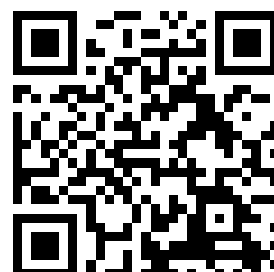

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SPECIAL TEXT

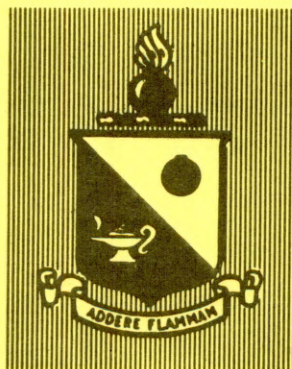
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RESISTOR & COLOR CODES

REPRINTED DEC 1984

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U.S. ARMY



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U.S. ARMY ORDNANCE CENTER AND SCHOOL

ABERDEEN PROVING GROUND
MARYLAND

DEPOSITORY

MAR 18 1985

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HOW TO USE THIS SELF-TUTOR TEXTBOOK

This self-tutor textbook is different from ordinary textbooks you have used. The first difference you will notice is that the self-tutor textbook presents information in small bits, a sentence or two at a time. These bits or sentences are numbered and called FRAMES. Each frame gives you a little bit of information. Then it "asks" you to write an answer or response to help you learn. After you write your response in the blank provided, you quickly turn the page to see if you are correct.

Each bit of information is explained in a sequence of several frames called an ACHIEVEMENT UNIT. Each frame presents the information to be learned in a slightly different form. In the first few frames of each unit, you are given some help (called CUES) in filling the blanks with the correct responses. But in the last frame of the unit, you are asked to give the complete correct answer without help or cues. This frame is called a PROVER frame because, by giving the correct response to this final frame of the unit, you prove that you have learned.

You'll find a complete program index on page 53.

After completing the last frame, read the final summary on page 47. Then test yourself to see how well you have learned by taking the Self-Test on page 49.

TABLE OF CONTENTS

	<u>Page</u>
Introduction.	iii
Fixed and variable resistors (frames 1-22)	1
Resistor color code (frames 23-49)	45
How to read color-coded resistors (frames 50-55)	7
Tolerance of color-coded resistors (frames 56-68).	19
Final summary.	47
Self-test.	49
Program index and final review	53
Answers to self-test	55

RESISTORS AND RESISTOR COLOR CODE

INTRODUCTION

Resistors are one of the most important components used in electronic circuits. They are used in electronic circuits to control the amount of current. A resistor can control current because it offers a specified amount of resistance to current. You can tell how much resistance a resistor has by reading the color bands painted on them. Each color stands for a number. Colors are used because you can see colors better than numbers, especially on small resistors.

Resistors are not perfect. The true ohmic value may vary a bit from the basic ohms rating given by the color bands. This variation is actually an error, called tolerance. You can tell how much a resistor value will vary by reading the tolerance color band. Now what will this text teach you about resistors?

After you complete this text and take the self-test, you will be able to do the following.

1. Identify fixed and variable resistors.
2. Describe how a potentiometer controls current in a circuit.
3. Read the basic ohmic value of a color-coded resistor.
4. Read the tolerance of a color-coded resistor.

1. A resistor is a circuit component which offers a certain specified amount of _____ to current. Draw the symbol for a resistor below.



TURN TO ANSWER ON PAGE 2

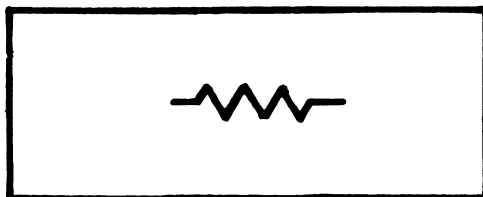


24. Some large resistors have the resistance values printed on them because the printed numbers can be made large enough to see, but most resistors use colored bands to indicate the _____ value.

47. Write in the memory aid; then fill in the number.

<u>COLOR</u>	<u>MEMORY AID</u>	<u>NUMBER</u>
BLUE	_____	_____
BLACK	_____	_____
YELLOW	_____	_____
VIOLET	_____	_____
ORANGE	_____	_____
WHITE	_____	_____
RED	_____	_____
GREEN	_____	_____
BROWN	_____	_____
GRAY	_____	_____

1. resistance (opposition)



GO TO NEXT FRAME ON PAGE 3

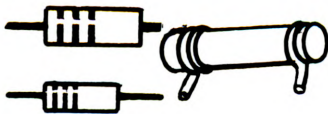


24. resistance

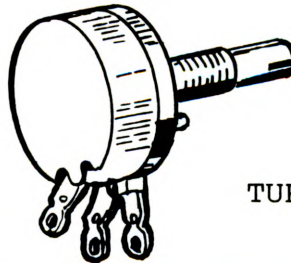
47.	BLUE	<u>SICK</u>	<u>6</u>
	BLACK	<u>NO-COLOR</u>	<u>0</u>
	YELLOW	<u>YELL-FOR HELP</u>	<u>4</u>
	VIOLET	<u>HEAVEN</u>	<u>7</u>
	ORANGE	<u>FREE</u>	<u>3</u>
	WHITE	<u>WINE</u>	<u>9</u>
	RED	<u>LIPS</u>	<u>2</u>
	GREEN	<u>FIVE-SPOT</u>	<u>5</u>
	BROWN	<u>BROW-WON</u>	<u>1</u>
	GRAY	<u>GREAT</u>	<u>8</u>

2. Resistors are either fixed or variable as shown below. A fixed resistor has one set value of resistance. The resistance of a variable resistor can be changed by an adjustable control. Which type of resistor would you use if you have to change the amount of current frequently? _____

A FIXED



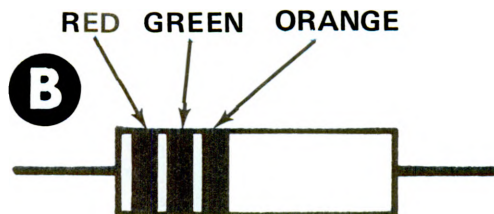
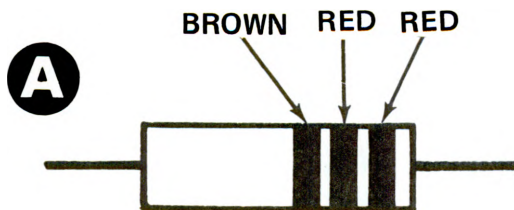
B VARIABLE



TURN TO PAGE 4



25. Look at these resistors. The colored bands stand for numbers in the resistor value. You read colors on resistor A as RED-RED-BROWN. On resistor B, you read the colors as ORANGE- _____ - _____.



48. First look at the numbers; next, write in the memory aid and then fill in the color.

COLOR

MEMORY AID

NUMBER

_____	_____	5
_____	_____	7
_____	_____	0
_____	_____	2
_____	_____	6
_____	_____	1
_____	_____	4
_____	_____	9
_____	_____	3
_____	_____	8

2. B. VARIABLE

NEXT FRAME

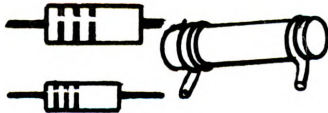


25. GREEN-RED

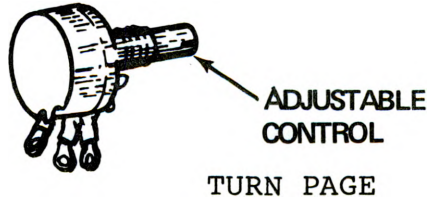
48.	<u>GREEN</u>	<u>FIVE-SPOT</u>	<u>5</u>
	<u>VIOLET</u>	<u>HEAVEN</u>	<u>7</u>
	<u>BLACK</u>	<u>NO-COLOR</u>	<u>0</u>
	<u>RED</u>	<u>LIPS</u>	<u>2</u>
	<u>BLUE</u>	<u>SICK</u>	<u>6</u>
	<u>BROWN</u>	<u>BROW-WON</u>	<u>1</u>
	<u>YELLOW</u>	<u>YELL FOR HELP</u>	<u>4</u>
	<u>WHITE</u>	<u>WINE</u>	<u>9</u>
	<u>ORANGE</u>	<u>TREE</u>	<u>3</u>
	<u>GRAY</u>	<u>GREAT</u>	<u>8</u>

3. A resistor that has one set value of resistance, such as 10 ohms or 47 megohms, allows a set value of current to flow. This type is shown in figure (A)(B) below.

A **FIXED**



B **VARIABLE**

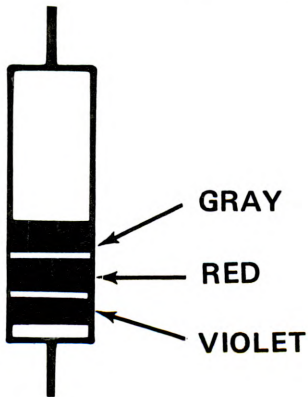


TURN PAGE

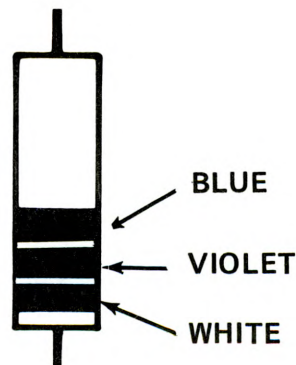


26. Here are two more resistors. You read colors on resistor A as VIOLET-RED- and _____. On resistor B, you read them as WHITE - _____ - _____.

A



B



*49. Write in the colors and numbers in the spaces provided.

