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ACS FINAL EXAM REVIEW FIRST TERM

General Chemistry I

Seventy questions. No surprises.

Concept review, worked examples, practice sets and a full-length mock exam

Michael Rainwater · Rainwater Private Tutoring · Athens, Georgia

2026–27 Edition

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General Chemistry I: ACS Final Exam Review, First Term
2026–27 Edition

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How to Use This Packet

The exam is 70 multiple-choice questions in 110 minutes. This packet is built to match it.

What Is in Each Chapter

- **Concept sections.** The idea first, then the rule, then an example. Terms are defined in the sidebar where they first appear.
- **Worked examples.** One for each kind of question the exam asks. Every example starts by naming what is asked and ends with a check.
- **Choosing the Method.** A table that matches the wording of a question to the first move.
- **Practice sets.** Exam-style questions with room to work. The last third of each set is harder because the steps are layered.
- **A review set.** Mixed questions from the whole chapter.

A Plan That Works

- Read a chapter's sections with a pencil. Work each example before reading its steps.
- Do the practice sets timed, at 90 seconds a question. Mark the ones you guessed.
- Check your answers against the key. For each miss, write down which choice you picked and why. The key names the slip behind the common wrong choices.
- Take the mock exam in one sitting, on scratch paper, with only the data sheet and a non-graphing calculator. The real exam does not allow writing in the booklet.
- Use the score guide after the mock exam to pick the chapters to revisit.

Three Moves for Every Question

Move	What it catches
1. Name what is asked.	Answering a nearby question: the wrong ion, the wrong geometry, the surroundings in place of the system.
2. Write the relationship before the numbers.	Reaching for a formula that does not fit.
3. Check the answer against the question.	A wrong sign, wrong units, or a value for the wrong object.

Chapters and Your Textbook

The chapters follow the order of the exam. The table lists where each one sits in Kotz, *Chemistry and Chemical Reactivity*, 11th edition, the CHEM 1211 text at UGA.

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	Packet chapter	Kotz chapters
1	Foundations	1, Let’s Review
2	Atoms, Molecules and Ions	2
3	Electronic Structure	6, 7
4	The Mole and Chemical Formulas	2
5	Stoichiometry	3, 4
6	Solutions and Aqueous Reactions	3, 4
7	Heat and Enthalpy	5
8	Structure and Bonding	8, 9
9	States of Matter	10, 11, 12

About the Author

Michael Rainwater runs Rainwater Private Tutoring, a one-on-one academic coaching and test prep practice that has served more than 150 families across Athens and metro Atlanta. General chemistry is one of the courses he teaches most. He scored 92 out of 100 on the ACS First-Term General Chemistry exam, the same exam this packet prepares you for.

He studies ecology at the University of Georgia, spoke at TEDxUGA in 2025, and performs as a concert pianist. The packet is built around how he teaches the course: the idea first, then the rule, then where students go wrong, with practice sets built around the errors that cost the most points. Every page was written and drawn for this packet.

For one-on-one help with this course, visit rainwatertutoring.com.

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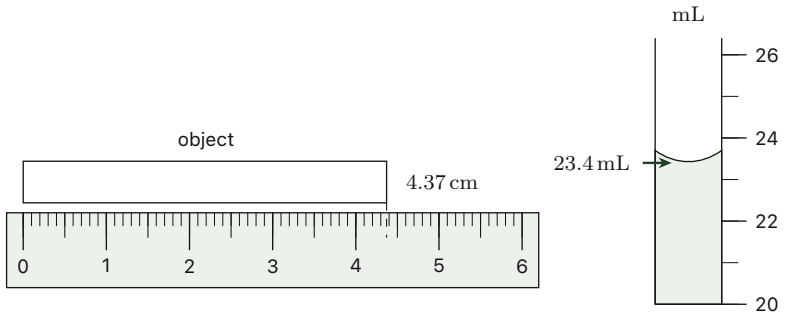
1 Foundations

In 1999 NASA lost the Mars Climate Orbiter, a $125 million spacecraft, because one team reported thruster data in pound-force seconds and the other read the numbers as newton-seconds. Nobody got the physics wrong; somebody dropped the units. Points on this material are lost the same way, so this chapter is about carrying units and digits all the way through. The mock exam gives this chapter 5 of its 70 questions.

1.1 Significant Figures

A measurement is read from a scale, and every scale has a smallest division. You read the digits you are sure of, then estimate one more between the marks. Those digits are the **significant figures**.

Significant figures
The certain digits of a measurement plus the one estimated digit.



$0.1\,\mathrm{cm}$ marks, so 4.3 is certain and 7 is estimated

Reading a scale
Read the bottom of the curved liquid surface, the meniscus. Estimate one digit past the smallest mark.

Count digits with these rules.

