Checking an Average Charge in an Iron Oxide

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

An iron oxide model uses the formula Fe_3O_4. Each oxygen in the model has oxidation number −2. The sum of the oxidation numbers in one formula unit is zero. The display allows the iron sites to be +2 or +3.

Proposed iron sites for one formula unit	**Fe at +2**	**Fe at +3**
P	3	0
Q	2	1
R	1	2
S	0	3

1 Which proposed set of iron sites balances the four oxygen atoms?

(1) P

(2) Q

(3) R

(4) S

2 Find the average oxidation number across the three iron sites. Explain how it follows from neutrality. [1]

Answer and work

3 A student says every iron site must have oxidation number +8/3. Evaluate the claim with the site model. [1]

Answer and work

A separate liquid model starts with iron ions in the same +2 to +3 ratio. It changes every Fe^{2+} ion into Fe^{3+} while spectator ions maintain charge balance.

4 For every three iron ions in the starting ratio, state how many electrons the iron loses during this change. [1]

Answer and work