Materials Chemistry: Models and Evidence

Student Worksheet | g10_u08_w31

I can: compare supplied material-model cards and write a property claim that stays within the data, conditions, and model boundary.
Scope card: This is a paper data-model exercise. The cards compare simplified metals, ceramics, polymers, and semiconductors under the printed model conditions only. They support property comparisons and model reasoning. They do *not* establish a real product choice, medical use, safety finding, engineering design, manufacturing method, lifetime, cost, environmental impact, or universal property claim.

card	simplified structure model	supplied property cue	condition boundary
M metal	mobile electrons among positive centers	conductivity score 8/10; deforms	model condition L
C ceramic	extended ionic/covalent network	conductivity score 1/10; cracks	model condition L
P polymer	long-chain molecules, attractions between chains	conductivity score 2/10; bends	model condition L
S semiconductor	band model with condition-sensitive carriers	score 2/10 in L; 7/10 in H	L versus H only

Reading note: A score is a supplied comparison on this card, not a measurement of every sample. "Deforms," "cracks," and "bends" are qualitative model cues, not product tests.

1. Name the four material classes represented by M, C, P, and S.

2. Which card uses a mobile-electron model?

3. Which card uses a long-chain-molecule model?

4. Which card uses an extended ionic/covalent-network model?

5. Which card explicitly includes condition-sensitive carriers?

6. Rank M, C, and P from highest to lowest supplied conductivity score in condition L.

7. Calculate the score difference between M and C in condition L.

8. Calculate the score difference between P and C in condition L.

9. Calculate the score change for S from condition L to H.

10. Which card has the largest supplied conductivity score in condition L?

11. Write a directly supported comparison between C and P using both a score and a qualitative cue.

12. What feature of the metal model is offered to explain its higher supplied score than C in condition L?

13. What is the narrowest supported statement about S across L and H?

14. Why does the score change for S not identify what changed in a real sample or device?

15. Why is a long-chain model not enough to prove every polymer will bend the same way?

16. State two kinds of evidence missing before choosing a material for a specific engineered product.

17. Critique: "M has score 8/10, so metal M is the safest and best product material."

18. Critique: "The semiconductor card proves a medical application will work."

19. Write a condition-bounded claim comparing M and S using two supplied scores.

20. Write a cautious CER: make a property-model claim, cite two card entries, reason with the model, and state one design/product boundary.