YELLOW	--	_____
7	--	_____
WHITE	--	_____
GRAY	--	_____
GREEN	--	_____
6	--	_____
RED	--	_____
3	--	_____
0	--	_____
4	--	_____

1	--	_____
5	--	_____
BLUE	--	_____
VIOLET	--	_____
2	--	_____
9	--	_____
ORANGE	--	_____
8	--	_____
BROWN	--	_____
BLACK	--	_____

**P
R
O
V
E
R**

3. A

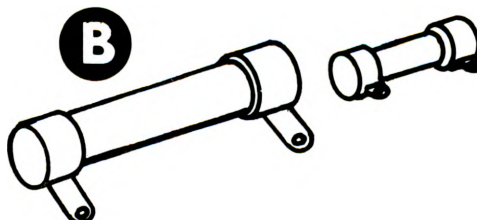
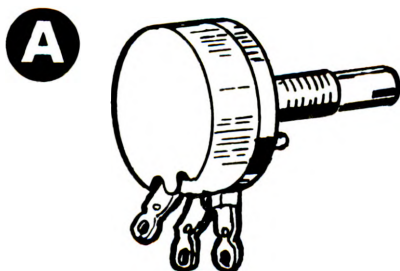
26. GRAY

VIOLET-BLUE

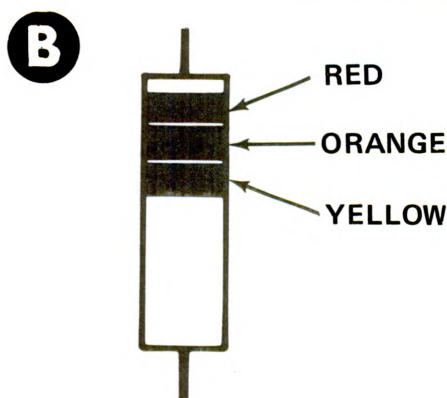
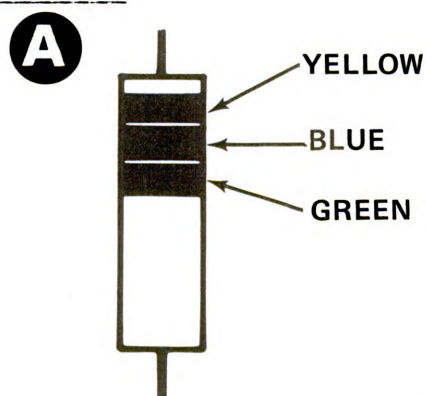
*49.

YELLOW	--	<u>4</u> ;	1	--	<u>BROWN</u> ;
7	--	<u>VIOLET</u> ;	5	--	<u>GREEN</u> ;
WHITE	--	<u>9</u> ;	BLUE	--	<u>6</u> ;
GRAY	--	<u>8</u> ;	VIOLET	--	<u>7</u> ;
GREEN	--	<u>5</u> ;	2	--	<u>RED</u> ;
6	--	<u>BLUE</u> ;	9	--	<u>WHITE</u> ;
RED	--	<u>2</u> ;	ORANGE	--	<u>3</u> ;
3	--	<u>ORANGE</u> ;	8	--	<u>GRAY</u> ;
0	--	<u>BLACK</u> ;	BROWN	--	<u>1</u> ;
4	--	<u>YELLOW</u> ;	BLACK	--	<u>0</u>

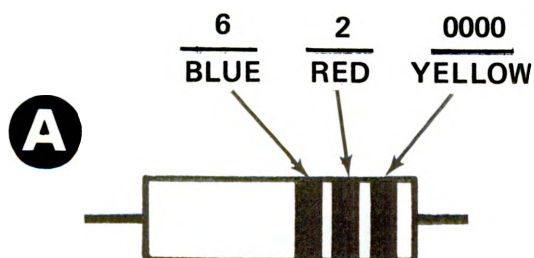
4. Sometimes you'll adjust a control knob on a radio set to change resistance in a circuit. Which figure (A)(B) should you choose when adjusting a variable resistor?



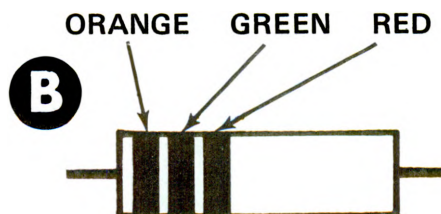
27. Now look at these resistors. The way you read the colors on resistor A is YELLOW- _____ - _____; on resistor B, you read the colors as _____ - _____ - _____.



50. Now let's apply the color code to some actual resistors. Give the value of resistor B. _____



VALUE: 620,000



VALUE: _____ OHMS

4. A

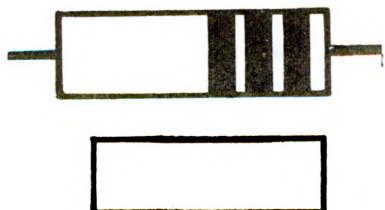
27. BLUE-GREEN

RED-ORANGE-YELLOW

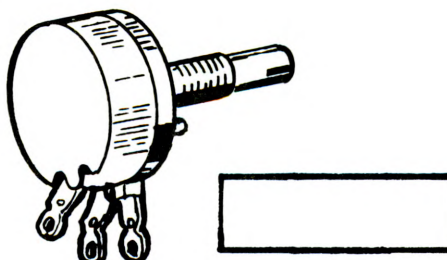
50. 3,500 ohms

5. This is the symbol for a fixed resistor: . The symbol for a variable resistor is the same except that it has a pointer which represents the adjustable control, like this . Draw the appropriate symbols in the spaces provided under the resistors below.

A

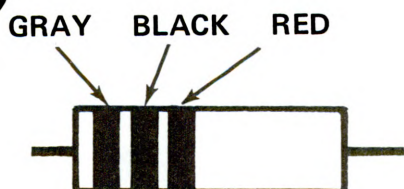


B

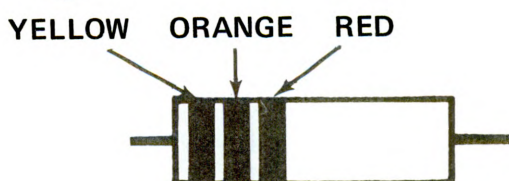


28. You read the colors on resistor A as GRAY - _____
 - _____, and on resistor B, as _____ - _____
 - _____.

A

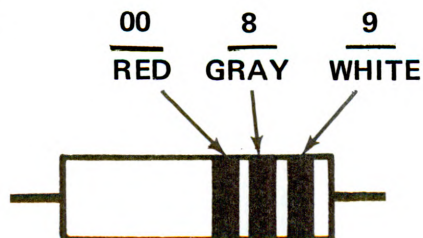


B



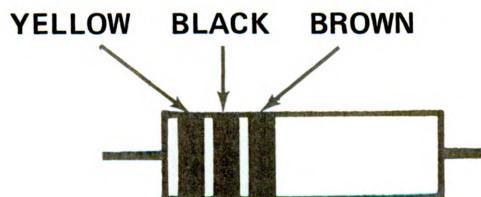
51. Give the value of resistor B.

A



VALUE: 9,800 OHMS

B



VALUE: _____ OHMS

5.

A



B



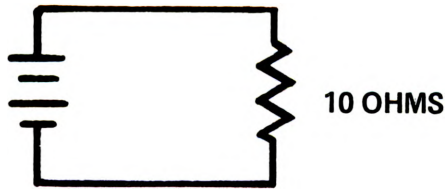
28. BLACK-RED

YELLOW-ORANGE-RED

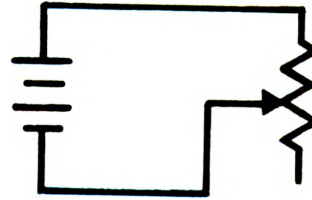
51. 100,000 ohms

6. Which circuit uses a fixed resistor? (A)(B)

A

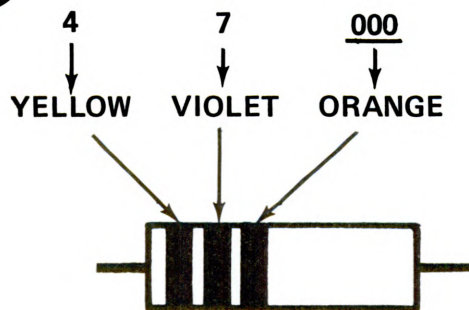


B

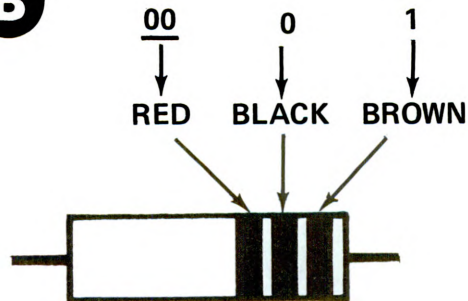


29. Remember the colored bands on carbon resistors stand for the _____ value. The value of resistor A is _____ ohms. The value of resistor B is _____ ohms.

A

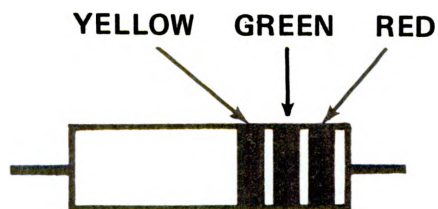


B



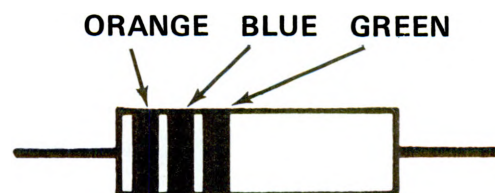
52. Give the values of resistors A and B.

A



VALUE: _____ OHMS

B



VALUE: _____ OHMS

6. A

29. resistance

47,000

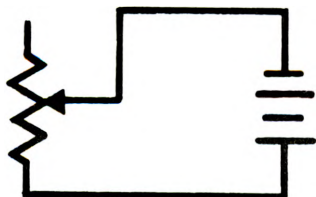
1,000

52. A. 250,000 ohms

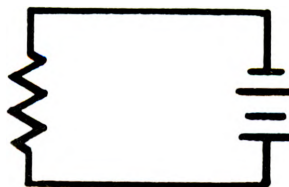
B. 3,600,000 ohms

*7. In which circuit can you change current flow without either replacing the resistor or battery? (A)(B)

A



B



**P
R
O
V
E
R**

30. Read the colors on the resistors below.

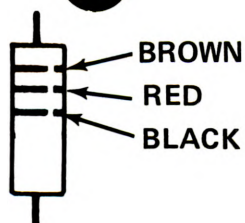
A:

B:

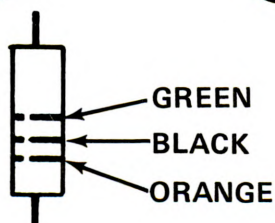
C:

D: _____.

