

APOLLO

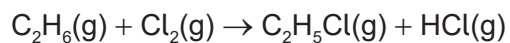
How much? The amount of chemical change SL

Chemistry

First assessment 2025

18 questions | questions

20. Chloroethane is produced by the reaction of ethane with chlorine.



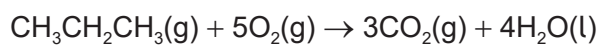
($\text{C}_2\text{H}_6 = 30.08 \text{ g mol}^{-1}$, $\text{Cl}_2 = 70.90 \text{ g mol}^{-1}$, $\text{C}_2\text{H}_5\text{Cl} = 64.52 \text{ g mol}^{-1}$, $\text{HCl} = 36.46 \text{ g mol}^{-1}$)

$$\% \text{ atom economy} = \frac{\text{molar mass of desired product}}{\text{molar mass of all reactants}} \times 100$$

What is the atom economy for this reaction?

- A. 15.7 %
- B. 46.6 %
- C. 63.9 %
- D. 99.9 %

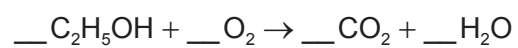
21. 75 cm³ of propane was completely combusted in 400 cm³ of oxygen according to the following equation.



What is the volume of unreacted oxygen remaining at the original conditions?

- A. 25 cm³
- B. 50 cm³
- C. 75 cm³
- D. 150 cm³

17. What is the coefficient of oxygen when the equation for the complete combustion of ethanol is balanced using the smallest whole numbers?

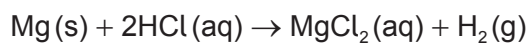


- A. 1
- B. 2
- C. 3
- D. 7

— 3 —

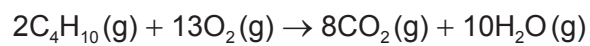
2225-0210

18. What are the limiting reactant and theoretical yield of hydrogen when 0.20 mol of magnesium reacts with 0.20 mol of hydrochloric acid?



	Limiting reactant	Theoretical yield of H ₂ / mol
A.	Mg	0.10
B.	Mg	0.20
C.	HCl	0.05
D.	HCl	0.10

3. Which volume of butane gas, in cm^3 , will produce 40 cm^3 of carbon dioxide gas when it is completely combusted in oxygen?



- A. 5
- B. 10
- C. 20
- D. 40

— 3 —

4445-0444

18. Which process to produce ethanol has an atom economy of 100?

- A. $\text{C}_2\text{H}_4 + \text{H}_2\text{O} \rightarrow \text{C}_2\text{H}_5\text{OH}$
- B. $\text{C}_6\text{H}_{12}\text{O}_6 \rightarrow 2\text{C}_2\text{H}_5\text{OH} + 2\text{CO}_2$
- C. $\text{CH}_3\text{COOC}_2\text{H}_5 + \text{NaOH} \rightarrow \text{C}_2\text{H}_5\text{OH} + \text{CH}_3\text{COONa}$
- D. $\text{CH}_3\text{COOC}_2\text{H}_5 + \text{H}_2\text{O} \rightleftharpoons \text{C}_2\text{H}_5\text{OH} + \text{CH}_3\text{COOH}$