- Nonzero digits always count.
- Zeros between nonzero digits count. The number 5008 has four.
- Leading zeros never count. The number 0.0072 has two.
- Trailing zeros count when the number has a decimal point. The number 2.500 has four, and 120. has three.
- Trailing zeros in a whole number with no decimal point are unclear. Write 1.20×10^2 to show three.

Exact numbers have unlimited significant figures. Calculated answers follow two rules.

Exact number
A count or a definition, such as 12 eggs or $1\,\mathrm{km}{=}1000\,\mathrm{m}$. It limits nothing.

- **Multiply or divide.** Keep as many significant figures as the measurement that has the fewest.
- **Add or subtract.** Keep as many decimal places as the measurement that has the fewest.

RULE Carry one extra digit through the steps and round once, at the end.

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Repeated measurements

A set of readings is judged two ways. **Accuracy** compares the average to the true value. **Precision** compares the readings to one another. The true volume below is $10.00\,\text{mL}$.

Accuracy and precision
Accurate: close to the true value. Precise: repeated readings close to each other.

Readings (mL)	Average	Description
10.01, 9.99, 10.00	10.00	accurate and precise
10.52, 10.50, 10.51	10.51	precise, not accurate
9.40, 10.60, 10.00	10.00	accurate on average, not precise
11.30, 9.10, 10.80	10.40	neither accurate nor precise

EXAMPLE 1.1

What is $(18.52 + 6.8) \times 0.150$, with the correct significant figures?

What is asked A sum, then a product. Each step has its own rule.

Add first $18.52 + 6.8 = 25.32$. The fewest decimal places is one, from 6.8, so the sum is good to 25.3. Carry the extra digit and keep 25.32.

Multiply $25.32 \times 0.150 = 3.798$. The sum is good to three significant figures and 0.150 has three.

Round Round once, at the end, to three significant figures: 3.80.

Check Rounding the sum to 25.3 first gives 3.795, which also rounds to 3.80.

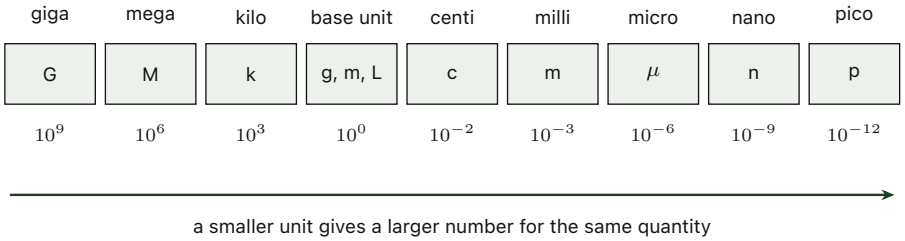
Answer **3.80**

1.2 Scientific Notation and Unit Conversions

Very large and very small numbers are written in **scientific notation**. Move the decimal point until one nonzero digit is to its left. Moving it left raises n. Moving it right lowers n. Every digit in a is significant, so 0.0000725 becomes 7.25×10^{-5} and 0.00007250 becomes 7.250×10^{-5}.

Scientific notation
A number written as $a \times 10^{n}$ with $1 \le a < 10$ and n a whole number.

A metric prefix multiplies a unit by a power of ten. Learn the ladder once and read it in both directions.



Converting units

Dimensional analysis converts a quantity by multiplying it by conversion factors. Write each factor so the unit you want to remove sits on the opposite side of the fraction bar from where it started. Units cancel the way numbers do. If the units on the left of the answer do not match the units you wanted, a factor is upside down.

Conversion factor
A ratio equal to 1, such as $\dfrac{1000\ \text{m}}{1\ \text{km}}$.

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Squared and cubed units

A conversion factor for a squared or cubed unit is the length factor raised to that power. Raise the number and the unit together.

$$1\ \text{m} = 10^2\ \text{cm}, \qquad \text{so} \qquad 1\ \text{m}^3 = \left(10^2\ \text{cm}\right)^3 = 10^6\ \text{cm}^3.$$

Length	Area	Volume
$1\ \text{m} = 10^2\ \text{cm}$	$1\ \text{m}^2 = 10^4\ \text{cm}^2$	$1\ \text{m}^3 = 10^6\ \text{cm}^3$
$1\ \text{dm} = 10\ \text{cm}$	$1\ \text{dm}^2 = 10^2\ \text{cm}^2$	$1\ \text{dm}^3 = 1\ \text{L} = 10^3\ \text{cm}^3$

RULE One milliliter equals one cubic centimeter. One liter equals 1000 mL and one cubic decimeter.

EXAMPLE 1.2

Convert $108\,\text{km/h}$ to meters per second.

What is asked A compound unit. Convert the top and the bottom separately.

Top Kilometers to meters: $\dfrac{1000\ \text{m}}{1\ \text{km}}$.

Bottom Hours to seconds: $\dfrac{1\ \text{h}}{3600\ \text{s}}$, since $1\ \text{h} = 60 \times 60\ \text{s}$.

