Investigating a Metal Hinge Fragment

Base your answers on the information provided and your knowledge of chemistry. Use the 2025 Chemistry Reference Tables as needed.

A school theater is replacing old metal hinges. Students receive simulated measurements from two separated metal samples. Each signal in the table identifies atoms with a particular proton count and mass number. Signal share is the percent of measured atoms in that sample.

Sample	Protons per atom	Mass number	Signal share (%)
H	28	58	70
H	28	60	30
J	27	59	100

1 Use the periodic table. Which element accounts for both signals from sample H?

(1) Co

(2) Ni

(3) Cu

(4) Fe

2 Explain how the two signals from H can have different mass numbers even though they come from the same element. Include the two neutron counts. [1]

Answer and work

3 Approximate the mass of each isotope by its mass number in atomic mass units. Use the signal shares to estimate the average mass of a measured atom from H. Show your setup. [1]

Answer and work

In a separate measurement, an ion from H and an ion from J are each found to have 26 electrons. A student concludes that the ions must be from the same element.

4 Use the measurements to evaluate the student’s conclusion. [1]

Answer and work

5 What are the charges of the measured ions from H and J, respectively?

(1) +1 and +2

(2) +2 and +1

(3) −2 and −1

(4) +2 and +2