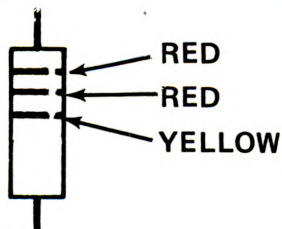
A



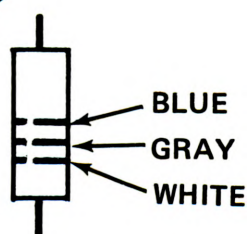
B



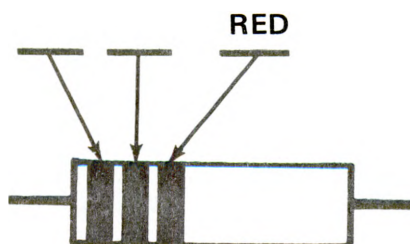
C



D



53. When you repair equipment, you will have to pick out resistors of certain values. Suppose, for example, that you need a 2,400-ohm resistor, what color bands will you look for? Fill in the colors below for a 2,400-ohm resistor.

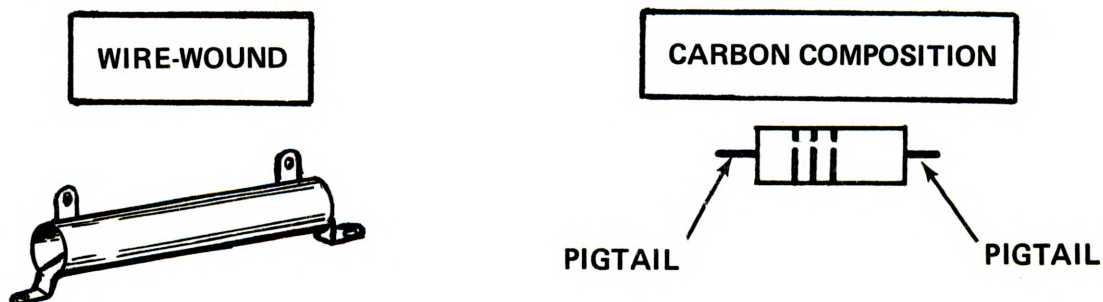


7. A

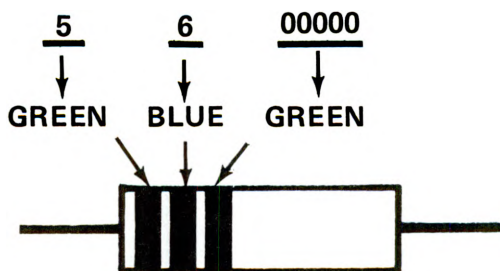
-
30. A: BROWN-RED-BLACK
B: ORANGE-BLACK-GREEN
C: RED-RED-YELLOW
D: WHITE-GRAY-BLUE

53. RED
YELLOW

8. The figure below shows two types of fixed resistors. Which type uses "pigtails"? _____ . Both types place a fixed amount of _____ in a circuit.



31. Each color has its own number. Thus, on the resistor below, GREEN stands for number _____, BLUE stands for number _____, and GREEN means that you add _____ (how many?) zeros. The value of the resistor is _____ ohms.



54. Write the colors for resistors having the values shown.

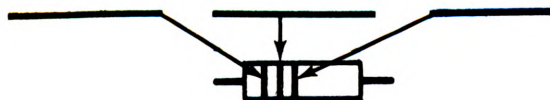
A 47,000 OHMS



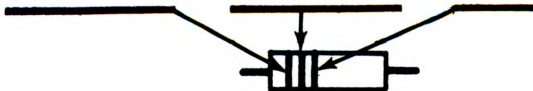
B 2,000,000 OHMS



C 980,000 OHMS



D 25 OHMS



8. Carbon composition

Resistance

31. 5

6

5

5,600,000

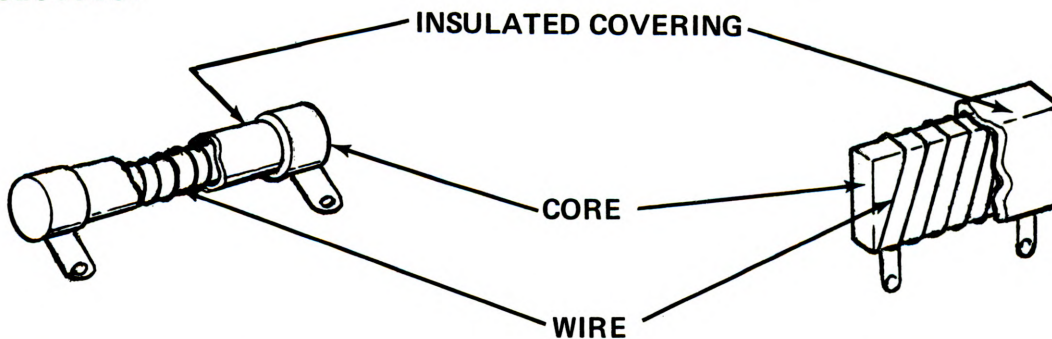
54. A. 47,000 - yellow-violet-orange

B. 2,000,000 - red-black-green

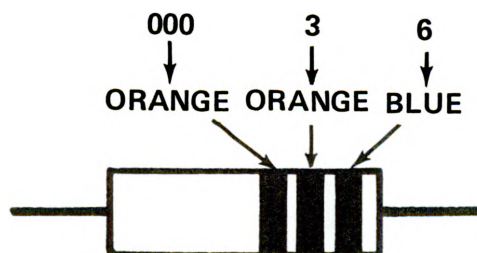
C. 980,000 - white-gray-yellow

D. 25 - red-green-black

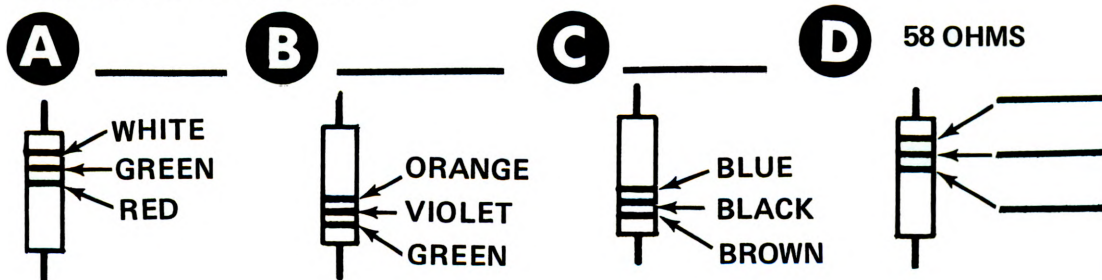
9. Resistors made with resistant wire are constructed with wire wound around a core of insulating material as shown below. These resistors are called wire wound resistors.



32. The color bands on the resistor below stand for a resistance value of 63,000 ohms. The first band is orange, which stands for number 3. The second band is orange, which stands for number 00. The third band is blue, which stands for how many zeros? 3.



*55. Give the values of resistors A, B, and C, and give the colors of resistor D.



**P
R
O
V
E
R**

9. wire-wound

32. blue - 6

orange - 3

orange - 3

*55. A. 9,500 ohms:

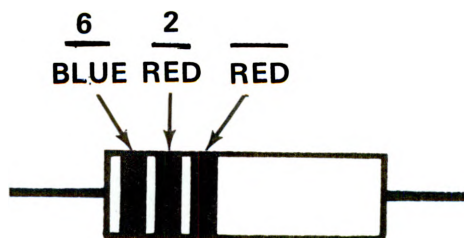
B. 57,000 ohms:

C. 10,000,000 ohms:

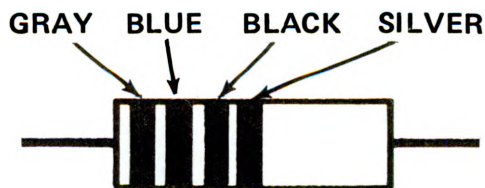
D. green-gray-black

10. A carbon composition resistor is made by mixing carbon granules with a binding material. The resistance depends on the amount of _____ granules.

33. The third color band always indicates the number of zeros at the end of the resistance value. For example, the third color band (RED) indicates that _____ (how many?) zeros should be placed after number 62.



56. Resistors are not perfect. The true ohms value may vary a bit from the basic ohms rating given by the first three color bands. This variation is actually an error, called TOLERANCE. A color-coded resistor has a fourth color band which tells you the percent of error you can expect in the basic ohms rating. What is the basic ohms rating of the resistor below? _____ ohms. Which color represents the tolerance band? _____.



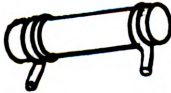
10. carbon

33. 2

56. 86
Silver

11. You can usually tell a carbon composition resistor by the colored bands painted around it. The color bands represent the value of the resistor in ohms. Which resistor below is a carbon resistor? (A)(B)(C).

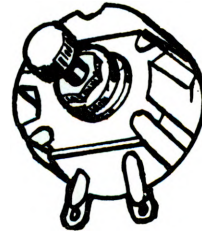
A



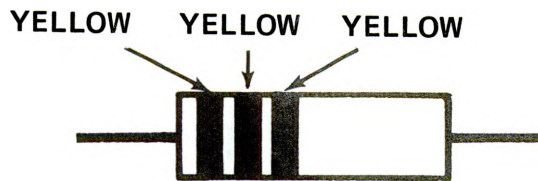
B



C



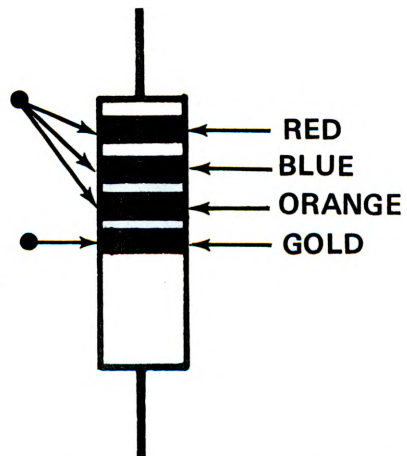
34. YELLOW stands for number 4. The value of the resistor below is not 444 ohms; instead it is (4,400) (440,000) ohms.