Combine
$$108\ \frac{\text{km}}{\text{h}} \times \frac{1000\ \text{m}}{1\ \text{km}} \times \frac{1\ \text{h}}{3600\ \text{s}} = 30.0\ \frac{\text{m}}{\text{s}}$$

Check Km and h cancel and m/s remains. Three significant figures, from 108.

Answer $30.0\,\text{m/s}$

EXAMPLE 1.3

A room measures $4.0\,\text{m}$ by $5.0\,\text{m}$ by $2.5\,\text{m}$. What is its volume in liters?

What is asked A volume in L, from three lengths in m.

Volume in m^3 $4.0 \times 5.0 \times 2.5 = 50.\ \text{m}^3$

Factor $1\ \text{m}^3 = 10^3\ \text{L}$, from $1\ \text{m}^3 = 10^6\ \text{cm}^3$ and $10^3\ \text{cm}^3 = 1\ \text{L}$.

Convert
$$50.\ \text{m}^3 \times \frac{10^3\ \text{L}}{1\ \text{m}^3} = 5.0 \times 10^4\ \text{L}$$

Check A cubic meter is large, so the liter count should be much larger than 50.

Answer 5.0×10^4 **L**

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1.3 Density and Temperature

Density links the mass of a sample to the space it fills.

$$d = \frac{m}{V}$$

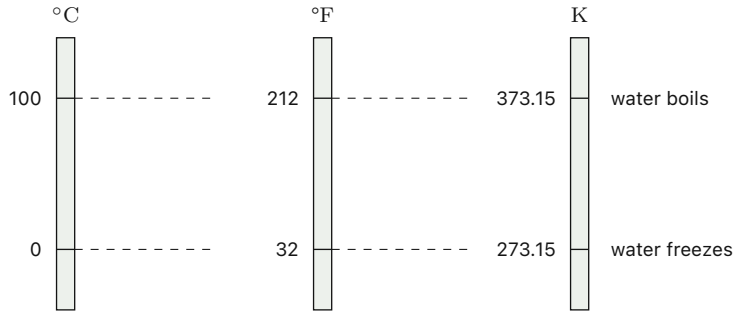
Density
Mass per unit volume. It does not depend on how much sample you have.

Solids and liquids use g/mL, which equals g/cm^3. Gases use g/L. When a solid does not have a regular shape, find its volume by displacement. Drop it in a graduated cylinder and subtract the starting water level from the final level. Rearrange $d = m/V$ when a question gives two of the three quantities and asks for the third.

Temperature scales

The kelvin is the same size as the degree Celsius. The two scales differ only in where zero sits. A Fahrenheit degree is smaller, and 180 of them span the same interval as 100 Celsius degrees.

$$T_\mathrm{K} = T_\mathrm{C} + 273.15 \qquad T_\mathrm{F} = 1.8\,T_\mathrm{C} + 32$$



Kelvin
Written without a degree sign. Zero kelvin is the lowest possible temperature.

RULE To go between °F and K, convert through °C.

EXAMPLE 1.4

What is the mass of $0.250\,\mathrm{L}$ of a liquid with density $1.26\,\mathrm{g/mL}$?

What is asked	Mass, from volume and density.
Rearrange	$m = d \times V$
Match units	The density is per mL, so convert the volume: 0.250 L $= 250.$ mL.
Calculate	$250.\ \mathrm{mL} \times 1.26\ \dfrac{\mathrm{g}}{\mathrm{mL}} = 315\ \mathrm{g}$, or 3.15×10^2 g.
Check	Three significant figures, from both values. The liquid is denser than water, so 250 mL should weigh more than 250 g.
Answer	3.15×10^2 **g**

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EXAMPLE 1.5

Convert $350\,\mathrm{K}$ to degrees Fahrenheit.

What is asked	Kelvin to Fahrenheit. Go through Celsius.
To Celsius	$350. - 273.15 = 76.85$ **°C**
To Fahrenheit	$1.8 \times 76.85 + 32 = 170.33$ **°F**
Round	The starting value has three significant figures, so 170. $^\circ\mathrm{F}$.
Check	Water boils at $212\,^\circ\mathrm{F}$ and $373.15\,\mathrm{K}$. A lower kelvin value must give a lower Fahrenheit value.
Answer	**170.** $^\circ\mathrm{F}$

