



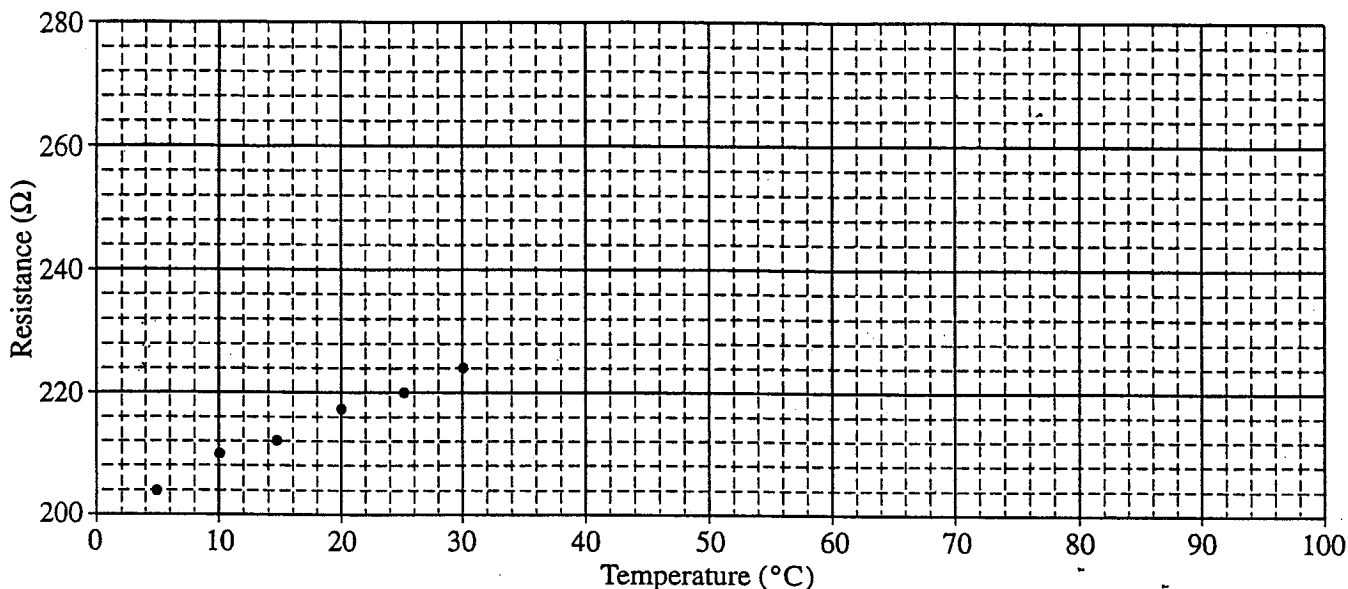
AP[®] Physics B 2001 Sample Student Responses

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5. (10 points)

A platinum resistor has a resistance that changes with temperature. Values of the resistance were obtained experimentally for several temperatures from 5°C to 30°C only and plotted on the graph above. Design a procedure in which this resistor can be used as a thermometer to measure the temperature of a liquid that is in the 50°C to 75°C range. The resistor can be safely immersed in liquids. Along with the resistor and the container of the liquid of unknown temperature, the following equipment and materials may be used.

Power supply

Ammeter (Note: The ammeter and the voltmeter cannot

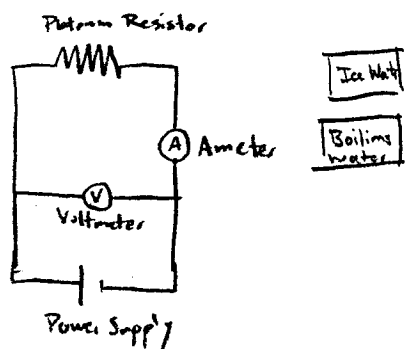
Voltmeter be used directly as an ohmmeter.)

Connecting wires

Ice-water bath

Boiling-water bath

(a) Sketch a diagram (with labels) to show how equipment is to be connected to make the necessary measurements, and briefly outline the steps to be followed.



First place the resistor in the Ice-water and record Current + Voltage when the system reaches equilibrium. Repeat in the boiling water. Use the equation $R = V/I$ to find the resistance at those points. Plot the data with the existing data and use it to extrapolate a linear curve for the Resistance versus temperature graph. Then place the resistor in the unknown liquid. Use the graph and measurements to determine the temperature. Use $R = V/I$ again and find the point on the linear curve that matches.