— 3 —

Turn over

4445-0444

21. How many moles of oxygen are needed for the complete combustion of 11.5 g of $\text{C}_3\text{H}_8(\text{g})$?

M_r propane = 44.1 g mol^{-1}

- A. 10.4
- B. 5.20
- C. 2.60
- D. 1.30

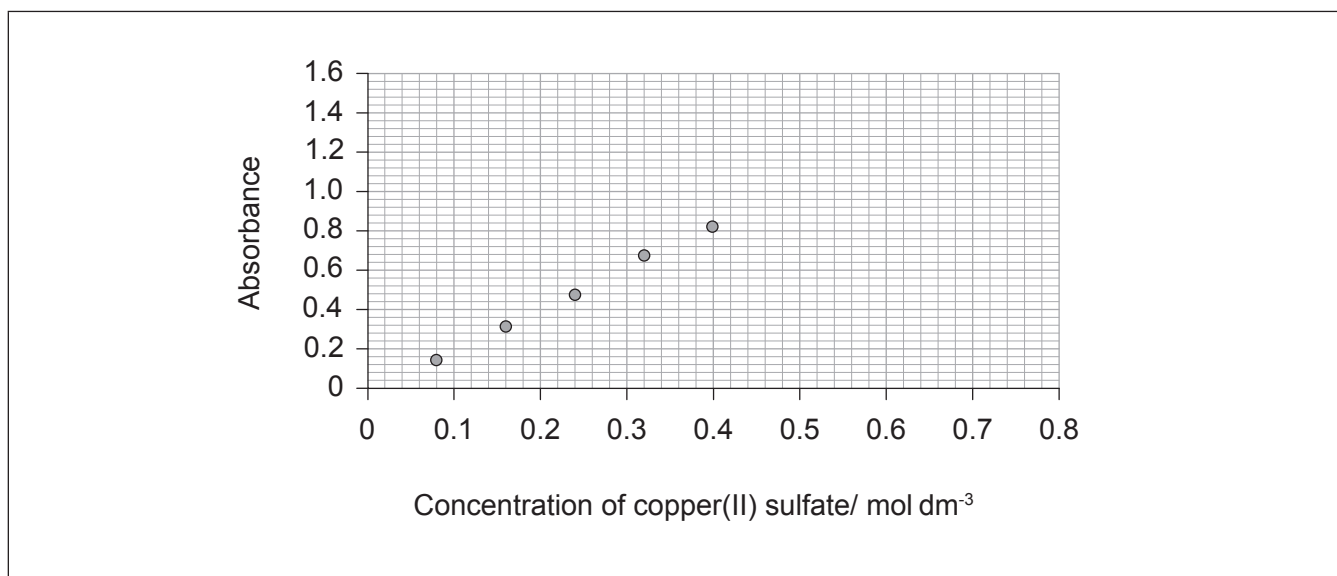
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2225-0222

3. A colorimetry experiment was conducted on a series of solutions of copper(II) sulfate, CuSO_4 . The absorbance versus concentration data were graphed.

(a) Draw a line of best fit in the graph, extrapolating beyond the data given.

[2]



(b) State the mathematical relationship between absorbance and concentration.

[1]

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(c) Deduce the equation that relates the absorbance to concentration, including the value of the constant.

[2]

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(d) Estimate the absorbance value of a $0.600 \text{ mol dm}^{-3}$ CuSO_4 solution.

[1]

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3. 3.162 g of calcium carbonate, $\text{CaCO}_3(\text{s})$, is reacted with 20.0 cm^3 of 4.00 mol dm^{-3} hydrochloric acid, $\text{HCl}(\text{aq})$.

(a) Write an equation for the reaction, including state symbols.

[2]

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(b) Deduce which reactant is limiting. Use sections 1, 4 and 7 of the data booklet.

[2]

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(c) Calculate the volume, in dm^3 at STP, of the gas produced. Use section 2 of the data booklet.

[1]

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(This question continues on the following page)

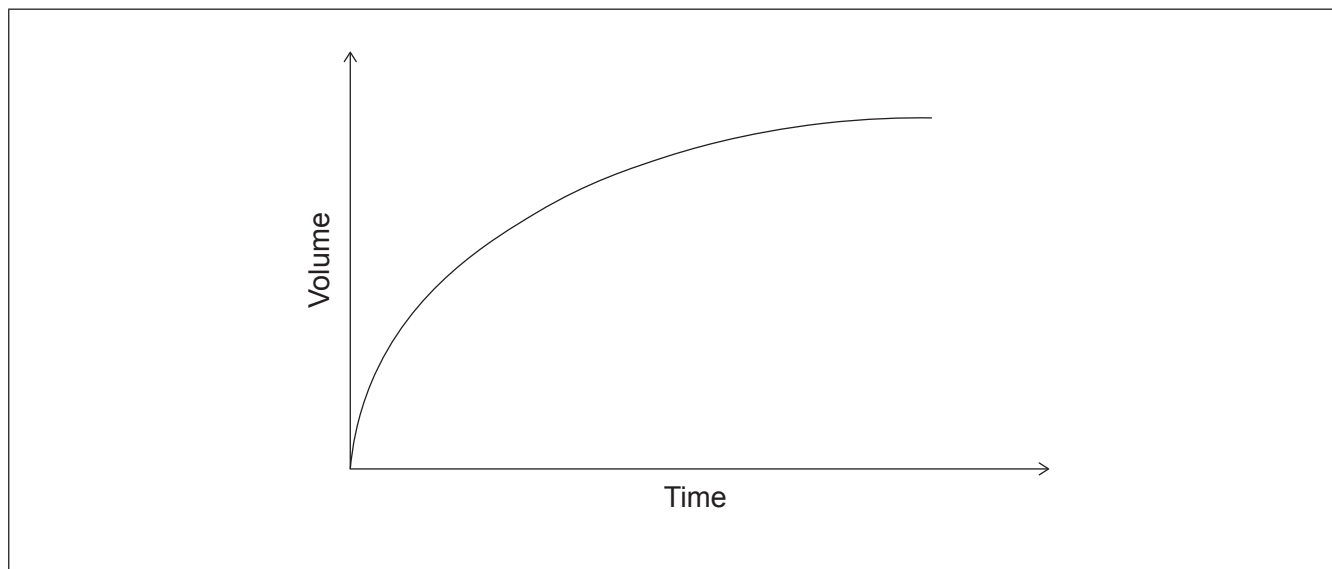


(Question 3 continued)

- (d) The rate of this reaction can be experimentally determined by measuring the volume of gas produced as time progresses.