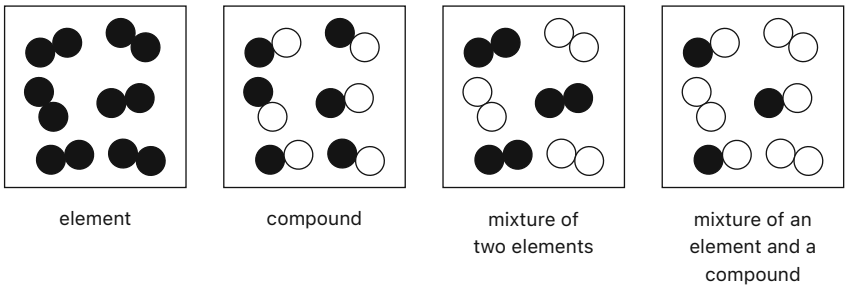
1.4 Matter and Its Properties

Matter is sorted by composition. A **pure substance** has the same composition throughout and cannot be separated by physical means. An **element** contains one kind of atom. A **compound** contains two or more elements joined in a fixed ratio, and only a chemical change can break it down. A **mixture** holds two or more substances in any ratio. In a **homogeneous mixture** the parts cannot be seen apart. In a **heterogeneous mixture** they can.

Pure substance
Matter with one fixed composition, either an element or a compound.

Category	Examples
Element	iron, helium, oxygen gas (O_2), diamond
Compound	water, sodium chloride, carbon dioxide
Homogeneous mixture	saltwater, air, brass
Heterogeneous mixture	granite, sand in water, salad

Particle diagrams show the same sorting. Count the kinds of particles, and look at how the atoms are joined. Atoms of different elements are drawn in different shades, and a pair of touching atoms is joined.



element | compound | mixture of two elements | mixture of an element and a compound

atom of one element atom of another element

Reading a diagram
Joined atoms form one particle. Count the different particles in the box, not the different shades.

Properties and changes

A **physical property** can be measured without changing what the substance is. Examples are melting point, density, color and solubility. A **chemical property** describes how a sub-

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stance reacts, such as flammability. A **physical change** alters form or state but not identity: melting, boiling, dissolving, crushing. A **chemical change** forms a new substance. Signs are a gas given off from a solid or a liquid, a permanent color change, a solid forming from two solutions, and heat or light released without any outside source.

Properties are also sorted by amount. An **intensive** property stays the same when you cut the sample in half. An **extensive** property halves with it.

Intensive and extensive
Intensive does not depend on amount. Extensive does.

Type	Examples
Intensive	density, melting point, boiling point, color, temperature
Extensive	mass, volume, length, total energy

RULE Dissolving and phase changes are physical. A chemical change forms a new substance.

EXAMPLE 1.6

Classify each sample: saltwater, granite, carbon dioxide, diamond.

What is asked One category for each sample.

One substance? Carbon dioxide and diamond are single substances. Saltwater and granite are mixtures.

Pure ones Diamond is carbon atoms only, so it is an element. Carbon dioxide has carbon and oxygen in a fixed ratio, so it is a compound.

Mixtures Saltwater looks uniform: homogeneous. Granite shows separate grains: heterogeneous.

Check Boiling the water off saltwater leaves the salt, so it holds two substances. Carbon dioxide cannot be split by any physical change.

Answer **homogeneous, heterogeneous, compound, element**

EXAMPLE 1.7

Label each change as physical or chemical: ice melting, iron rusting, sugar dissolving in water, a match burning.

What is asked One label for each change.

Test Ask whether a new substance forms. If the identity is the same, the change is physical.

Physical Melting ice is still water. Dissolving spreads sugar through water, and evaporating the water recovers the sugar.

Chemical Rusting forms iron oxide. A burning match forms gases and ash that were not there before.

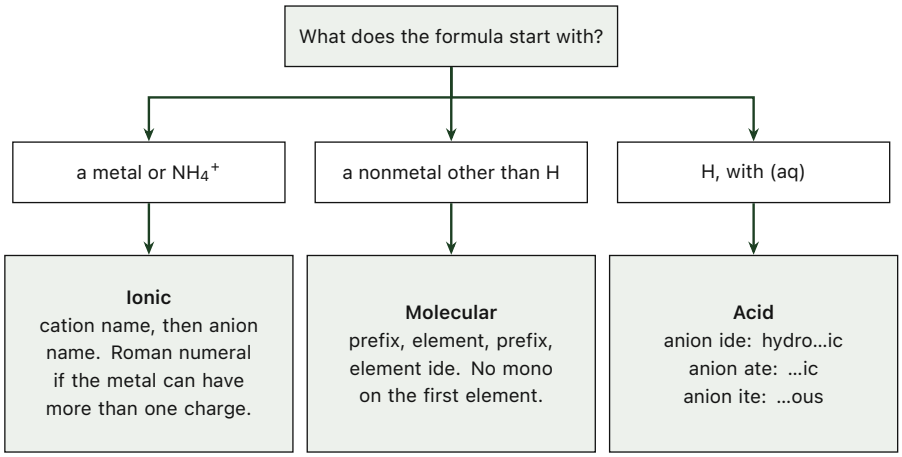
Check Cooling brings back the ice and evaporation brings back the sugar. Nothing cools rust or ash back into iron or wood.

