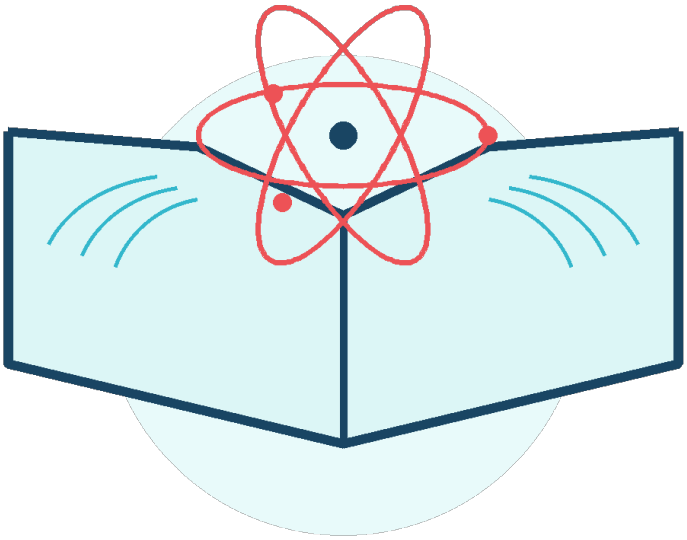
GENERAL CHEMISTRY I

CHM 1100

QUESTION BANK

CHAPTER 4 • MASS RELATIONSHIPS IN CHEMICAL REACTIONS

جامعة الجوف | Jouf University



PRACTICE • CHECK • SUCCEED

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CHAPTER 04

Mass Relationships in Chemical Reactions

العلاقات بين الكتل في التفاعلات الكيميائية

QUESTION BANK

KEYWORDS • الكلمات المفتاحية

01 Chemical Reaction & Chemical Equation	التفاعل الكيميائي والمعادلة الكيميائية
02 Reactants & Products	المتفاعلات والنواتج
03 Physical States: (s), (l), (g), (aq)	الحالات الفيزيائية للمواد في المعادلة
04 Reading a Balanced Equation	قراءة المعادلة الموزونة: جسيمات، مولات، كتل
05 Coefficients vs. Subscripts	المعاملات والأرقام السفلية
06 Balancing Chemical Equations	خطوات وزن المعادلات الكيميائية
07 Mole Ratio	النسبة المولية من المعادلة الموزونة
08 Amounts of Reactants & Products	حساب كميات المتفاعلات والنواتج

Read • Balance • Convert • Calculate

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How to Use This Question Bank

- *Study the Exam Revision Guide of this chapter first.*
- *Answer each section without notes and under a time limit (about 1 minute per MCQ).*
- *Mark every question you were not sure about with a star (★).*
- *Check your answers with the Answer Key at the end, then revise the exact idea you missed.*

إرشادات استخدام بنك الأسئلة

ذاكر أولاً: راجع ملف المراجعة الخاص بهذا الفصل قبل البدء في الحل.

حلّ كأنك في الاختبار: حلّ دون الرجوع للمذكرة، وحدد لنفسك وقتاً (دقيقة تقريباً لكل سؤال اختيار من متعدد).

علّم الأسئلة غير المؤكدة: ضع نجمة ★ بجانب كل سؤال لم تكن متأكداً من إجابته.

صحّح وتعلّم من أخطائك: استخدم نموذج الإجابة في نهاية الملف، وارجع للفكرة التي أخطأت فيها.

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Section A | Multiple Choice Questions

القسم الأول: اختيار من متعدد — اختر الإجابة الصحيحة

1. A chemical reaction is best described as a process in which:

a) *a substance changes only its physical state*
b) *substances are changed into new substances*
c) *new elements are created from old elements*
d) *atoms are destroyed and replaced by others*

2. In a chemical equation, the reactants are written:

a) *on the right side of the arrow*
b) *on the left side of the arrow*
c) *above the arrow only*
d) *on both sides of the arrow*

