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CHEMISTRY

FREE SAMPLE

UNIT 2 · TOPIC PRACTICE WORKBOOK

D1.1 — The Mole and Quantitative Chemistry

A complete sample section: 10 written questions, answer spaces and worked solutions. The full workbook contains 68 sections.

Try the questions before reading the included solutions.

Extract pages retain their original page numbers.

Independent original practice. Not an official Pearson assessment.

Aligned to Pearson AAQ Applied Science, specification Issue 7 (May 2026).

UNIT 2 / D1.1 / SECTION 32

The Mole and Quantitative Chemistry

Learning goals: Use moles across particles, formulas, solutions and limiting-reactant calculations.

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Topic marks: 40 My score: _____ Retry date: _____

Q1 Build **4 marks**

Calculate the mass of 0.375 mol of calcium carbonate (Mr=100.1) and the number of formula units ($N_A = 6.02 \times 10^{23}$ mol^{-1}).

Q2 Build **5 marks**

25.0 cm^3 of 0.160 mol dm^{-3} NaOH reacts with HCl. Find moles of NaOH and volume of 0.100 mol dm^{-3} HCl needed.

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Q3 Apply **6 marks**

Using the formula strip, calculate (a) moles in 12.0 g Mg (Ar 24.3), (b) gas volume at RTP if that many moles of H_2 forms, and (c) percentage yield if actual gas volume is 9.00 dm^3.

Given: QUANTITY TRIANGLE. n=m/M / Vgas=n x 24 dm^3 / yield=actual/theoretical x_{100}

Q4 Apply **3 marks**

Find moles and particles in 8.8 g CO_2. Use Mr=44 and Avogadro constant 6.02×10^{23}/mol.

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Q5 Reason **4 marks**

A compound contains 2.4 g C, 0.40 g H and 3.2 g O. Find empirical formula using Ar = 12, 1, 16.

Q6 Reason **5 marks**

For $Mg+2HCl \rightarrow MgCl_2+H_2$, 4.8 g Mg (Ar = 24) reacts with 0.30 mol HCl. Identify limiting reactant and calculate hydrogen volume at RTP_{24} dm^3/mol.

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Q7 Reason **3 marks**

Find molar concentration when 0.075 mol solute makes 250 cm^3 solution.

Q8 Reason **3 marks**

Find mass concentration for 3.6 g dissolved to make 150 cm^3 solution.

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Q9 Reason **3 marks**

A synthesis gives 7.2 g product from a theoretical 9.0 g. Calculate percentage yield and explain one cause of a value below 100%.

Q10 Reason **4 marks**

Calculate theoretical mass of CaO from 15.0 g $CaCO_3$ using $CaCO_3 \rightarrow CaO + CO_2$, Mr = 100 and 56 respectively.

Next: D1.2.1 - Factors Affecting Reaction Rate

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Q1 [4 marks] Calculate the mass of 0.375 mol of calcium carbonate (Mr=100.1) and the number of formula units ($N_A=6.02\times10^{23}$ mol^{-1}).

- Mass $0.375\times100.1=37.54$ g (2)
- number $=0.375\times6.02\times10^{23}=2.26\times10^{23}$ (2).

Q2 [5 marks] 25.0 cm³ of 0.160 mol dm^{-3} NaOH reacts with HCl. Find moles of NaOH and volume of 0.100 mol dm^{-3} HCl needed.

- $n=0.160\times0.0250=0.00400$ mol (2)
- 1:1 ratio (1)
- $V=0.00400/0.100=0.0400$ dm³ $=40.0$ cm³ (2).

Q3 [6 marks] Using the formula strip, calculate (a) moles in 12.0 g Mg (Ar 24.3), (b) gas volume at RTP if that many moles of H_2 forms, and (c) percentage yield if actual gas volume is 9.00 dm³.

- $n=12.0/24.3=0.494$ mol [2]
- $V=0.494\times24=11.85$ dm³ [2]
- yield $9.00/11.85\times100=75.9\%$ [2].

Q4 [3 marks] Find moles and particles in 8.8 g CO_2. Use Mr=44 and Avogadro constant 6.02×10^{23}/mol.

n=8.8/44=0.20 mol [1];
N=0.20 × 6.02 × 10²³ [1];
1.204 × 10²³ molecules [1].

Q5 [4 marks] A compound contains 2.4 g C, 0.40 g H and 3.2 g O. Find empirical formula using Ar = 12, 1, 16.

Moles 0.20, 0.40, 0.20 [2];
ratio 1:2:1 [1];
CH_2O [1].

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Q6 [5 marks] For $Mg+2HCl \rightarrow MgCl_2+H_2$, 4.8 g Mg (Ar = 24) reacts with 0.30 mol HCl. Identify limiting reactant and calculate hydrogen volume at RTP$_{24}$ dm³/mol.

Mg_{0}.20 mol [1];
needs 0.40 mol HCl [1];
HCl limiting [1];
H_2=0.15 mol [1];
3.6 dm³ [1].

Q7 [3 marks] Find molar concentration when 0.075 mol solute makes 250 cm³ solution.

Volume 0.250 dm³ [1];
c=n/V [1];
0.300 mol/dm³ [1].

Q8 [3 marks] Find mass concentration for 3.6 g dissolved to make 150 cm³ solution.

0.150 dm³ [1];
3.6/0.150 [1];
24 g/dm³ [1].

Q9 [3 marks] A synthesis gives 7.2 g product from a theoretical 9.0 g. Calculate percentage yield and explain one cause of a value below 100%.

7.2/9.0 × 100=80% [2];
incomplete reaction/product loss/side reaction [1].

Q10 [4 marks] Calculate theoretical mass of CaO from 15.0 g $CaCO_3$ using $CaCO_3 \rightarrow CaO+CO_2$, Mr = 100 and 56 respectively.

n($CaCO_3$)=0.150 mol [1];
ratio 1:1 [1];
n(CaO)=0.150 mol [1];
mass 8.4 g [1].

Common error to avoid: mixing units, signs, initial values and equilibrium values. Accept equivalent scientific wording and alternative valid calculations; award only the stated total. For extended answers, each distinct credited point must answer the context.