Answer **physical, chemical, physical, chemical**

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1.5 Naming Compounds

Look at the first symbol and the formula type, then follow one of three naming routes.



Ionic compounds

Name the cation first, then the anion. A monatomic anion ends in *ide*. Groups 1 and 2, aluminum, zinc and silver form one charge only, so they take no numeral. Most other metals can form several ions. The **Roman numeral** gives the charge of the metal ion, and you find it from the anion: the cation charges must cancel the anion charges. In $FeCl_3$ three Cl^- give -3, so iron is $+3$ and the name is iron(III) chloride. The subscript is never the charge.

To write a formula from a name, write both ions with charges, then use as many of each as it takes to make the total charge zero. Reduce to the smallest whole-number ratio. Put parentheses around a polyatomic ion when you need more than one.

Polyatomic ions

Learn the table. An **oxyanion** is a polyatomic ion that contains oxygen, and the oxyanions of chlorine show the pattern. Per*chlor*ate has one more oxygen than chlorate, and hypochlorite has one fewer than chlorite.

Polyatomic ion
A charged group of atoms that stays together, such as NO_3^-.

Ion	Name	Ion	Name	Ion	Name
NH_4^+	ammonium	NO_3^-	nitrate	ClO_4^-	perchlorate
OH^-	hydroxide	NO_2^-	nitrite	ClO_3^-	chlorate
CN^-	cyanide	SO_4^{2-}	sulfate	ClO_2^-	chlorite
$C_2H_3O_2^-$	acetate	SO_3^{2-}	sulfite	ClO^-	hypochlorite
MnO_4^-	permanganate	PO_4^{3-}	phosphate	CrO_4^{2-}	chromate
HCO_3^-	hydrogen carbonate	CO_3^{2-}	carbonate	$Cr_2O_7^{2-}$	dichromate
HSO_4^-	hydrogen sulfate	HPO_4^{2-}	hydrogen phosphate	$H_2PO_4^-$	dihydrogen phosphate

Hydrates and molecular compounds

A **hydrate** is named as the ionic compound, then a prefix plus *hydrate* for the water. $CuSO_4 \cdot 5\,H_2O$ is copper(II) sulfate pentahydrate. Prefixes for 1 through 10 are mono, di, tri, tetra, penta, hexa, hepta, octa, nona and deca.

Hydrate
An ionic compound with water built into the crystal, written after a dot.

Two nonmetals form a **molecular compound**. Use the same prefixes for the count of each

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atom. Leave *mono* off the first element. Drop the final *a* or *o* of a prefix before oxide: monoxide, tetroxide, pentoxide, decoxide. So CO is carbon monoxide and N_2O_4 is dinitrogen tetroxide. Some books keep the *a* and write decaoxide. Prefixes belong to molecular names only. Never write them in an ionic name.

Acids

An **acid** in water is named from its anion. The suffix changes, and the first form is *hydro*.

Anion ends in	Acid name	Example
ide	hydro…ic acid	HCl(aq), hydrochloric acid
ate	…ic acid	H_2SO_4(aq), sulfuric acid
ite	…ous acid	H_2SO_3(aq), sulfurous acid

RULE An ate anion gives an ic acid. An ite anion gives an ous acid.

EXAMPLE 1.8

Name $NiSO_4 \cdot 6\,H_2O$.

What is asked	A hydrate. Name the salt, then the water.
Anion	SO_4^{2-} is sulfate, charge -2.
Cation charge	One sulfate gives -2 and there is one nickel, so nickel is $+2$.
Water	Six H_2O is hexahydrate.
Check	Nickel can form several ions, so the numeral is required.
Answer	**nickel(II) sulfate hexahydrate**

EXAMPLE 1.9

Write the formula for tin(IV) carbonate.

What is asked	A formula from a name with a numeral.
Ions	Tin(IV) is Sn^{4+}. Carbonate is CO_3^{2-}.
Balance	Two carbonates give -4, which cancels $+4$ from one tin.
Write	$Sn(CO_3)_2$, with parentheses because two polyatomic ions are needed.
Check	$(+4) + 2(-2) = 0$.
Answer	**$Sn(CO_3)_2$**

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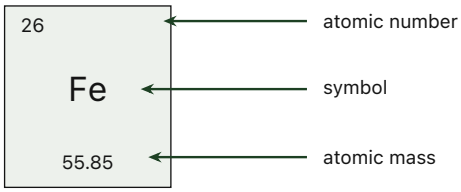
EXAMPLE 1.10

Name P_4O_{10}.

What is asked	A name for two nonmetals. Use prefixes.
First element	Four phosphorus atoms: tetraphosphorus.
Second element	Ten oxygen atoms: *deca* plus oxide. This packet drops the *a* before the vowel, so decoxide.
Check	The formula shows the whole count. No reduction to P_2O_5 is done in the name.
Answer	**tetraphosphorus decoxide**

1.6 The Exam Data Sheet

The exam gives a periodic table and a list of constants. You do not memorize atomic masses or constants. You do need to read them accurately, and you need to know which values the sheet does not give.



