Following Color Through Two Model Beams

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

A classroom display sends two beams into the same detector. The detector has independent channels for red and blue light. Its counts for each color add when the beams are combined. A clear model filter can reduce one color in one beam before combination.

Beam	Red counts in one second	Blue counts in one second
P	12	4
Q	3	13

1 How many blue counts should the detector record in one second with both beams and no filter?

(1) 4

(2) 13

(3) 15

(4) 17

A filter in beam Q passes half of its blue signal and all of its red signal. In the model, the indicator turns on only when the expected rates are at least 11 red counts/s and at least 11 blue counts/s.

2 Calculate the two expected detector rates with the filter in beam Q. Treat the expected rates as averages over repeated measurements. [1]

Answer and work

3 Use the expected rates to determine whether the filtered combined beam meets both indicator conditions. [1]

Answer and work

4 If the same filter moves from beam Q to beam P, predict whether the indicator conditions will be met. Explain what changes about the blue rate. [1]

Answer and work