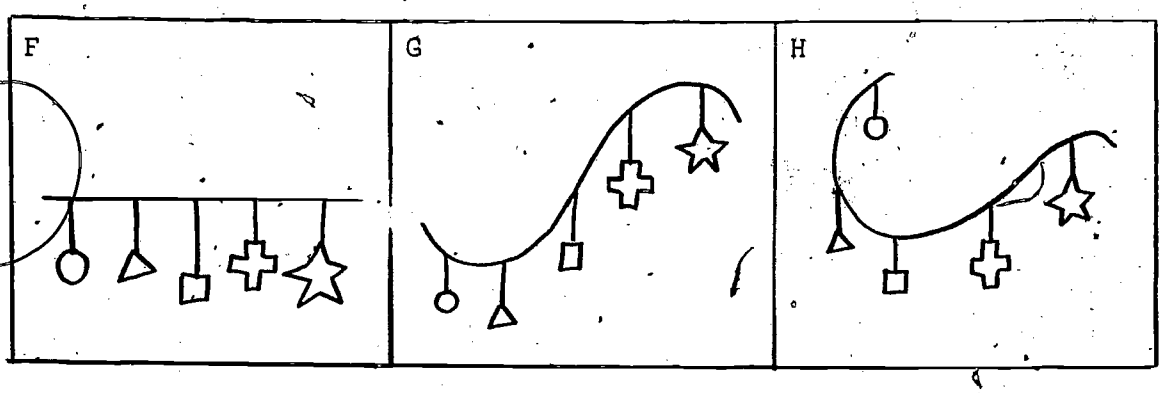
1. How are these pictures the same?
2. How are they different?
3. What can you say about all the pictures?

II. Look at these:



1. How is picture D the same as picture E?
2. How are they not the same?

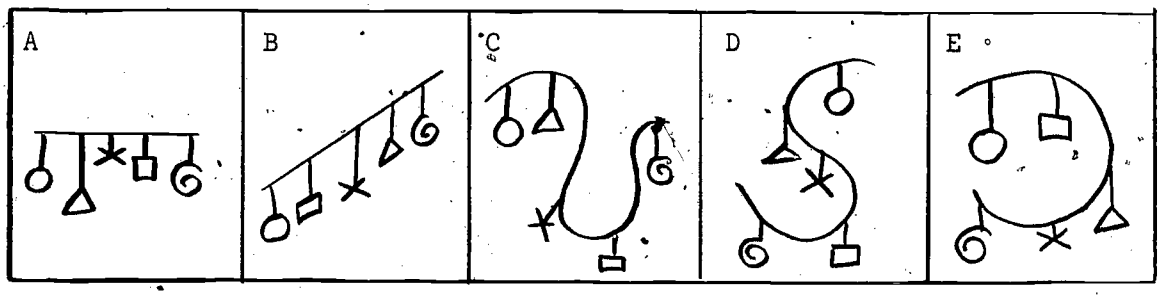
III. Look at these:



1. How are these the same?
2. How are they different?
3. How is picture F like picture H?
4. What can you say about all of these?

Exercises:

I. Draw a mark around the pictures which are the same as picture A.



II. Draw the missing things to make all of these pictures look the same as picture A.