Reading a cell
The mass is in g/mol. Use every digit shown.

The table lists atomic masses to two decimal places or more. Use the digits on the sheet. A molar mass, the mass in grams of one mole of a substance (Chapter 4), is the sum of the atomic masses, each multiplied by its subscript. The constants are given to four significant figures or more, so they almost never limit the significant figures of an answer. The measured values in the problem do.

Quantity	Symbol	Value
Avogadro constant	N_A	6.022×10^{23} mol^{-1}
Gas constant	R	$0.082\,06\,\mathrm{L\,atm/(mol\,K)}$ and $8.314\,\mathrm{J/(mol\,K)}$
Speed of light	c	2.998×10^{8} m/s
Planck constant	h	6.626×10^{-34} J · s

Metric prefixes and everyday conversions such as minutes to seconds are not always printed on a data sheet. Know them. Pick the value of R whose units match the rest of the problem.

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EXAMPLE 1.11

What is the molar mass of $Al_2(SO_4)_3$?

What is asked	A molar mass, from table values.
Count atoms	The subscript outside the parentheses multiplies everything inside: 2 Al, 3 S, 12 O.
Look up	Al 26.98, S 32.06, O 16.00.
Add	$2(26.98) + 3(32.06) + 12(16.00) = 53.96 + 96.18 + 192.00 = 342.14$
Check	Twelve oxygens contribute more than half the total, and 192 of 342 is 56 percent.
Answer	$342.14\,\mathrm{g/mol}$

1.7 Choosing the Method

Most wrong answers in this chapter come from using a nearby rule: decimal places where the question needs significant figures, a subscript where it needs a charge, or 273.15 added to a Fahrenheit value. Match the wording to the move.

The question says	Do this
Add or subtract measurements	Round to the fewest decimal places, not significant figures.
Multiply or divide measurements	Round to the fewest significant figures.
Convert cm^3, m^2 or m^3	Raise the whole factor to the power: $1\ m^3 = 10^6\ cm^3$.
A solid is dropped in water, and two levels are given	Subtract the levels to get the volume, then divide the mass by it.
Temperature in $^\circ F$ and the answer in K	Convert to $^\circ C$ first. Never add 273.15 to a Fahrenheit value.
A name with a Roman numeral	The numeral is the metal charge. Balance charges to find the subscripts.
Two nonmetals, or a metal and a nonmetal	Nonmetals only: prefixes. Metal present: ionic, so no prefixes.
A particle diagram with two shades	Count kinds of particles. Joined atoms are one particle, so a joined pair of unlike atoms is a compound.

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PRACTICE SET 1A 9 questions · 14 minutes · no calculator needed

1. Which measurement has exactly three significant figures?

(A) $0.004\,050\,\mathrm{g}$ **(B)** $4.0500\,\mathrm{g}$
(C) $0.0450\,\mathrm{g}$ **(D)** $45.00\,\mathrm{g}$

2. What is the sum $15.2 + 0.355 + 8.04$, with the correct significant figures?

(A) 23.6 **(B)** 23.60
(C) 23.595 **(D)** 23.5

3. Four identical coins have a total mass of $12.48\,\mathrm{g}$. What is the mass of one coin?

(A) $3.120\,\mathrm{g}$ **(B)** $3\,\mathrm{g}$
(C) $49.92\,\mathrm{g}$ **(D)** $0.3205\,\mathrm{g}$

4. Which list contains **only** intensive properties?

(A) density, volume, color
(B) mass, melting point, density
(C) density, boiling point, color
(D) length, temperature, density

5. Which observation shows a chemical change?

(A) Dry ice shrinks into a gas.
(B) Sugar dissolves in water.
(C) A copper wire is hammered flat.
(D) Zinc in acid bubbles and shrinks.

6. What is $\dfrac{4.20 \times 0.0300}{2.5}$, with the correct significant figures?

(A) 0.05 **(B)** 0.0504
(C) 0.0500 **(D)** 0.050

7. How is 0.00007250 written in scientific notation, with the correct significant figures?

(A) 7.25×10^{-5} **(B)** 7.250×10^{-5}
(C) 7.250×10^{-4} **(D)** 7.250×10^{5}

8. A wavelength is $652\,\mathrm{nm}$. What is this in micrometers?

(A) $6.52 \times 10^{5}\ \mu\mathrm{m}$ **(B)** $6.52 \times 10^{-1}\ \mu\mathrm{m}$
(C) $6.52 \times 10^{-4}\ \mu\mathrm{m}$ **(D)** $6.52 \times 10^{-7}\ \mu\mathrm{m}$