57. Look at this resistor and fill in the blanks.

THE FIRST THREE BANDS GIVE
THE NUMBER OF _____ S.

THE FOURTH BAND GIVES
THE T _____ .



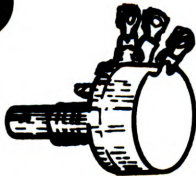
11. B

34. 440,000

57. ohms
tolerance

12. Wire-wound resistors are usually made for circuits that handle high currents. The value of resistance is usually stamped on the side. Which resistor below is a wire-wound resistor? (A) (B) (C).

A



B

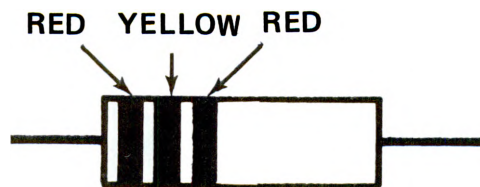


C

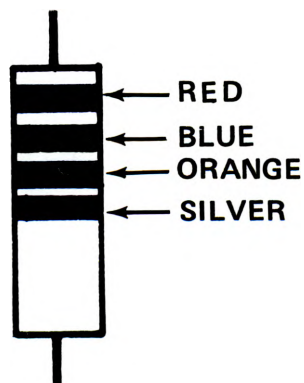


35. RED is 2. YELLOW is 4.

The value of the resistor below is 24 ohms.



58. Now look at this resistor. The first three bands show that its basic ohms rating is _____ ohms. The fourth band shows the _____ or error.



12. C

35. 2,400

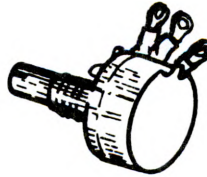
58. 26,000 ohms
tolerance

*13. Which resistor below is a wire-wound, fixed resistor? _____. Which is a carbon composition, fixed resistor? _____.

A

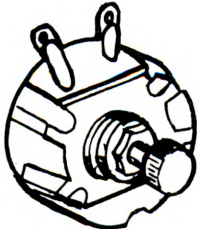


B

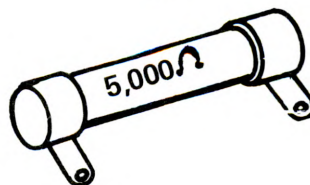


**P
R
O
V
E
R**

C



D

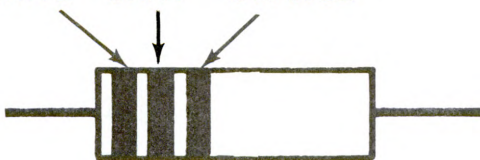


36. WHITE is 9, GRAY is 8, ORANGE is 3.

Resistor A is _____ ohms.
Resistor B is _____ ohms.

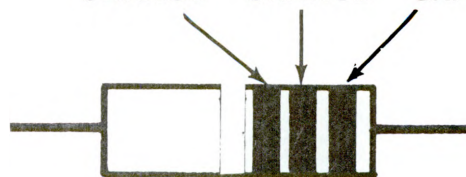
A

WHITE GRAY ORANGE



B

ORANGE ORANGE GRAY

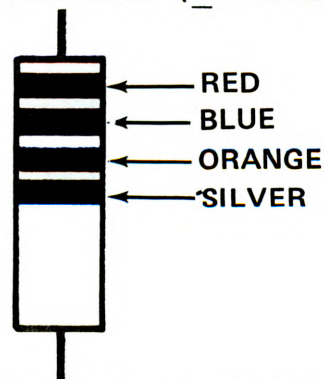


59. The tolerance band means that the true ohms value of a resistor may vary within certain limits, called TOLERANCE LIMITS. A resistor has a value of 26,000 ohms. The fourth color band is SILVER, which stands for $\pm 10\%$ TOLERANCE ($\pm$ means "plus or minus").

Read this resistor as: 26,000 ohms
 $\pm 10\%$ tolerance.

Read the tolerance limits as: 28,600
ohms and 23,400 ohms.

The basic ohms rating is _____ ohms.
Silver has a tolerance of _____.
The tolerance limits are _____ ohms
and _____ ohms.



*13. D

A

36. a. 98,000

b. 83,000

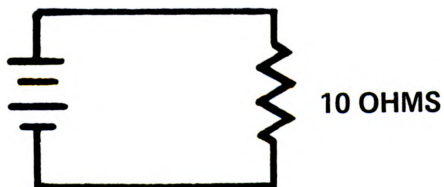
59. 26,000

+10%

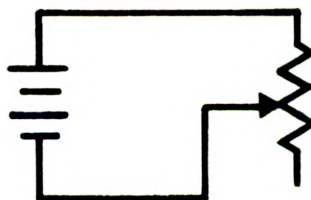
28,600 and 23,400

14. A variable resistor is used when the resistance in a circuit must be changed frequently. Which circuit below uses a variable resistor? (A)(B).

A



B

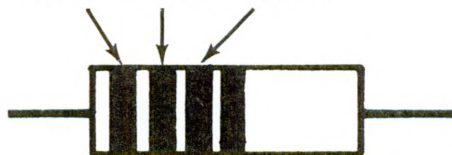


37. BLACK is zero. BROWN is 1. RED is 2.

If BLACK is the third color, you do not place any zeros after the first two numbers. For example, resistor A is 20 ohms, not 200 ohms. Resistor B is _____ ohms.

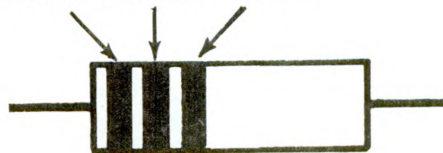
A

2 0 (NO ZEROS)
RED BLACK BLACK



B

BROWN BLACK BLACK



60. A resistor has a basic ohms rating of 300 ohms and a +10% tolerance. To find the tolerance limits, you must first find the ABSOLUTE TOLERANCE AMOUNT.

To find the absolute tolerance amount, do this:

MULTIPLY: OHMS X TOLERANCE

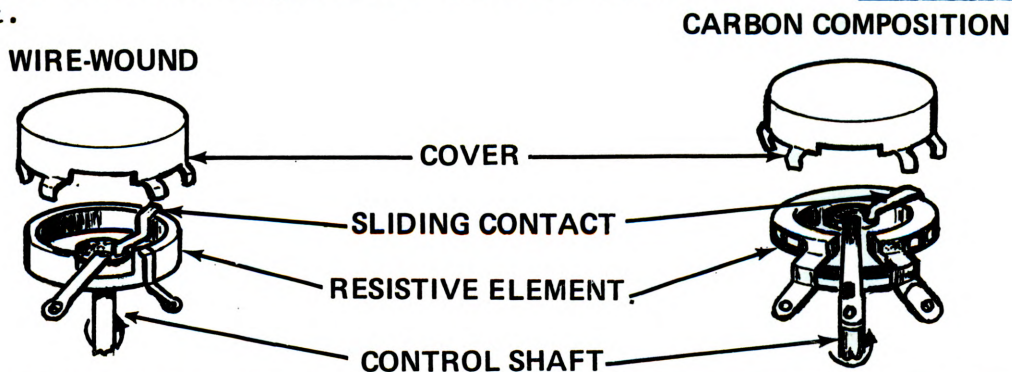
$300 \times 10\% = 300 \times .10 =$

14. B

37. 10

60. 30

15. The figure below shows the construction of two variable resistors. Notice that the resistive element can be either wire-wound or carbon composition. Also note that the adjustable control shaft moves a sliding contact.



38. VIOLET is 7, WHITE is 9, BLACK is 0.
 Resistor A is _____ ohms, not 700 ohms.
 Resistor B is _____ ohms.

A

VIOLET BLACK BLACK



B

WHITE BLACK BLACK



61. The absolute tolerance amount of a 300 ohms $\pm 10\%$ tolerance resistor is 30. To find the TOLERANCE LIMITS, do this:

1. For the lower limit of tolerance:

Subtract: Absolute tolerance amount from basic ohms rating.

$$300 - 30 = \text{_____ ohms.}$$

2. For the upper limit of tolerance:

Add: $300 + 30 = \text{_____ ohms.}$

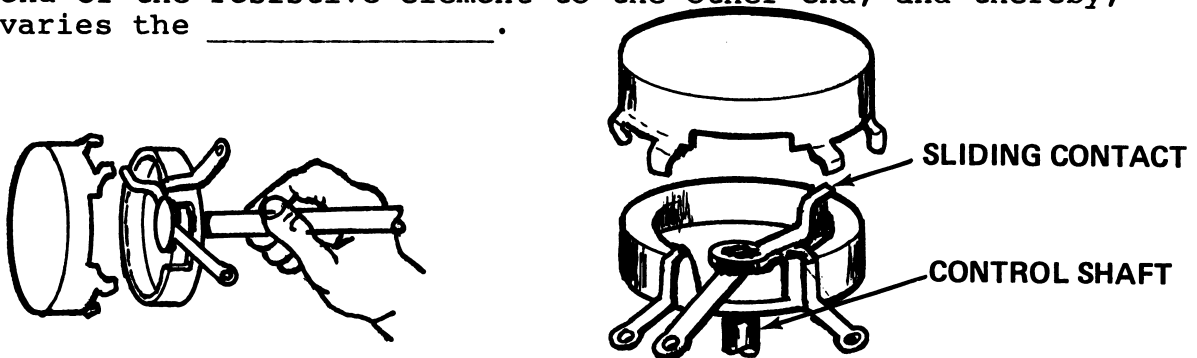
The tolerance limits are _____ ohms and _____ ohms.

15. wire-wound
carbon composition
sliding

38. A. 70
B. 90

61. 270 ohms
330 ohms
330 ohms and 270 ohms

16. A variable resistor is usually called a potentiometer (abbreviated "pot"). Here's how a potentiometer works. When you turn the control shaft, the sliding contact slides from one end of the resistive element to the other end, and thereby, varies the _____.



