Choosing a Dilution for Two Detector Bands

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

A workshop uses two independent detector channels for a dissolved dye sample. Each channel is accurate from two to eight signal units, including the endpoints. A dilution divides each expected signal by the same dilution factor. The workshop must bring both channels into range in one measurement.

Channel	Expected signal without dilution
P	18
Q	6

1 Which factor gives both readings inside the accurate range?

(1) Two

(2) Three

(3) Four

(4) All three

2 Find the smallest possible factor that brings P into range and the greatest factor that keeps Q in range. [1]

Answer and work

3 A student chooses a factor of four because it reduces P further. Explain why that decision fails the joint requirement. [1]

Answer and work

A new sample is expected to give P = 24 and Q = 4 before dilution. Its two channels have the same accurate range as before.

4 Determine whether one dilution factor can bring both new readings into range. Show the limiting comparison. [1]

Answer and work

The workshop changes its procedure. It can prepare two separate portions of the new sample and use the in-range result from a different channel in each portion.

5 Choose a dilution factor for each portion and identify which channel to use from each reading. [1]

Answer and work