9. A car travels at $54\,\mathrm{km/h}$. What is its speed in m/s?

(A) $0.015\,\mathrm{m/s}$
(B) $1.9 \times 10^{2}\,\mathrm{m/s}$
(C) $3.2 \times 10^{3}\,\mathrm{m/s}$
(D) $15\,\mathrm{m/s}$

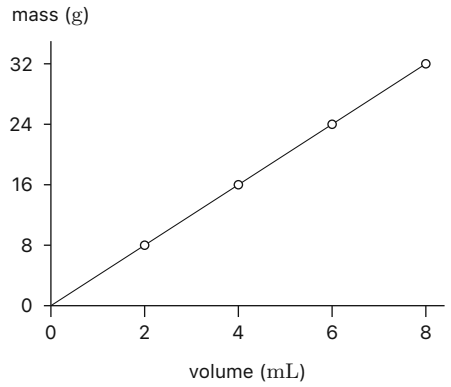
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PRACTICE SET 1B 10 questions · 15 minutes · calculator allowed

1. A $47.30\,\text{g}$ metal sample is lowered into a graduated cylinder. The water level rises from $25.0\,\text{mL}$ to $31.0\,\text{mL}$. What is the density of the metal?

(A) $1.9\,\text{g/mL}$
(B) $7.9\,\text{g/mL}$
(C) $1.5\,\text{g/mL}$
(D) $0.13\,\text{g/mL}$

2. The graph shows the mass of different volumes of one metal. What is the density of the metal?



(A) $0.25\,\text{g/mL}$
(B) $24\,\text{g/mL}$
(C) $30\,\text{g/mL}$
(D) $4.0\,\text{g/mL}$

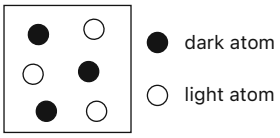
3. The density of aluminum is $2.70\,\text{g/cm}^3$. What is it in kg/m^3?

(A) $2.70 \times 10^{3}\,\text{kg/m}^3$
(B) $2.70 \times 10^{-9}\,\text{kg/m}^3$
(C) $2.70 \times 10^{-1}\,\text{kg/m}^3$
(D) $2.70 \times 10^{6}\,\text{kg/m}^3$

4. A cube has edges of $2.50\,\text{cm}$. What is its volume in cubic meters?

(A) $1.56 \times 10^{1}\,\text{m}^3$
(B) $1.56 \times 10^{-1}\,\text{m}^3$
(C) $1.56 \times 10^{-2}\,\text{m}^3$
(D) $1.56 \times 10^{-5}\,\text{m}^3$

5. The box shows a sample at the particle level. What does it represent?



(A) a mixture of two elements
(B) a pure compound
(C) a pure element
(D) a mixture of an element and a compound

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6. The table gives densities in g/mL. An unknown liquid has a mass of $31.5\,\text{g}$ and a volume of $25.0\,\text{mL}$. Which liquid is it?

ethanol	water	glycerol	mercury
0.789	1.00	1.26	13.6

(A) glycerol **(B)** ethanol
(C) water **(D)** mercury

7. Mercury freezes at $-38.8\,^\circ\text{C}$. What is this temperature in degrees Fahrenheit?

(A) $-69.8\,^\circ\text{F}$
(B) $-37.8\,^\circ\text{F}$
(C) $-12.2\,^\circ\text{F}$
(D) $-39.3\,^\circ\text{F}$

8. A thermometer reads $100.0\,^\circ\text{F}$. What is this temperature in kelvin?

(A) $37.8\,\text{K}$
(B) $373\,\text{K}$
(C) $310.9\,\text{K}$
(D) $396\,\text{K}$

9. A tank leaks $0.35\,\text{mL/s}$. How many liters leak in $2.0\,\text{h}$?

(A) $2.5\times10^{3}\,\text{L}$
(B) $0.042\,\text{L}$
(C) $2.5\,\text{L}$
(D) $2.5\times10^{-3}\,\text{L}$

10. A gold foil is $5.0\,\text{cm}$ by $4.0\,\text{cm}$ by $0.0020\,\text{cm}$. The density of gold is $19.3\,\text{g/cm}^3$. What is the mass of the foil in milligrams?