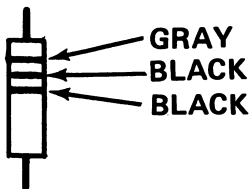
39. GRAY is 8. BLUE is 6. BLACK is 0.

Resistor A is _____ ohms.

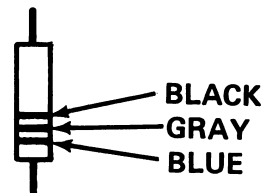
Resistor B is _____ ohms.

Resistor C is _____ ohms.

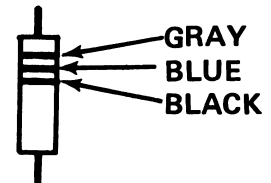
A



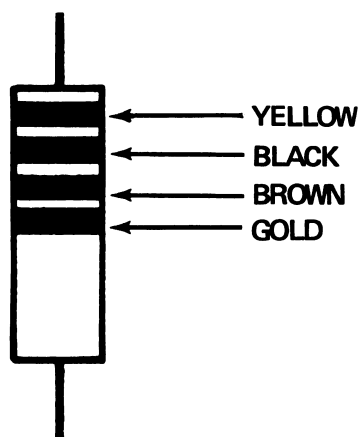
B



C



62. Look at this resistor. The basic ohms rating is _____ ohms. The tolerance band color is _____.



16. resistance

39. A: 80

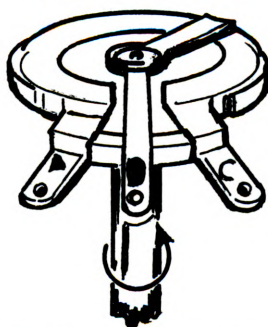
B: 68

C: 86

62. 400 ohms

GOLD

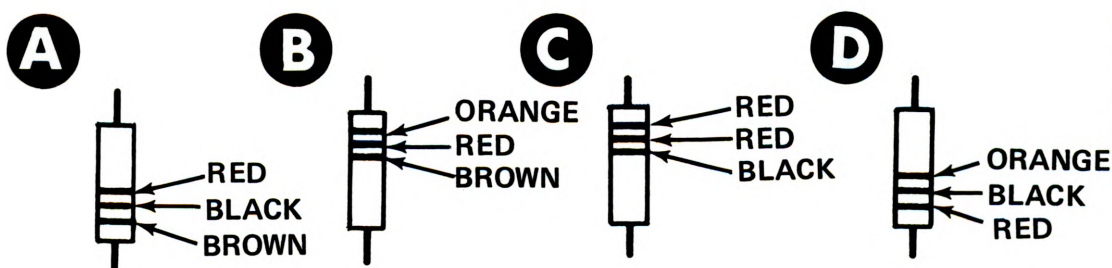
17. Look at this exposed view of the potentiometer. Notice that the resistance is fixed between terminals A and C. As you move the control shaft, the resistance changes between terminals A and B and _____ and _____.



*40. BLACK is 0. BROWN is 1. RED is 2. ORANGE is 3.

Resistor A is _____ ohms.
 Resistor B is _____ ohms.
 Resistor C is _____ ohms.
 Resistor D is _____ ohms.

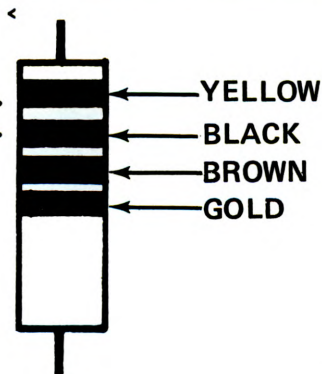
PROVER



63. Here's the same resistor again. The tolerance band is GOLD, which stands for a $\pm 5\%$ tolerance. Multiply basic ohms rating by the tolerance to get the Absolute Tolerance Amount. Write it here: Absolute tolerance amount: _____.

Now add and subtract to find the Tolerance Limits.

Write them here: Upper limit: _____ ohms.
 Lower limit: _____ ohms.



17. B and C

*40. A: 1,000

B: 320

C: 22

D: 20,000

63. $400 \times 0.05 = \underline{20}$

Upper limit: $400 + 20 = \underline{420}$ ohms

Lower limit: $400 - 20 = \underline{380}$ ohms

18. The symbol for a potentiometer is shown below. When you turn the control shaft, you change the resistance between terminals _____ and _____, and between terminals _____ and _____. The resistance is fixed between terminals _____ and _____.



41. A resistor with colored bands is called a color-coded resistor because the colored bands indicate the _____ value.

64. Look at this resistor. The basic ohms rating is _____ ohms.

The FOURTH BAND is missing.

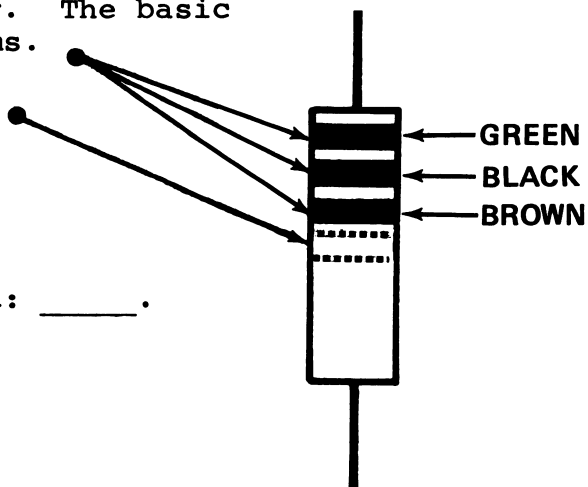
So the tolerance is +20%.

COMPUTE:

The absolute tolerance amount: _____.

The upper limit: _____.

The lower limit: _____.



18. 1 and 2

3 and 2

1 and 3

41. resistance

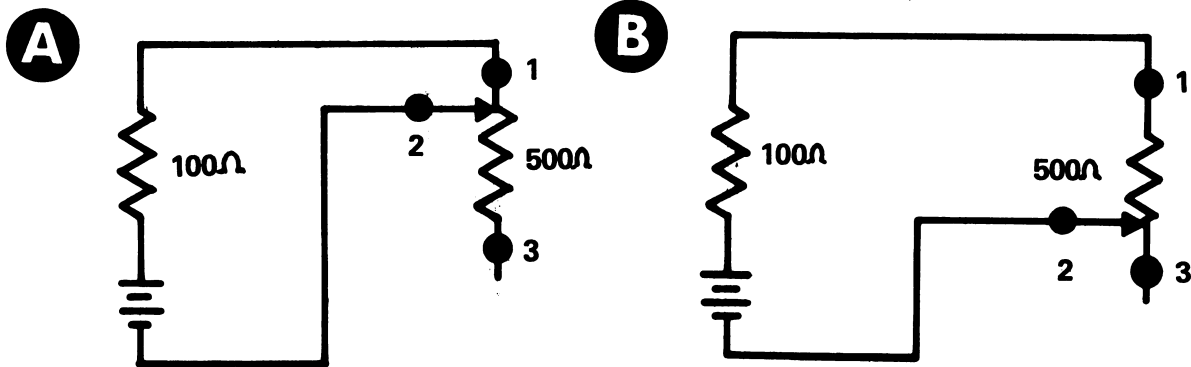
64. 500 ohms

Absolute tolerance amount: $500 \times 0.20 = \underline{100}$

The upper limit: $500 + 100 = \underline{600}$ ohms

The lower limit: $500 - 100 = \underline{400}$ ohms

19. In circuit A, the potentiometer is at zero resistance; therefore, the total resistance in the circuit is _____ ohms. In circuit B, the potentiometer is at maximum resistance. What is the total resistance now? _____ ohms.



42. There's a color for each number from 0 to 9. To help you remember the color and number, you'll learn a memory aid for each color-number combination. For example, to remember that BLUE stands for 6, think of feeling BLUE and SICK. The word "sick" rhymes with the number 6.

"WHITE WINE" is a memory aid to help you associate the color WHITE with the number _____. (Think of a number that rhymes with WINE.)

65. The FOURTH COLOR BAND shows the TOLERANCE.

If the Fourth Band is	The Tolerance is:
GOLD	+5%
SILVER (think of tin)	+10%
MISSING	+20%

Fill in the blanks below with the correct tolerances:

GOLD



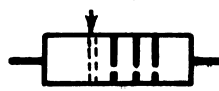
+ _____ %

SILVER



+ _____ %

MISSING



+ _____ %

19. 100

600

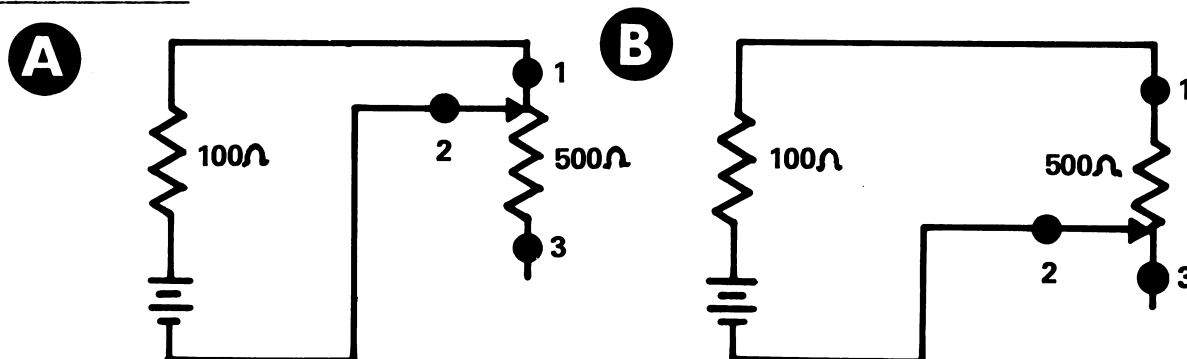
42. 9

65. GOLD: +5%

SILVER: +10% (think of tin)

MISSING: +20%

20. Which circuit below offers the most resistance to current? _____. Which circuit has the most current flow?



43. To learn the color code numbers from 0 to 9, read the memory aid first, and fill in the number next to the first color. Do this for each color given.

