Electrical Conductivity of Materials

New Regents original practice • Name: _____ Date: _____
Show your work for written answers.

An electric current requires mobile charge carriers. Compare measurements made at the same voltage and with samples of the same dimensions.

1 Which particles can carry current through a solid piece of copper?

(1) Mobile electrons

(2) Copper nuclei leaving the material

(3) Neutrons moving freely between atoms

(4) Only molecules of water

2 Explain why dissolving an ionic salt in water can allow it to conduct even if the dry crystal conducts poorly. [1]

Answer and work

3 Which control helps isolate the effect of material on measured current?

(1) Use the same sample length and cross-sectional area.

(2) Use a different voltage for every sample.

(3) Measure a different length for every material.

(4) Change the temperature after each reading.

4 Explain why an insulating outer coating can be useful even when a wire’s inner material must conduct. [1]

Answer and work

Comparing Model Test Pieces

Use the information below to answer the questions.

A test applies the same voltage to four equal-sized solid pieces at the same temperature. The design requires a conducting core with at least 50 mA and a jacket material with no more than 1 mA.

Piece	Material model	Current (mA)
P	Metal	90
Q	Conductive composite	55
R	Polymer	0.2
S	Ceramic	3.0

5 Which pair meets the stated requirements for a core and a jacket, respectively?

(1) P and S

(2) Q and R

(3) R and Q

(4) S and P

6 Identify every eligible core and support the answer with the data. [1]

Answer and work

7 By how much does S exceed the maximum allowed current for a jacket? [1]

Answer and work

8 If the core now needs at least 80 mA, which piece still qualifies as a core?

(1) P only

(2) Q only

(3) P and Q

(4) R and S