3. The symbol (aq) after a formula means that the substance is:

a) *a pure liquid*
b) *dissolved in water*
c) *a gas*
d) *a solid precipitate*

4. In $KBr(aq) + AgNO_3(aq) \rightarrow KNO_3(aq) + AgBr(s)$, the solid product is:

a) KNO_3
b) $AgBr$
c) KBr
d) $AgNO_3$

5. When balancing a chemical equation, you are allowed to change:

a) *the subscripts in the formulas*
b) *the coefficients in front of formulas*
c) *the symbols of the elements*
d) *the formulas of the products*

6. Two units of NO_2 in a balanced equation are written as:

a) N_2O_4
b) $2NO_2$
c) N_2O_2
d) NO_4

7. The coefficients in a balanced equation directly give the ratio of:

a) *masses in grams*
b) *moles of substances*
c) *atomic numbers*
d) *densities*

8. For $2Mg + O_2 \rightarrow 2MgO$, which statement is correct?

a) $2\ g\ Mg + 1\ g\ O_2 \rightarrow 2\ g\ MgO$
b) $2\ mol\ Mg + 1\ mol\ O_2 \rightarrow 2\ mol\ MgO$
c) $1\ mol\ Mg + 2\ mol\ O_2 \rightarrow 2\ mol\ MgO$
d) $2\ mol\ Mg + 2\ mol\ O_2 \rightarrow 2\ mol\ MgO$

9. When balancing $C_3H_8 + O_2 \rightarrow CO_2 + H_2O$, the element that should be balanced LAST is:

a) *C*
b) *H*
c) *O*
d) *any element*

10. Which equation is correctly balanced?

a) $H_2 + O_2 \rightarrow H_2O$
b) $2H_2 + O_2 \rightarrow 2H_2O$
c) $H_2 + O_2 \rightarrow 2H_2O$
d) $2H_2 + 2O_2 \rightarrow 2H_2O$

11. In $C_5H_{12} + x\,O_2 \rightarrow 5CO_2 + 6H_2O$, the value of x is:

a) 5 *b) 6*
c) 8 *d) 16*

12. When $C_2H_6 + O_2 \rightarrow CO_2 + H_2O$ is balanced with the smallest whole numbers, the coefficient of O_2 is:

a) 3 *b) 7*
c) 3.5 *d) 14*

13. The smallest whole-number coefficients for $Al + O_2 \rightarrow Al_2O_3$ are:

a) 2, 3, 1 *b) 4, 3, 2*
c) 2, 1, 1 *d) 4, 6, 2*

14. In the balanced equation $CH_4 + __O_2 \rightarrow CO_2 + 2H_2O$, the coefficient of O_2 is:

a) 1 *b) 2*
c) 3 *d) 4*

15. For $2H_2 + O_2 \rightarrow 2H_2O$, how many moles of H_2O form from 3 mol of O_2 (excess H_2)?

a) 3 mol *b) 6 mol*
c) 1.5 mol *d) 2 mol*

16. The FIRST step in calculating the mass of a product from a mass of reactant is to:

a) write the balanced equation *b) convert product moles to grams*
c) multiply the mass by coefficients *d) add the masses of all reactants*

17. To convert grams of substance A into moles of A, you:

a) multiply by the molar mass of A *b) divide by the molar mass of A*
c) multiply by Avogadro's number *d) divide by the coefficient of A*

18. In the path mol A → mol B, we use:

a) the molar mass of B *b) the mole ratio from the equation*
c) Avogadro's number *d) the density of B*

19. For $C + O_2 \rightarrow CO_2$, the mass of CO_2 formed from 12 g of C is: (C = 12, O = 16)

a) 12 g *b) 32 g*
c) 44 g *d) 22 g*

20. For $2Li + 2H_2O \rightarrow 2LiOH + H_2$, the moles of Li needed to produce 1.0 mol of H_2 is:

a) 0.5 mol *b) 1.0 mol*
c) 2.0 mol *d) 4.0 mol*

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Section B | True or False

القسم الثاني: صح أم خطأ – صحّح العبارة الخاطئة

Write T (True) or F (False). Correct each false statement.

