Gas Volumes in Balanced Reactions

New Regents original practice • Name: _____ Date: _____
Show your work for written answers.

At the same temperature and pressure, ideal-gas volumes are proportional to mole amounts. Balanced equation coefficients give the reacting mole ratios.

1 Which condition allows balanced mole ratios to be used directly as ratios of gas volumes?

(1) The gas volumes are compared at the same temperature and pressure.

(2) All gases have the same molar mass.

(3) The gases have the same color.

(4) Every gas has a different pressure.

2 Use $2CO(g) + O_2(g) \rightarrow 2CO_2(g)$. What volume of CO_2 can form from 8.0 L CO with excess oxygen at the same temperature and pressure? [1]

Answer and work

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3 For $N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$, what volume ratio of H_2 to N_2 is required under matched conditions?

(1) 1:3

(2) 1:2

(3) 2:1

(4) 3:1

4 Explain why the volume ratio from a balanced equation cannot be applied directly if reactant and product volumes are reported at different pressures. [1]

Answer and work

_____

_____

A Model of Gas Consumption

Use the information below to answer the questions.

A simulation uses $N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$ to predict theoretical yields. Each volume is reported at the same temperature and pressure. Nitrogen is in excess in every run.

Run	**H_2 supplied (L)**
P	6.0
Q	9.0
R	12.0

5 What volume of NH_3 can theoretically form in P?

(1) 2.0 L

(2) 3.0 L

(3) 4.0 L

(4) 6.0 L

6 Calculate the volume of N_2 consumed in Q. Show the gas-volume ratio. [1]

Answer and work

7 How does the theoretical NH_3 volume in R compare with that in P?

(1) It is half as large.

(2) It is the same.

(3) It is twice as large.

(4) It is three times as large.

8 Explain why the table is sufficient to find the theoretical NH_3 volumes even though it gives no exact starting volumes for N_2. [1]

Answer and work