The order on the periodic table

Atomic structure and properties | constructed element comparison

Name _____ Date _____

Model element X has valence pattern 2-8-1 and model element Y has 2-8-7. Treat them as neutral atoms in their ground states. The patterns are deliberately simplified shell representations.

1. Predict the common ion charge for each in an ionic compound.

2. Construct a model of electron transfer and the resulting ratio.

3. Explain what the shell model supports and one feature it leaves out.

Use evidence and show the relationships in your reasoning. Additional paper is permitted.

What the boiling evidence can show

Interparticle forces | constructed property investigation

Name _____ Date _____

Two molecular liquids of similar molar mass have boiling points 55°C and 95°C under the same external pressure. The task supplies that their main relevant difference is the strength of attractions between molecules.

1. Use the evidence to compare interparticle attractions.

2. Explain what energy supplied during boiling does in this model.

3. Design an additional measurement or control needed for a stronger comparison.

Use evidence and show the relationships in your reasoning. Additional paper is permitted.

Conservation on both sides

Reaction models | atom-count model

Name _____ Date _____

A proposed reaction is H2 + O2 -> H2O. The subscripts identify the substances and must remain fixed. The system is closed.

1. Balance the equation using coefficients.

2. Use atom counts to justify the coefficients.

3. Explain why a balanced equation supports mass conservation without requiring equal molecule counts.

Use evidence and show the relationships in your reasoning. Additional paper is permitted.

A system that warms its surroundings

Chemical energy | constructed thermal evidence

Name _____ Date _____

Two solutions are mixed in an insulated cup. The surrounding solution temperature rises from 21°C to 27°C. In a simplified energy model, the reaction system transfers energy to the solution. Assume other heat exchanges are negligible.

1. Identify the transfer direction and classify the modeled reaction.

2. Represent relative reactant and product chemical potential energy levels.

3. Explain why a temperature increase alone does not determine the activation energy.

Use evidence and show the relationships in your reasoning. Additional paper is permitted.

Which evidence measures rate?

Reaction rate | constructed reaction data

Name _____ Date _____

Equal masses of the same solid react with excess acid under two conditions. Gas volume is measured over time. Temperature is the only changed condition.

Time s	A mL	B mL
0	0	0
10	20	35
60	60	60

1. Compare the initial observed rates over 0 to 10 seconds.

2. Explain the comparison using a particle-collision model.

3. Explain why equal final volumes do not imply equal rates.

Use evidence and show the relationships in your reasoning. Additional paper is permitted.

A concentration threshold

Solutions | constructed solution data

Name _____ Date _____

A lab target permits at most 5 g of dissolved solute per 100 mL of solution. Sample A contains 12 g in 200 mL of solution. Sample B contains 9 g in 300 mL of solution. Volumes refer to final solution volumes.

1. Compare each sample with the target using a common basis.

2. Find the minimum final volume needed for A at the target concentration, retaining all solute.

3. Explain why volume of water added is not always identical to final solution volume.

Use evidence and show the relationships in your reasoning. Additional paper is permitted.