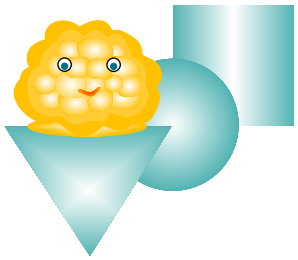
Teacher Information:

Using an Analog Multimeter-Answer Key



This information covers Worksheets No. 1, No. 2 and No. 3. Any teacher comments are added in red and do NOT appear on the student version of these worksheets.

Instruction Card No. 1:

Using the Multimeter as an Ammeter

The student worksheet is actually only a part of the information that describes how to fully use the multimeter. In this worksheet for the students the largest scale for current is the 250m scale. The smallest scale is the 50μA setting. On the 250m scale the needle should not even appear to move when the students test their current. When they switch to the lower scale they can see the needle jump ever so slightly to the right the moment they touch the metal portion of both the red and the black probe from the meter. They need to connect and then let go and then touch them again to see the needle move. It will only move slightly when they set the dial on the 50μA setting.

Instruction Card No. 2:

How to Use a Multimeter

1. Why should the resistance scale measure zero when the probes are touching?

   To show that it works. When the probes are together there is no resistance to the current, therefore the meter needs to read zero.

2. Three differences when reading the resistance on the ohmmeter portion of this multimeter are:
   - **The scale is green.**
   - **The scale is not linear. Intervals between integers are not uniformly the same as a linear progression would be.**
   - **The scale reads from the right to the left and all the other scales read from the left to the right.**

3. What do you think will happen to the multimeter if you try to measure resistance without disconnecting the component from the circuit?

   It would damage the meter. There is a fuse in the meter and the fuse would probably break so the meter would not work.

Instruction Card No. 3:

Reading the Scales on the Multimeter

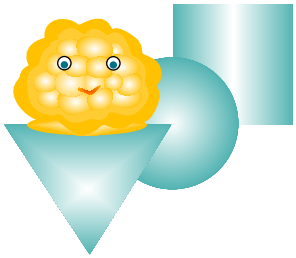
Questions:

Looking at the Scale on Top of the Meter Face:

1. Look at the face of the meter in front of you. What three colors are represented on the scale face?

   Red, green and black.

2. What measurements can be taken on each of the colored scales? What color will not be used for this activity?



Green measures resistance, red measures AC values and Black measures DC voltage , DC amperage and dB decibels of sound. Red will not be used at all.

3. What scale(s) will not be used for this activity?

dB decibels of sound and the AC scale.

4. What color is used for two different readings on the same scale?

Black.

5. Which scale is very different from all the others on the meter face? Why?

Ohms. The distance between integers changes and it is read from the right to the left.

6. How many DC scales are there on this meter? List the range of each scale. For example, one scale reads from 0 to 5.

There are 4 scales. The first reads from 0-5 as indicated in the sample answer above. The next are 0 – 10, 0 – 25 and 0 – 125.

7. Looking at the black scales, how many divisions are there between any two integers?

10 divisions.

8. How do you know what you are using the DC scale for?

Your dial on the bottom of the face of the meter is switched to DCV or DCA. Also the placement of the probes determine this. If you are breaking the circuit to include the multimeter as an ammeter in series you would be measuring current. If the probes are placed across the buzzer as if it were parallel to the circuit you would be measuring the voltage.

Looking at the Dial on the Meter Face:

For questions 9 through 12 use the position of the numbers on a clock from 1 through 12 to describe the location on the dial.

9. Look at the dial now. What section of the dial will never be used in these activities?

1 o'clock to 3 o'clock.

10. If you were to take a measurement for resistance where would you position your dial pointer?

4 o'clock to 5 o'clock.

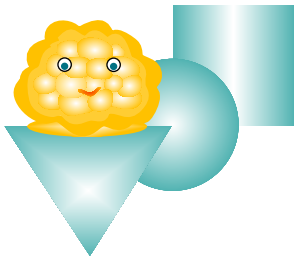
11. Where would you place your dial point to take DC current?

Between the 6 and 7 and between the 7 and 8 o'clock positions.

12. Which location would be appropriate to take a reading of DC voltage?

8 o'clock and 11 o'clock.

Putting It All Together to Take a Reading:



13. Now let's try another setting? Your dial is at 500 volts and your needle is pointing to 2.3 on the 1-5 scale. How many units would be represented by each whole number 1, 2, 3, 4 and 5?

    1 – 5 represents 0 through 500. 500 divided by 5 = 100. 2 X 100 = 200.

    How many units would be represented by .1, .2 etc?

    100 divided by 10 equals 10 each. Since the dial is reading .3 then 3 notches represents 3 X 10 = 30.

    What are the total volts?

    200 + 30 = 230 volts.

    What would be the reading in volts if the pointer was at the 2.4 position?

    240 volts following the same procedure used in the previous example

    You will never need such a high voltage since that would be very dangerous but this activity illustrates how to figure out what the meter represents.

14. Let's say you have set the dial to measure current at the 50μA position and the dial is at the 3.6 position on the 1-5 scale. What would your amperage be?

    Since the scale reads 5, divide 50 by 5 and this equals 10 for each integer. The dial reads at 3 so that represents 30 μA. There are 10 intervals between the 3 and the 4 integer. 10 units divided by 10 possible total units equals 1 unit each. 1 and 6 equals 6 so 30 plus the 1 equals 36 μA.

Questions 15 -17 refer to the Ohms scale.

15. Notice that the intervals between numbers are not uniform. What if you set your dial to R X 10 ohms and the needle was pointing to the 6 position. What would the resistance be of that component? Remember that the X means times.

    60 because 6 X 10 = 60.

16. What would the resistance be if the needle was at the second notch after 50?

    70 X 10 = 700 ohms. Remember that the dial is set at R X 10.

17. What would the resistance be if the needle is positioned at the 2nd notch after the 100 mark on the meter?

    1400 ohms

    Can you explain how you came up with that answer?

    Each interval between 100 and 200 is 1/5th of 100 which is equal to 20 units. Since the needle is at the second notch 20 X 2 = 40. 40 X 10 since the dial is set at R X 10 makes this value now 400 and 400 + 1000 equals 1400 ohms.