COLOR	NUMBER	MEMORY AID
RED	_____	Think of TWO RED LIPS.
ORANGE	_____	Say ORANGE TREE (thus mispronouncing the number).
BLUE	_____	Think of feeling BLUE and SICK (sounds like like the number).
VIOLET	_____	Say VIOLET HEAVEN (rhymes with the number).
GREEN	_____	A FIVE dollar bill or a FIVE spot is GREEN.
BLACK	_____	Think of BLACK as NO color.
WHITE	_____	Think of WHITE WINE (rhymes with the number).
YELLOW	_____	Think of YELL FOR help.
BROWN	_____	Pronounce BROWN as BROW-WON.
GRAY	_____	Say GRAY-EIGHT or GREAT.

66. Look at the fourth band to find the tolerance.

REMEMBER
 5% 10% 20%
 (TIN)

	MISSING ↓ 	GOLD ↓ 	SILVER ↓
	A	B	C
BASIC OHMS RATING	800 ohms	900 ohms	1,000 ohms
Tolerance	_____	_____	_____
Lower limit	_____	_____	_____
Upper limit	_____	_____	_____

20. B

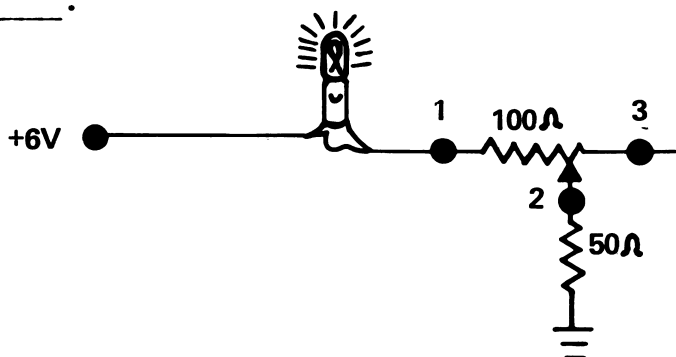
A

43. RED 2
 ORANGE 3
 BLUE 6
 VIOLET 7
 GREEN 5
 BLACK 0
 WHITE 9
 YELLOW 4
 BROWN 1
 GRAY 8

66.

	A	B	C
Tolerance:	<u>+20%</u>	<u>+5%</u>	<u>+10%</u>
Lower limit:	<u>640</u>	<u>855</u>	<u>900</u>
Upper limit:	<u>960</u>	<u>945</u>	<u>1,100</u>

21. This circuit uses a potentiometer to control the amount of current. Suppose you moved the slider contact (2) toward end-terminal (1). Does the lamp get brighter or dimmer?



44. Read the memory aid first. Then fill in the numbers next to the colors.

COLOR	NUMBER	MEMORY AID
GRAY	_____	GRAY-EIGHT or GREAT
BROWN	_____	BROW-WON
YELLOW	_____	YELL-FOR help
WHITE	_____	WHITE WINE
BLACK	_____	NO color
GREEN	_____	FIVE spot
VIOLET	_____	VIOLET HEAVEN
BLUE	_____	BLUE and SICK
ORANGE	_____	ORANGE TREE
RED	_____	TWO RED LIPS

67. Compute the tolerance limits for each of these.

	SILVER	MISSING	GOLD
			
BASIC OHMS	A	B	C
RATING	<u>20,000</u>	<u>5,200</u>	<u>5,000,000</u>
Tolerance:	_____	_____	_____
Lower limit:	_____	_____	_____
Upper limit:	_____	_____	_____

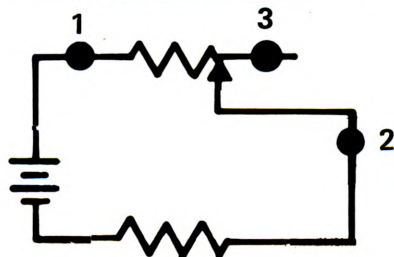
21. brighter

44. GRAY 8
BROWN 1
YELLOW 4
WHITE 9
BLACK 0
GREEN 5
VIOLET 7
BLUE 6
ORANGE 3
RED 2

67.

	A	B	C
Tolerance:	<u>+10%</u>	<u>+20%</u>	<u>+5%</u>
Lower limit:	<u>18,000</u>	<u>4,160</u>	<u>4,750,000;</u>
Upper limit:	<u>22,000</u>	<u>6,240</u>	<u>5,250,000;</u>

*22. Look at the potentiometer in this circuit. As you move the slider contact (2) toward end-terminal (3), the resistance of the circuit (increases) (decreases), causing (more) (less) current to flow.



PROVER

45. Fill in the numbers next to the colors.

<u>COLOR</u>	<u>NUMBER</u>	<u>MEMORY AID</u>
BLACK	_____	NO color
GREEN	_____	FIVE spot
BLUE	_____	BLUE and SICK
BROWN	_____	BROW-WON
GRAY	_____	GRAY-EIGHT or GREAT
WHITE	_____	WHITE WINE
ORANGE	_____	ORANGE TREE
YELLOW	_____	YELL-FOR help
VIOLET	_____	VIOLET HEAVEN
RED	_____	TWO RED LIPS

*68. Rate these resistors.

A	B	C	D
_____ OHMS	_____ OHMS	_____ OHMS	_____ OHMS
+ _____ %	+ _____ %	+ _____ %	+ _____ %

PROVER

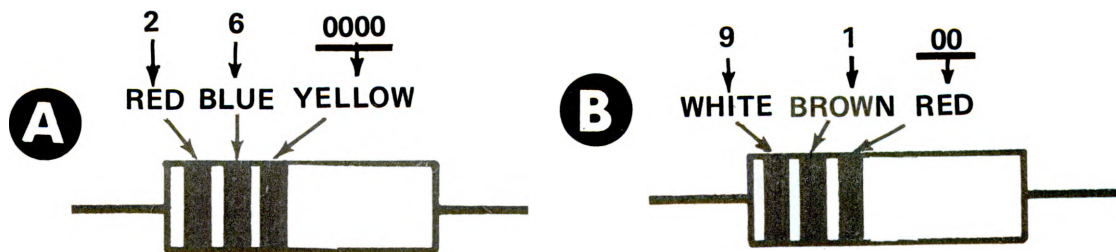
*22. increases

less

45.	BLACK	<u>0</u>
	GREEN	<u>5</u>
	BLUE	<u>6</u>
	BROWN	<u>1</u>
	GRAY	<u>8</u>
	WHITE	<u>9</u>
	ORANGE	<u>3</u>
	YELLOW	<u>4</u>
	VIOLET	<u>7</u>
	RED	<u>2</u>

-
68. A. 7,000 ohms +5%
B. 12 ohms +10%
C. 3,800,000 ohms +20%
D. 47,000 ohms +10%
-

23. Carbon resistors have colored bands to indicate their resistance values. For example, the colored bands on resistor A stand for (26 ohms) (260,000 ohms), and for resistor B they stand for _____ ohms.



46. Read the memory aid, then fill in the color and number.

<u>MEMORY AID</u>	<u>COLOR</u>	<u>NUMBER</u>
TWO RED LIPS	_____	_____
GRAY-EIGHT or GREAT	_____	_____
ORANGE TREE	_____	_____
BROW-WON	_____	_____
FIVE spot	_____	_____
BLUE and SICK	_____	_____
NO color	_____	_____
WHITE WINE	_____	_____
YELL-FOR help	_____	_____
VIOLET HEAVEN	_____	_____

NOW READ THE FINAL SUMMARY ON PAGE 47.

Then take the self-test.

23. 260,000

9,100

Now turn to frame 24 on page 1.

46.	<u>RED</u>	<u>2</u>
	<u>GRAY</u>	<u>8</u>
	<u>ORANGE</u>	<u>3</u>
	<u>BROWN</u>	<u>1</u>
	<u>GREEN</u>	<u>5</u>
	<u>BLUE</u>	<u>6</u>
	<u>BLACK</u>	<u>0</u>
	<u>WHITE</u>	<u>9</u>
	<u>YELLOW</u>	<u>4</u>
	<u>VIOLET</u>	<u>7</u>

Now turn to frame 47 on page 1.

FINAL SUMMARY

There are two basic types of resistors, fixed and variable. Both types may use either wire-wound or carbon composition as the resistive element. A fixed resistor has only one set value, which may be as low as a fraction of an ohm or as high as several million ohms. A variable resistor is usually called a potentiometer. Its resistance can be changed to vary the amount of current in a circuit.

Wire-wound resistors usually have the value of resistance stamped on the side. Carbon resistors have color bands to indicate the resistance value and tolerance. Each color stands for a number. You read ohmic value of a color-coded resistor from end-to-center. The resistance and tolerance color code are listed below with the memory aids.

RESISTANCE COLOR CODE

<u>Number</u>	<u>Color</u>	<u>Memory Aid</u>
0	BLACK	Think of BLACK as <u>NO</u> -color.
1	BROWN	Pronounce BROWN as BROW- <u>WON</u> .
2	RED	Think of TWO RED LIPS.
3	ORANGE	Say ORANGE <u>TREE</u> (thus mispronouncing the number).
4	YELLOW	Think of YELL- <u>FOR</u> help.
5	GREEN	A FIVE dollar bill or "five spot" is GREEN.
6	BLUE	Think of feeling BLUE and <u>SICK</u> (sounds like the number).
7	VIOLET	Say VIOLET <u>HEAVEN</u> (rhymes with the number).
8	GRAY	Say GRAY- <u>EIGHT</u> or GREAT.
9	WHITE	Think of WHITE <u>WINE</u> (rhymes with the number).

TOLERANCE COLOR CODE

5% GOLD

10% SILVER Think of tin (sounds like ten), looking like silver.

