Checking an Excited Atom Against the Table

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

A classroom display records how many electrons occupy each shell of three particles. A particle can be excited when an electron moves to a higher shell. In this model the row of an element in the periodic table corresponds to the occupied shells of its neutral ground-state atom.

Record	Protons	Electrons in shells 1, 2, 3, and 4
P	12	2, 8, 2, 0
Q	12	2, 8, 1, 1
R	12	2, 8, 1, 0

1 Which pair has the same nuclear charge and the same total number of electrons but a different shell arrangement?

(1) P and Q

(2) P and R

(3) Q and R

(4) All three

2 Explain why Q fits excitation from P while R fits loss of an electron from P. [1]

Answer and work

The display confirms P is the neutral ground-state record. The periodic table lists magnesium in period 3.

3 A student puts Q in period 4 because its fourth shell is occupied. Use the records and the model rule to evaluate the claim. [1]

Answer and work

4 A neutral sodium atom also has the arrangement 2, 8, 1. Explain how a proton count can distinguish it from R. [1]

Answer and work