(A) $0.77\,\text{mg}$
(B) $7.7\times10^{2}\,\text{mg}$
(C) $2.1\,\text{mg}$
(D) $7.7\times10^{5}\,\text{mg}$

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PRACTICE SET 1C 9 questions · 14 minutes · no calculator needed

1. What is the name of $Fe_2(SO_4)_3$?

(A) iron(II) sulfate
(B) iron(III) sulfite
(C) diiron trisulfate
(D) iron(III) sulfate

2. Which is the formula of calcium phosphate?

(A) $CaPO_4$ **(B)** $Ca_3(PO_4)_2$
(C) $Ca_2(PO_4)_3$ **(D)** Ca_3P_2

3. What is the name of N_2O_4?

(A) tetranitrogen dioxide
(B) dinitrogen oxide
(C) dinitrogen tetroxide
(D) nitrogen dioxide

4. Which is the formula of diphosphorus pentoxide?

(A) P_2O_3 **(B)** P_2O_5 **(C)** P_5O_2 **(D)** PO_5

5. What is the name of $HNO_2(aq)$?

(A) nitrous acid
(B) nitric acid
(C) hydronitric acid
(D) hyponitrous acid

6. What is the name of $CoCl_2 \cdot 6\,H_2O$?

(A) cobalt(II) chloride hexahydrate
(B) cobalt(III) chloride hexahydrate
(C) cobalt(II) dichloride hexahydrate
(D) cobalt(II) chloride dodecahydrate

7. A balance standard has a true mass of $5.000\,\text{g}$. Which set of three readings is both accurate and precise?

(A) 5.31, 5.29, 5.30 **(B)** 4.62, 5.37, 4.98
(C) 5.01, 4.99, 5.00 **(D)** 4.15, 5.80, 5.05

8. Which formula and name are correctly matched?

(A) Na_2SO_3, sodium sulfate
(B) $Fe(NO_3)_2$, iron(III) nitrate
(C) PCl_3, phosphorus chloride
(D) $(NH_4)_2CO_3$, ammonium carbonate

9. What is the name of $Ca(H_2PO_4)_2$?

(A) calcium dihydrogen phosphate
(B) calcium hydrogen phosphate
(C) calcium(II) dihydrogen phosphate
(D) calcium phosphate

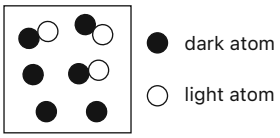
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PRACTICE SET 1 REVIEW 8 questions · 12 minutes · mixed

1. What is $(12.34 - 11.90) \times 2.50$, with the correct significant figures?

(A) 1.1 **(B)** 1.10 **(C)** 1 **(D)** -17.4

2. The box shows a sample at the particle level. What does it represent?



(A) a pure compound
(B) a mixture of two elements
(C) a mixture of an element and a compound
(D) a pure element

3. Ethanol has a density of $0.789\,\mathrm{g/mL}$. What is the mass of $1.50\,\mathrm{L}$ of ethanol?

(A) $1.90\,\mathrm{g}$ **(B)** $1.18 \times 10^{3}\,\mathrm{g}$
(C) $1.18\,\mathrm{g}$ **(D)** $1.90 \times 10^{3}\,\mathrm{g}$

4. Which sample is a homogeneous mixture?

(A) brass, an alloy (a mixture of metals) with the atoms evenly mixed
(B) orange juice with pulp
(C) pure copper(II) sulfate
(D) oil and vinegar dressing

5. What is the name of $Mn(ClO_4)_2$?

(A) manganese(II) chlorate
(B) manganese(II) chlorite
(C) manganese diperchlorate
(D) manganese(II) perchlorate

6. Seawater has a density of $1.025\,\mathrm{g/mL}$. What is the mass, in kilograms, of $2.5\,\mathrm{m^3}$ of seawater?

(A) $0.26\,\mathrm{kg}$ **(B)** $2.6 \times 10^{3}\,\mathrm{kg}$
(C) $2.6 \times 10^{6}\,\mathrm{kg}$ **(D)** $2.6\,\mathrm{kg}$

7. The speed of light is 2.998×10^{8} m/s. What is this in km/h?

(A) $2.998 \times 10^{5}\,\mathrm{km/h}$ **(B)** $1.079 \times 10^{12}\,\mathrm{km/h}$
(C) $8.328 \times 10^{1}\,\mathrm{km/h}$ **(D)** $1.079 \times 10^{9}\,\mathrm{km/h}$

8. Using atomic masses from the periodic table, how many moles are in $18.0\,\mathrm{g}$ of $Ca(OH)_2$?

(A) $4.12\,\mathrm{mol}$ **(B)** $0.315\,\mathrm{mol}$
(C) $0.243\,\mathrm{mol}$ **(D)** $0.486\,\mathrm{mol}$

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Answers

Letter answers for every practice set and the mock exam. Worked solutions are in the answer key edition.

1 Foundations

1A	1 **C**	2 **A**	3 **A**	4 **C**	5 **D**	6 **D**	7 **B**	8 **B**	9 **D**	
1B	1 **B**	2 **D**	3 **A**	4 **D**	5 **A**	6 **A**	7 **B**	8 **C**	9 **C**	10 **B**
1C	1 **D**	2 **B**	3 **C**	4 **B**	5 **A**	6 **A**	7 **C**	8 **D**	9 **A**	
Review	1 **A**	2 **C**	3 **B**	4 **A**	5 **D**	6 **B**	7 **D**	8 **C**		

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