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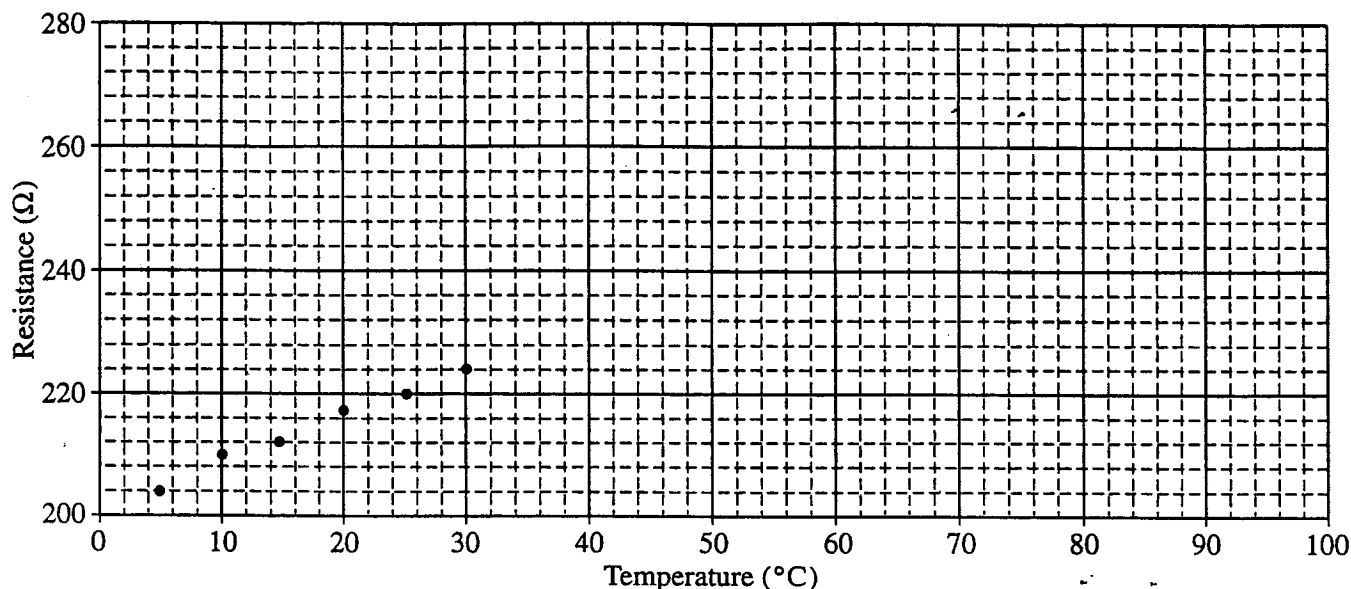
(b) Discuss what measurements will be taken to determine the temperature of the unknown liquid.

To determine the temperature of the unknown liquid, one must measure the voltage and current of the circuit once the resistor has reached an equilibrium with the liquid.

(c) Discuss one assumption that must be made regarding equipment or procedure in order to use the method you have described.

The assumption I made is that the graph of the resistor's resistance versus temperature remains linear for all temperatures from 0°C to 100°C .

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5. (10 points)

A platinum resistor has a resistance that changes with temperature. Values of the resistance were obtained experimentally for several temperatures from 5°C to 30°C only and plotted on the graph above. Design a procedure in which this resistor can be used as a thermometer to measure the temperature of a liquid that is in the 50°C to 75°C range. The resistor can be safely immersed in liquids. Along with the resistor and the container of the liquid of unknown temperature, the following equipment and materials may be used.

Power supply

Ammeter (Note: The ammeter and the voltmeter cannot be used directly as an ohmmeter.)

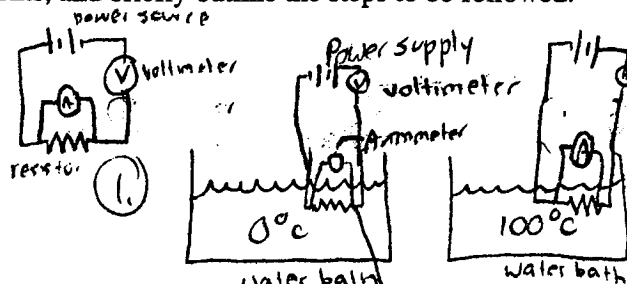
Voltmeter

Connecting wires

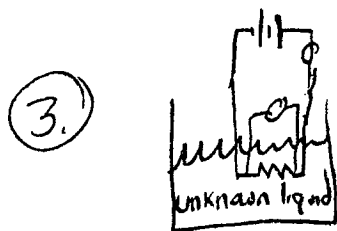
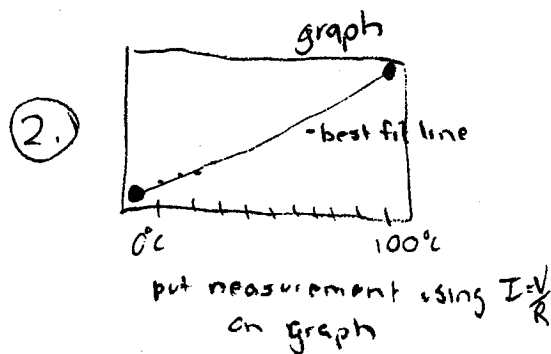
Ice-water bath

Boiling-water bath

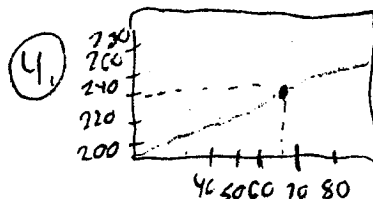
(a) Sketch a diagram (with labels) to show how equipment is to be connected to make the necessary measurements, and briefly outline the steps to be followed.



connect the battery to the ammeter, voltmeter, and resistor in series, immerse resistor in hot and cold water bath



immerse in unknown liquid, finding amps + volts



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match resistance on location with best fit line

(b) Discuss what measurements will be taken to determine the temperature of the unknown liquid.

measure amps, voltage in hot water, use $I = \frac{V}{R}$ to find resistance and graph
measure amps, voltage in cold water, use $Z = \frac{V}{R}$ to find resistance, graph
draw best fit line

measure amperage and voltage in unknown liquid use $Z = \frac{V}{R}$ to find resist., and graph
match with best fit line

(c) Discuss one assumption that must be made regarding equipment or procedure in order to use the method you have described.

boiling and freezing temperatures will not effect resistance differently
or voltage or amperage differently than other temps.

istance,

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