#	Statement	T / F
1	*In a chemical reaction, atoms are rearranged and no new elements are created.*	( )
2	*The products of a reaction are written on the left side of the arrow.*	( )
3	*The symbol (l) is used for a substance dissolved in water.*	( )
4	*Changing H_2O to H_2O_2 is an acceptable way to balance oxygen atoms.*	( )
5	*The coefficients in a balanced equation can be read as numbers of particles or numbers of moles.*	( )
6	*In $2Mg + O_2 \rightarrow 2MgO$, 2 g of Mg react with 1 g of O_2.*	( )
7	*A balanced equation has the same number of each type of atom on both sides.*	( )
8	*If a coefficient such as 7/2 appears, multiply all coefficients by 2.*	( )
9	*In a hydrocarbon combustion equation, it is best to balance oxygen first.*	( )
10	*The mole ratio can be applied directly to grams of reactant to get grams of product.*	( )

Section C | Short Essay Questions

القسم الثالث: أسئلة مقالية قصيرة

1. Define each of the following: (a) chemical reaction (b) chemical equation (c) reactants (d) products.

2. Why must we change only the coefficients, and never the subscripts, when balancing an equation? Use NO_2 as an example.

3. State the steps used to balance a chemical equation.

4. Explain the meaning of $2Mg(s) + O_2(g) \rightarrow 2MgO(s)$ in terms of particles, moles and mass. (Mg = 24.3, O = 16.0)

5. List the four rules for calculating the mass of a product from a given mass of reactant, and draw the conversion path.

Section D | Calculations & Balancing

القسم الرابع: مسائل حسابية ووزن معادلات

1. Balance: $C_3H_8 + O_2 \rightarrow CO_2 + H_2O$

2. Balance: $C_4H_{10} + O_2 \rightarrow CO_2 + H_2O$

3. Balance: $Fe + O_2 \rightarrow Fe_2O_3$

4. Balance: $N_2 + H_2 \rightarrow NH_3$

5. $C(s) + O_2(g) \rightarrow CO_2(g)$. Calculate the mass of CO_2 produced from burning 18 g of carbon. (C = 12, O = 16)

6. $2Li + 2H_2O \rightarrow 2LiOH + H_2$. How many grams of Li are needed to produce 4.0 g of H_2? (Li = 7, H = 1)

7. $2H_2 + O_2 \rightarrow 2H_2O$. Calculate the mass of water formed from 8.0 g of H_2 (excess O_2). (H = 1, O = 16)

8. $2Mg + O_2 \rightarrow 2MgO$. Calculate the mass of MgO formed from 4.86 g of Mg. (Mg = 24.3, O = 16.0)

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Answer Key | نموذج الإجابة

Section A — Multiple Choice

Q	Answer	Why
1	(b) substances are changed into new substances	Substances change into NEW substances; atoms are rearranged, not created or destroyed.
2	(b) on the left side of the arrow	Reactants → left; products → right.
3	(b) dissolved in water	(aq) = aqueous = dissolved in water.
4	(b) AgBr	(s) marks the solid: AgBr.
5	(b) the coefficients in front of formulas	Only coefficients may change; changing subscripts creates a different substance.
6	(b) $2NO_2$	The coefficient 2 goes in front: $2NO_2$. N_2O_4 is a different compound.
7	(b) moles of substances	Coefficients = mole (and particle) ratios.
8	(b) 2 mol Mg + 1 mol O_2 → 2 mol MgO	Coefficients are moles, not grams.
9	(c) O	In combustion, balance C, then H, then O last.
10	(b) $2H_2 + O_2 \rightarrow 2H_2O$	Left: 4 H, 2 O; right: 4 H, 2 O.
11	(c) 8	O on the right = 5(2) + 6 = 16 → 8 O_2.
12	(b) 7	$2C_2H_6 + 7O_2 \rightarrow 4CO_2 + 6H_2O$ (3.5 is not a whole number).
13	(b) 4, 3, 2	$4Al + 3O_2 \rightarrow 2Al_2O_3$.
14	(b) 2	O on the right = 2 + 2 = 4 → 2 O_2.
15	(b) 6 mol	1 mol O_2 → 2 mol H_2O, so 3 mol O_2 → 6 mol H_2O.
16	(a) write the balanced equation	Rule 1: always start from the balanced equation.
17	(b) divide by the molar mass of A	n = m ÷ M.
18	(b) the mole ratio from the equation	Moles of A → moles of B use the coefficient ratio.
19	(c) 44 g	12 ÷ 12 = 1 mol C → 1 mol CO_2 × 44 = 44 g.
20	(c) 2.0 mol	2 mol Li : 1 mol H_2 → 2.0 mol Li.