Sketch another curve for the reaction taking place with the acid at a higher temperature and all other conditions unchanged.

[1]

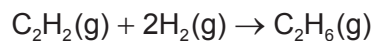


Turn over

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4440-0212

5. Ethyne, C_2H_2 , is hydrogenated to form ethane.



- (a) 140.0 cm^3 of ethyne is reacted with 160.0 cm^3 of hydrogen in a container at 420 K and $1.00 \times 10^5\text{ Pa}$. Ethane is the only product.

Determine the maximum possible volume of ethane formed under these conditions of temperature and pressure.

[2]

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- (b) Determine the total volume of gas present in the container at the end of the reaction under the same conditions of temperature and pressure.

[2]

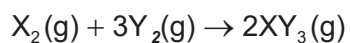
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Turn over

19. Equal volumes of X_2 and Y_2 gases are allowed to react in a sealed container to form XY_3 gas. After completion of the reaction, the volume of XY_3 is measured to be 40 cm^3 .

What was the volume, in cm^3 , of X_2 gas at the beginning?



- A. 20
- B. 40
- C. 60
- D. 120

20. What is the volume of nitrogen dioxide, in cm^3 , produced at STP when 1.28 g of copper reacts with excess nitric acid?



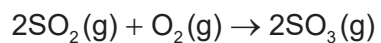
Molar volume of an ideal gas at STP is $22.7 \text{ dm}^3 \text{ mol}^{-1}$

- A. 227
- B. 456
- C. 684
- D. 914

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0025-0210

21. Sulfur dioxide reacts with oxygen gas to produce sulfur trioxide.



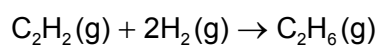
The reaction of 96 grams of SO_2 with excess amount of O_2 produces 96 grams of SO_3 .

What is the percentage yield of SO_3 ?

- A. 20%
- B. 60%
- C. 80%
- D. 100%

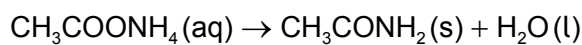
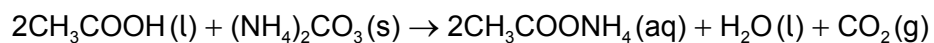
4. What is the volume, in dm^3 , of ethane gas, $\text{C}_2\text{H}_6(\text{g})$, produced when 0.25 dm^3 of ethyne, $\text{C}_2\text{H}_2(\text{g})$, reacts with 0.40 dm^3 of hydrogen gas, $\text{H}_2(\text{g})$?

All volumes are measured under the same conditions.



- A. 0.20
- B. 0.25
- C. 0.40
- D. 0.45

18. What is the theoretical yield, in g, of ethanamide, CH_3CONH_2 , that can be produced from the reaction of 4.00 g of ammonium carbonate, $(\text{NH}_4)_2\text{CO}_3$, with excess ethanoic acid, CH_3COOH ?



$$M_{\text{r}}(\text{NH}_4)_2\text{CO}_3 = 96.11$$

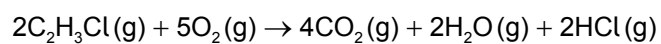
$$M_{\text{r}}\text{CH}_3\text{CONH}_2 = 59.08$$

- A. 1.23
B. 2.46
C. 4.92
D. 6.51

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0020-0222

19. What is the amount, in mol, of H_2O produced for a reaction between 10.0 mol of $\text{C}_2\text{H}_3\text{Cl}$ and 10.0 mol of O_2 if the yield is 90 %?



- A. 3.60
- B. 4.00
- C. 9.00
- D. 10.00

- 20.** The complete combustion of 20.0 cm^3 of a gaseous hydrocarbon, C_xH_y , produces 80.0 cm^3 of gaseous products. This volume reduces to 40.0 cm^3 when the water vapour present condenses. All volumes are measured at the same temperature and pressure.

What is the molecular formula of the hydrocarbon?

- A. CH_4
- B. C_2H_2
- C. C_2H_4
- D. C_3H_6

Turn over

- 21.** Large deposits of methane hydrate, $\text{CH}_4 \cdot 6\text{H}_2\text{O}$ ($M_r = 124$), have been discovered under the ocean floor. What mass of carbon dioxide would be produced by the complete combustion of 12.4 g of the methane hydrate?
- A. 4.40 g
 - B. 26.4 g
 - C. 34.1 g
 - D. 44.0 g