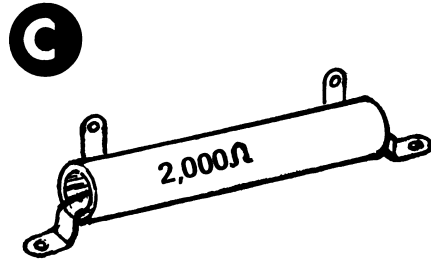
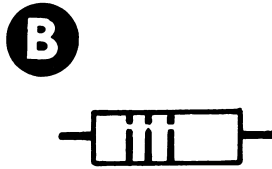
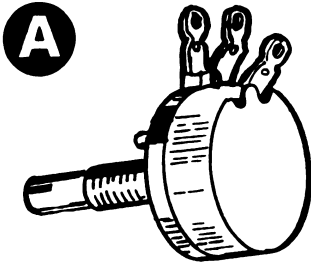
20% NO color

Now take the self-test on page 49.

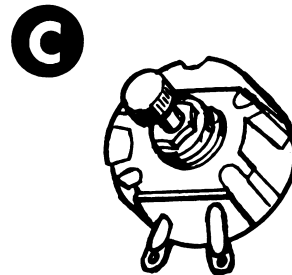
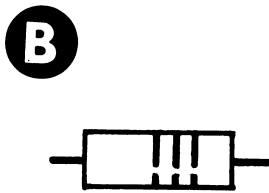
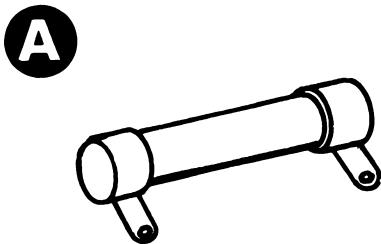
SELF-TEST

RESISTORS AND RESISTOR COLOR CODE

1. Which resistor below is a potentiometer? (A)(B)(C).

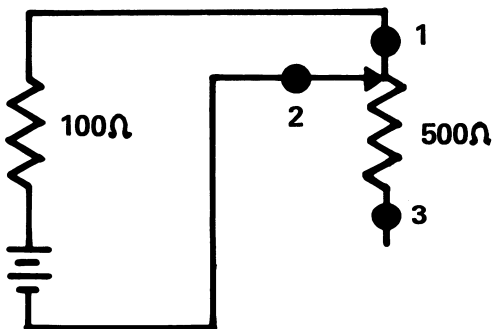


2. Which resistor below is a carbon composition fixed resistor? (A)(B)(C).

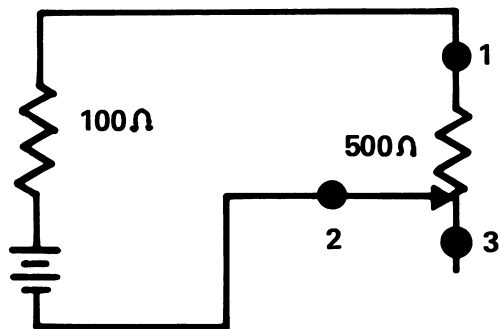


3. Which circuit below has the higher resistance? _____.
Which circuit has the most current flow? _____.

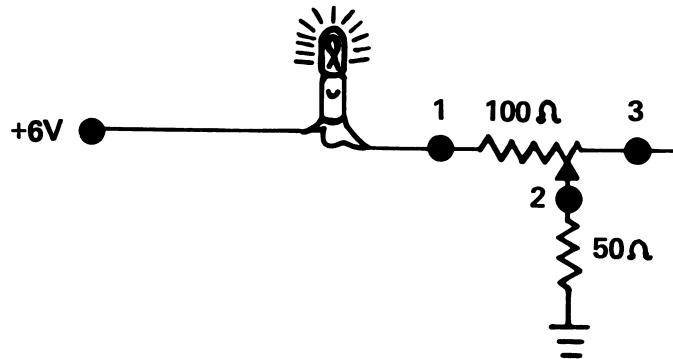
A



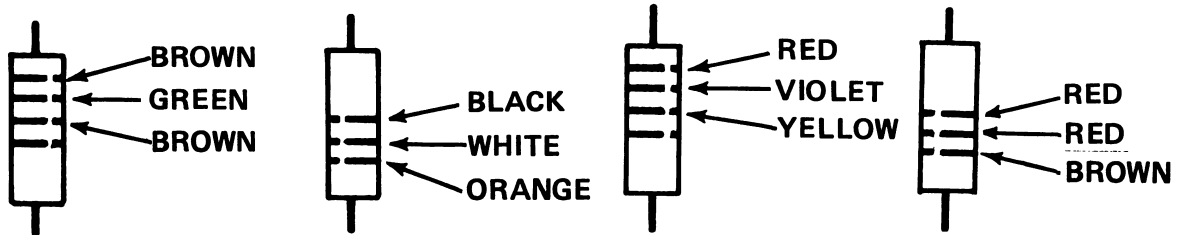
B



4. Look at the potentiometer in this circuit. As you move the slider contact (2) toward end-terminal (3). (more)(less) current flows.



5. Give the basic ohms value of these resistors.



_____ ohms _____ ohms _____ ohms _____ ohms

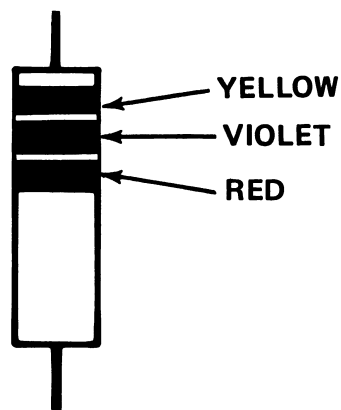
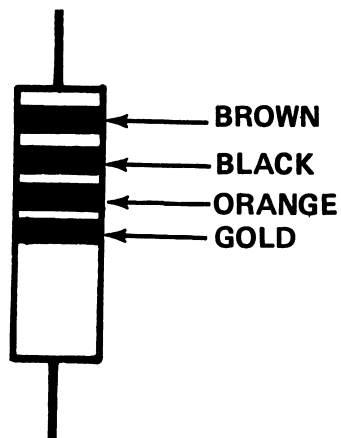
6. Write in the colors for resistors having these values.

<u>Value</u>	<u>Colors</u>		
A. 74,000 ohms	_____	_____	_____
B. 6,800 ohms	_____	_____	_____
C. 470,000 ohms	_____	_____	_____
D. 120 ohms	_____	_____	_____
E. 50 ohms	_____	_____	_____

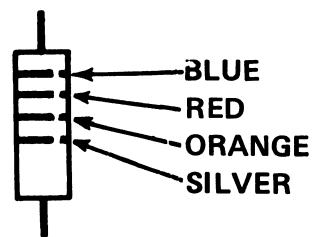
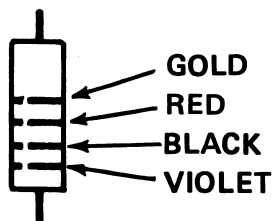
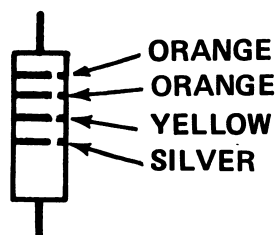
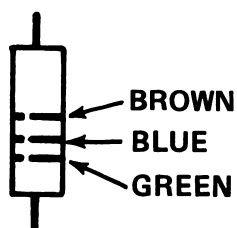
7. Write in the tolerance limits for these resistors.

Upper limit: _____ ohms Upper limit: _____ ohms

Lower limit: _____ ohms Lower limit: _____ ohms

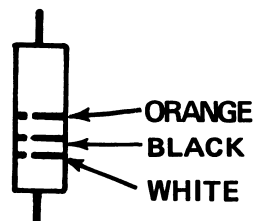
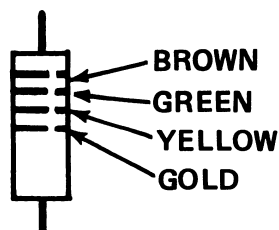
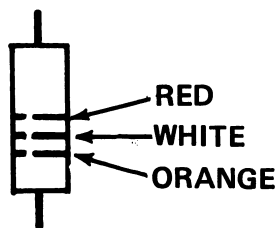
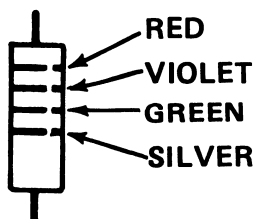


8. Rate these resistors.



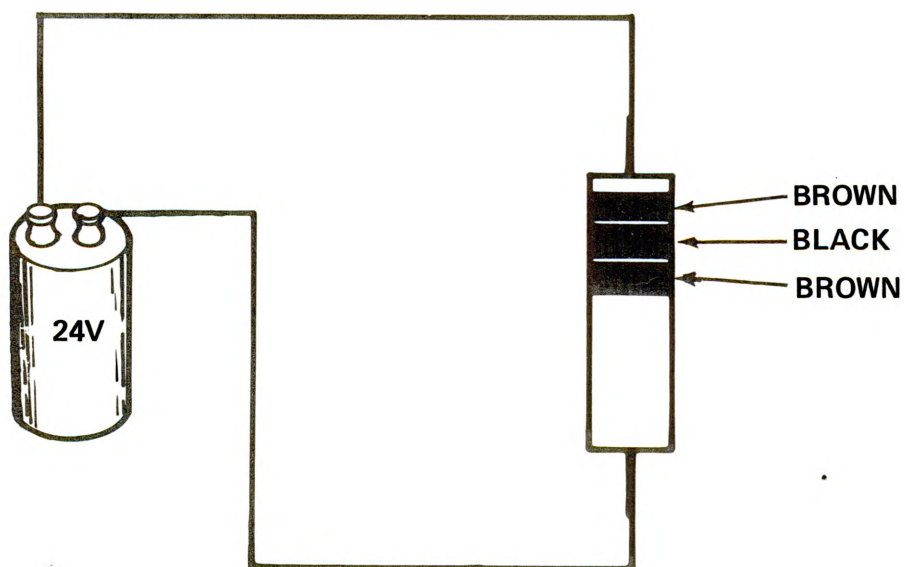
_____ ohms _____ ohms _____ ohms _____ ohms
 + _____ % + _____ % + _____ % + _____ %

9. Now rate these resistors.



_____ ohms _____ ohms _____ ohms _____ ohms
 + _____ % + _____ % + _____ % + _____ %

10. Look at this circuit. How much current would flow at the upper tolerance limit of the resistor? _____ amp. How much current would flow at the lower tolerance limit? _____ amp.