Section B — True or False

Q	Answer	Correction
1	True	—
2	False	Products are written on the RIGHT side.
3	False	(aq) means dissolved in water; (l) means liquid.
4	False	Never change subscripts — H_2O_2 is a different substance.
5	True	—
6	False	2 mol Mg react with 1 mol O_2 (48.6 g with 32.0 g).
7	True	—
8	True	—
9	False	Balance C and H first; balance O last.
10	False	Convert grams to moles first, then use the mole ratio.

Section C — Model Answers

1. (a) A process in which a substance (or substances) is changed into one or more new substances. (b) A representation that uses chemical symbols and formulas to show what happens during a reaction. (c) The chemicals that react with each other (written on the left). (d) The new chemicals produced by the reaction (written on the right).

2. Subscripts are part of the formula; changing them changes the identity of the substance. Doubling NO_2 must be written $2NO_2$ (two molecules of nitrogen dioxide). Writing N_2O_4 describes a different compound.

3. 1) Write correct formulas of all reactants (left) and products (right). 2) Balance elements that appear in only one reactant and one product first. 3) Balance elements that appear in two or more substances. 4) Check that each atom has the same number on both sides; clear fractions by multiplying by 2.

4. Particles: 2 atoms of Mg react with 1 molecule of O_2 to give 2 units of MgO. Moles: 2 mol Mg + 1 mol O_2 → 2 mol MgO. Mass: 48.6 g Mg + 32.0 g O_2 → 80.6 g MgO (mass is conserved).

5. 1) Write the balanced equation. 2) Convert grams of reactant to moles. 3) Use the mole ratio to find moles of product. 4) Convert moles of product to grams. Path: g A → (÷ M of A) → mol A → (× ratio) → mol B → (× M of B) → g B.

Section D — Worked Solutions

1. C: $3CO_2$; H: $8 \rightarrow 4H_2O$; O on right = 6 + 4 = 10 → $5O_2$. **$C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$**

2. C: $4CO_2$; H: $10 \rightarrow 5H_2O$; O on right = 8 + 5 = 13 → 13/2 O_2; ×2: **$2C_4H_{10} + 13O_2 \rightarrow 8CO_2 + 10H_2O$**

3. Fe: 2Fe; O: 3 → 3/2 O_2; ×2: **$4Fe + 3O_2 \rightarrow 2Fe_2O_3$** (Fe 4 = 4, O 6 = 6)

4. N: $2NH_3$; H on right = 6 → $3H_2$. **$N_2 + 3H_2 \rightarrow 2NH_3$**

5. n(C) = 18 ÷ 12 = 1.5 mol → n(CO_2) = 1.5 mol (1 : 1) → mass = 1.5 × 44 = **66 g CO_2**

6. n(H_2) = 4.0 ÷ 2 = 2.0 mol → n(Li) = 2.0 × 2 = 4.0 mol → mass = 4.0 × 7 = **28 g Li**

7. n(H_2) = 8.0 ÷ 2 = 4.0 mol → n(H_2O) = 4.0 mol (2 : 2) → M(H_2O) = 18 g/mol → mass = 4.0 × 18 = **72 g H_2O**

8. n(Mg) = 4.86 ÷ 24.3 = 0.200 mol → n(MgO) = 0.200 mol (2 : 2) → M(MgO) = 40.3 g/mol → mass = 0.200 × 40.3 = **8.06 g MgO**

فهمت القوانين، لكن ما زلت تتردد عند حل المسائل؟

تابع شرح الفصل مع الأستاذ عبدالله، وتعلّم كيف تختار القانون المناسب وتطبقه خطوة بخطوة.

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