I. PROCEDURE:

Measurement of standard metabolic rate:

1. Check to make sure you have all necessary components of both respirometers.
2. Select a cricket from the terrarium. Record the sex of the cricket.
3. Place the cricket on the scale. Record the mass of the cricket.
4. Place a cotton ball inside the respirometer.
5. Pipet 1 ml of 15% KOH onto the cotton ball inside the respirometer.
6. Cover cotton ball with the black shield.
7. Place your cricket inside the respirometer and cover with the rubber stopper.
8. Insert calibrated capillary tube into the rubber stopper.
9. Assemble the control respirometer exactly in the same manner as above, except exclude the cricket.
10. Label each respirometer to indicate the experimental treatment or control.
11. Submerge both respirometers in the water basin and place them adjacent to each other in a horizontal position, utilizing the metal tube rack.
12. Leave respirometers for 5 minutes to permit the gas pressure to equilibrate inside the respirometers. Record the temperature of the water in the basin using a thermometer.
13. Note the location where the outer edge of the water reaches on the scale of the calibrated tube. This is the initial reading. For the next 5 min., record the position of the outer edge of the water at 1 min. intervals. Do this simultaneously for both respirometers.

    Note: if the water moves so rapidly that it is sucked up the entire length of the calibrated tube in less than 5 minutes, take recordings every 15 or 30 sec. over a shorter time period. If the water moves very slowly, take measurements at longer time intervals. Also Note: It is important to restrict movement of the cricket when measuring metabolic rate because exercise has profound affects on respiration, and thus could skew your results.
14. Calculate the amount of oxygen consumed per time (i.e. the metabolic rate) from your average number of units moved per time period by the water on the calibrated tubes using the following equation:

$$Metabolic\ rate\ (M.R.) = \frac{ml\ Oxygen}{h} = \frac{(No.\ units\ on\ tube \times 0.01\ ml)}{Time\ in\ sec.} \times \frac{60\ sec.}{1\ min.} \times \frac{60\ min.}{1\ h} = \frac{ml\ Oxygen}{h}$$

The **mass-specific metabolic rate** can then be calculated with the following equation:

$$Mass\text{-}specific\ M.R. = \frac{ml\ Oxygen}{h} \div mass\ (g) = \frac{ml\ Oxygen}{g \cdot h}$$

15. Remove the respirometers from the water and open the respirometers to let fresh air in. Close the respirometers.

Repeat steps 11 - 14 above to take another measurement of respiration of the same cricket. Do this again to take 3 total measurements of a single cricket. Average the three measurements for both respirometers. Subtract the background rate (i.e. the avg. of the control respirometer) from the observed cricket rate (i.e. the avg. of the cricket's respirometer) to calculate the true metabolic rate of your cricket.

Do females and males have the same metabolic rate?

16. Place your cricket into the plastic bin next to the cricket terrarium. Select another cricket from the cricket terrarium that is of the opposite sex from the one that you made your first metabolic measurements.
17. Repeat steps 2 - 15 to measure the metabolic rate of your new cricket.
18. Repeat steps 2 - 15 for at least 3 individuals of each sex. Try to select crickets of different sizes so as to also measure the potential affect of size on metabolic rate.

What is the effect of size on metabolic rate?

19. Now, look at your distribution of sizes of individuals measured. If your crickets were all of a similar mass, take metabolic measurements (repeating steps 2 - 15) of 4 more crickets that are of different size than those you previously measured (2 bigger and 2 smaller).

What is the effect of temperature?

20. Repeat steps 2 - 15 on 3 more crickets, but instead add ice to the water in the water basin to make an ice bath. Allow the respirometers to equilibrate for 10 minutes prior to measurement. Check the ice bath temperature with a thermometer. Record this temperature at the beginning of each metabolic measurement. Repeat again on 3 more crickets with warm water from the tap.