Correct answers are given on page 55.

PROGRAM INDEX AND FINAL REVIEW

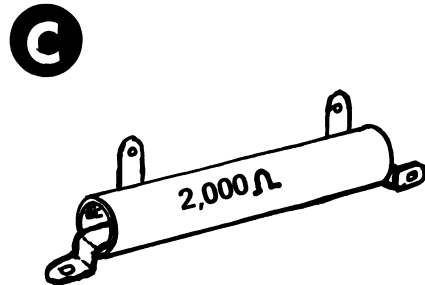
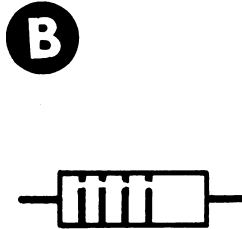
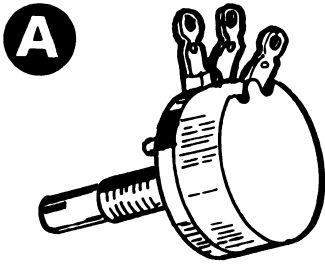
Here is an index of all the important points covered in this text. The number given after each statement indicates the frames.

1. How to identify fixed and variable resistors. (1-7)
2. How to identify wire-wound fixed resistors and carbon composition fixed resistors. (8-13)
3. A potentiometer controls current by changing the total resistance in a circuit. (14-22)
4. How to read the sequence of bands on a color-coded resistor. (23-40)
5. Each color in the color code stands for a number. (41-49)
6. How to read the basic ohmic value of a resistor using the color code. (50-55)
7. How to read the tolerance of a color-coded resistor. (56-68)

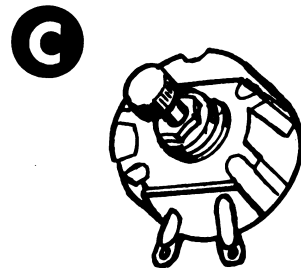
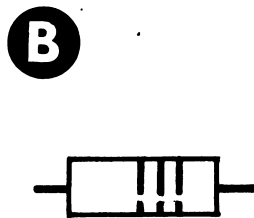
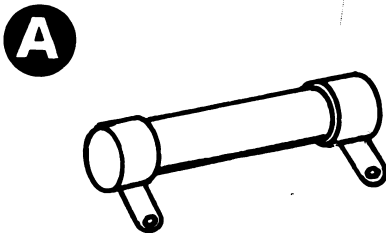
SELF-TEST ANSWER SHEET

RESISTORS AND RESISTOR COLOR CODE

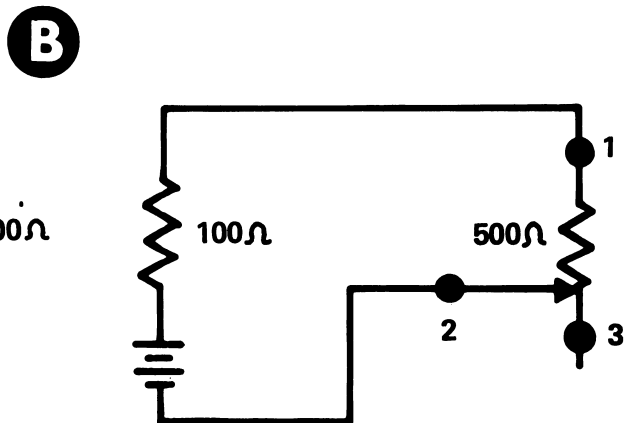
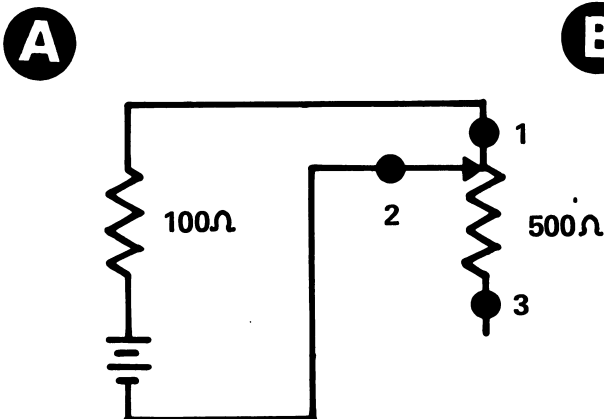
1. Which resistor below is a potentiometer? A



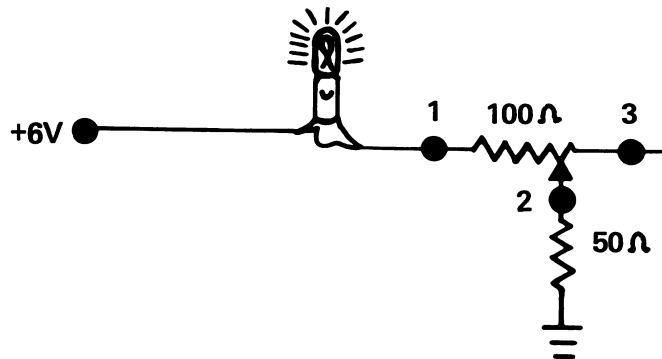
2. Which resistor below is a carbon composition fixed resistor? B



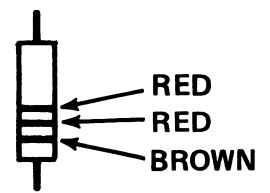
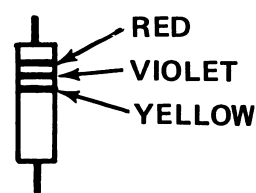
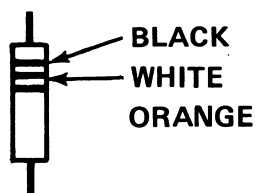
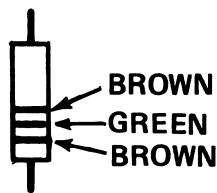
3. Which circuit below has the higher resistance? B.
Which circuit has the most current flow? A.



4. Look at the potentiometer in this circuit. As you move the slider contact (2) toward end-terminal (3). (more) (less) current flows.



5. Give the basic ohms value of these resistors.



150 ohms 39 ohms 270,000 ohms 1,200 ohms

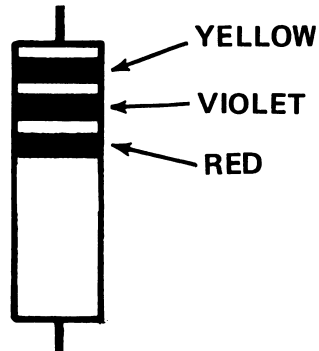
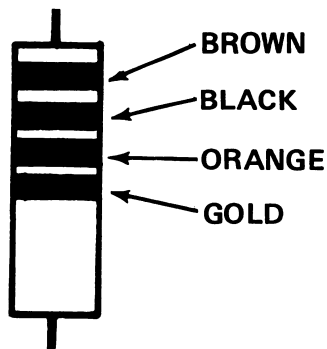
6. Write in the colors for resistors having these values.

<u>Value</u>	<u>Colors</u>		
A. <u>74,000 ohms</u>	<u>VIOLET</u> ,	<u>YELLOW</u> ,	<u>ORANGE</u>
B. <u>6,800 ohms</u>	<u>BLUE</u> ,	<u>GRAY</u> ,	<u>RED</u>
C. <u>470,000 ohms</u>	<u>YELLOW</u> ,	<u>VIOLET</u> ,	<u>YELLOW</u>
D. <u>120 ohms</u>	<u>BROWN</u> ,	<u>RED</u> ,	<u>BROWN</u>
E. <u>50 ohms</u>	<u>GREEN</u> ,	<u>BLACK</u> ,	<u>BLACK</u>

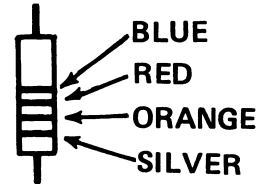
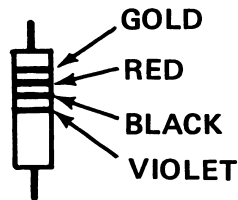
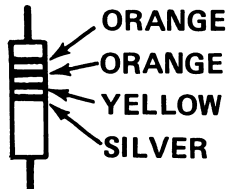
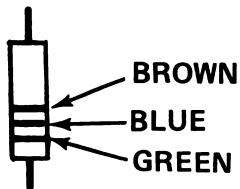
7. Write in the tolerance limits for these resistors.

Upper limit: 10,500 ohms Upper limit: 5,640 ohms

Lower limit: 9,500 ohms Lower limit: 3,760 ohms

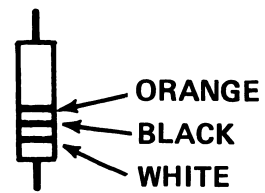
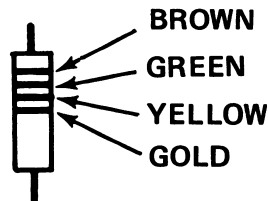
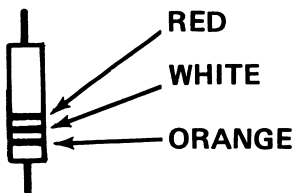
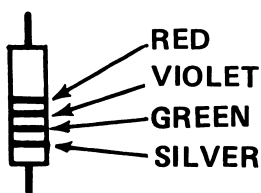


8. Rate these resistors.



560 ohms 330,000 ohms 7,000 ohms 62,000 ohms
 + 20 % + 10 % + 5 % + 10 %

9. Now rate these resistors.



2,700,000 ohms 3,900 ohms 150,000 ohms 90,000 ohms
 + 10 % + 20 % + 5 % + 20 %

10. Look at this circuit. How much current would flow at the upper tolerance limit of the resistor? 0.2 amp. How much current would flow at the lower tolerance limit? 0.3 amp.

