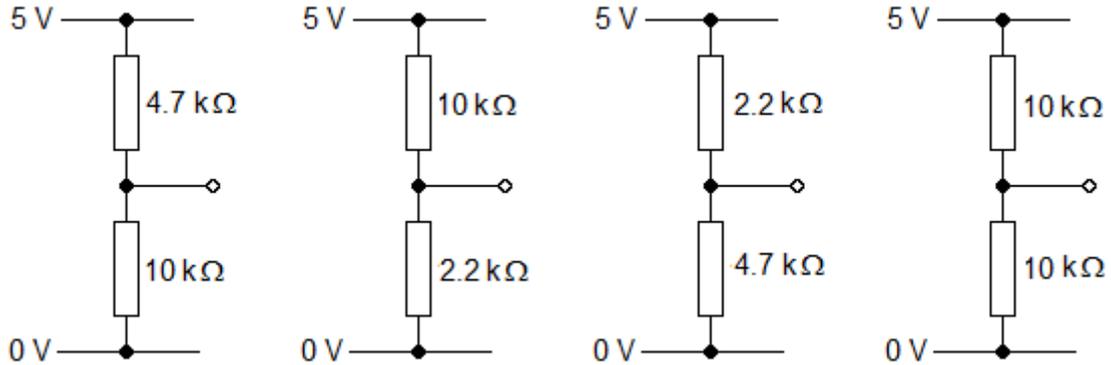


**Voltage dividers**

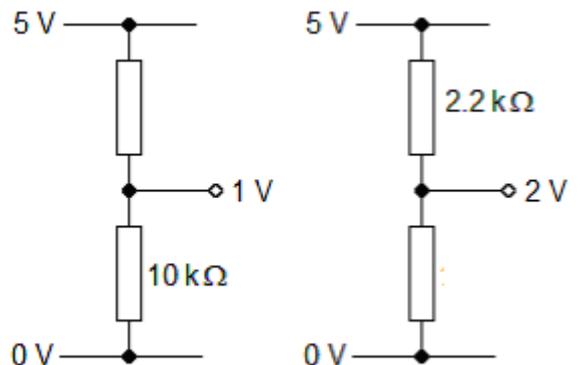
You are going to measure the output signal of these four voltage divider circuits and compare it with the calculated value.



- 1 For the first voltage divider, calculate
  - the total resistance  $R_{total}$
  - the current in the resistors  $I$
  - the voltage  $V_{calc}$  across the bottom resistor.
- 2 Assemble the circuit on breadboard. Use a voltmeter to measure the voltage  $V_{meter}$  at the output. If all is well, it should agree closely with the value of  $V_{calc}$  calculated in step 1.
- 3 Complete the table below for the four voltage dividers.

$R_t$	$R_b$	$R_{total}$	$I$	$V_{calc}$	$V_{meter}$
4.7 kΩ	10 kΩ				

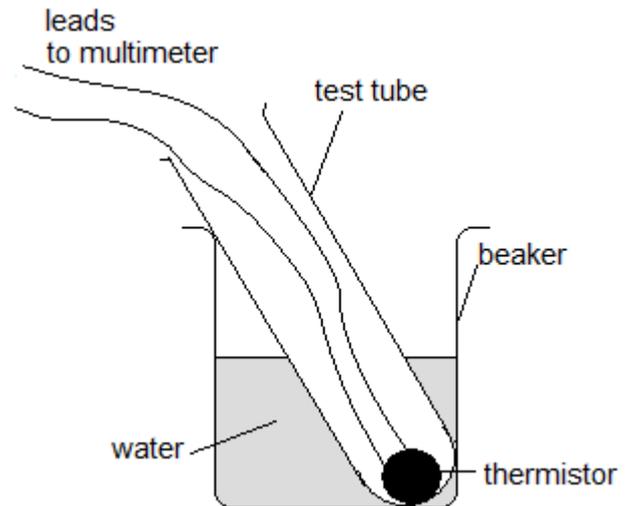
- 4 Calculate suitable values for the unmarked resistors in these voltage dividers.
- 5 Assemble each voltage divider and use a voltmeter to verify that their output is at the stated voltage. Use pairs of resistors in series, as necessary, to obtain the required resistance value.



## Environmental sensors

You are going to find the transfer characteristic of a thermistor, use it to make a simple temperature sensor and then evaluate the use of an LDR to measure light intensity.

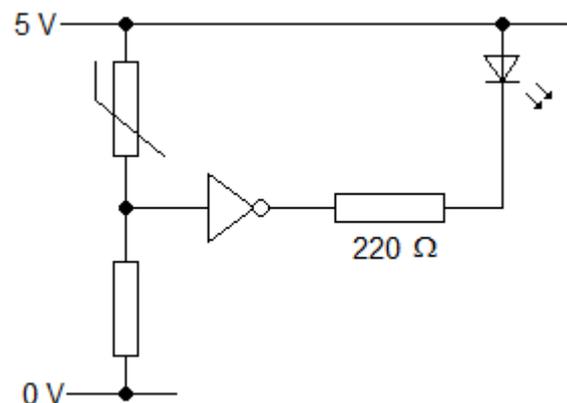
- 1 Set up the circuit shown opposite.  
The thermistor needs to be connected to a multimeter set up as an ohm-meter. A thermometer will be needed to measure the temperature inside the test tube.



- 2 Use hot and cold water to hold the thermistor at several temperatures between 0 °C and 100 °C. Record the resistance of the thermistor each time.

- 3 Use your measurements to plot a resistance-temperature graph for the thermistor.

- 4 The circuit shown opposite uses an LED to indicate when the thermistor is above 20 °C. Use the graph to select a suitable value for the pull-down resistor.



- 5 Assemble the circuit. If all is well, the LED should start to glow when you heat the thermistor in your hand.

- 6 Replace the thermistor with an LDR. By trial-and-error, select a value for the pull-down resistor which allows the LED to stop glowing when you cover the LDR with your hand.

- 7 What do your observations of the circuit on your breadboard tell you about the relationship between the resistance of an LDR and its illumination?