CHEMISTRY · UNIT 1 — PARENT COPY

Baseline Check — Scoring Key

Answers, point values, and a per-target scoring grid so the "before" number is comparable to the graded exam later.

Before you score it: resist the urge to correct as it is being taken. The value of a baseline is that it is honest. A low score here is *good news* — it means the study time has somewhere to go. Share the number only if the student wants it; what matters is the per-target grid on the last page.

Part A — Concepts and Models

1. Mass and volume — 5 pts · Target 1

a) (3 pts) **Mass** = the amount of matter in an object; unit **grams (g)**. **Volume** = the amount of space an object takes up; unit **mL** or **cm³**. *1 pt each definition, 1 pt for both units correct.*
b) (2 pts) **No.** Weight is the force of gravity pulling on the object and changes with location (less on the Moon); mass is the amount of matter and does not change.
★ **Watch for:** "mass is how much something weighs." That is the exact wording on her Learning Targets sheet. If it reappears here, it is a genuine gap, not a slip.

2. Particle diagram: liquid to solid — 3 pts · Target 10

Same number of atoms, drawn **closer together in an orderly/regular arrangement**, filling slightly less space.
1 pt same count | 1 pt closer spacing | 1 pt ordered arrangement.
Common error: drawing fewer atoms (that would mean matter vanished) or drawing smaller atoms (atoms do not shrink — the gaps do).

3. Particle diagram: the gas phase — 2 pts · Target 10

Same atoms, spread far apart with large empty spaces between them, filling a much bigger volume.
1 pt drawing | 1 pt sentence naming the increased spacing / empty space.

4. Burning steel wool — 4 pts · Target 3

Drawing (2 pts): the same iron atoms **plus additional oxygen atoms now bonded to them** (drawn as a different size or shade, attached — not floating loose).
Explanation (2 pts): mass rose from 9.40 g to 11.85 g, a gain of **2.45 g**, which is the **mass of oxygen taken from the air**. No matter was created — the sample simply contains more atoms than before. Counting the air as part of the system, total mass is conserved.
Full credit requires naming oxygen from the air. "It gained mass because it burned" is 0 for the explanation.

5. Reading a histogram — 4 pts · Target 2

a) (2 pts) **The mass really did change.** The loss clusters near 1.0 g and *every* group lost mass — that is far too large and too consistent to be measurement error (a balance is uncertain by ~0.01–0.1 g, not 1 g), and error would scatter on both sides of zero.
b) (1 pt) The tablet reacted with the water and produced **carbon dioxide gas, which escaped from the open cup** and carried its mass away with it.
c) (1 pt) Sealed, the bars would cluster **at zero** — the gas stays inside the system, so total mass is conserved.
Note: this is deliberately the opposite of the sugar-dissolving case she may remember. The skill being tested is telling a *real* change from experimental error, not reciting one answer.

6. Container volume vs. liquid volume

3 pts · Target 4

a) (2 pts) The slope is about **1 mL per cm³**, which means every 1 cm³ of container space holds 1 mL of liquid — **cm³ and mL measure the same amount of space**.
b) (1 pt) You would expect exactly **1.00**, because 1 cm³ = 1 mL by definition. The measured 1.02 is slightly off because of ordinary measurement error in the ruler and cylinder readings.

7. Mass vs. volume graph

8 pts · Target 7

a) (2 pts) **M = 0.780V − 0.220** (mass in g, volume in cm³)
b) (2 pts) The slope is the **density: 0.780 g/cm³** — every 1 cm³ of this substance has a mass of 0.780 g. *1 pt for "density", 1 pt for stating it with units / in words.*
c) (2 pts) **It floats.** Its density, 0.780 g/cm³, is *less than* water's 1.00 g/cm³. *The number is required for full credit.*
d) (2 pts) M = 0.780(50.0) − 0.220 = 39.0 − 0.220 = 38.78 → **38.8 g** (3 sig figs).
Also full credit: using density alone, 0.780 × 50.0 = 39.0 g. Accept either; the intercept is tiny.

8. Density problem

3 pts · Target 9

Want volume → **V = m ÷ D**
`V = 85.0 g ÷ 1.49 g/mL = 57.0469...` → **57.0 mL** (3 sig figs)
1 pt correct rearrangement | 1 pt arithmetic | 1 pt sig figs and unit.
Common error: multiplying instead of dividing (giving 127 mL). The sanity check: chloroform is denser than water, so 85 g of it should take up *less* than 85 mL.

9. Is it pure?

4 pts · Target 8

`D = 33.0 g ÷ 3.50 cm³ = 9.4285...` → **9.43 g/cm³** (3 sig figs)
No, it is not pure silver. Pure silver is 10.5 g/cm³, and 9.43 is well below that — far more than measurement error could explain. It is most likely an alloy or a silver-plated base metal.
2 pts the calculation | 1 pt for explicitly comparing her number to 10.5 | 1 pt for a stated verdict. One good sentence can earn both of the last two — that is fine, award both.
This is where students lose points: computing 9.43 and stopping. The conclusion sentence is worth its own point.

Part B — Measurement and Calculation

10. Reading a graduated cylinder

3 pts · Target 5

a) **37.6 mL** **b)** **3 sig figs** **c)** The **6** (the tenths digit) is uncertain. The marks are every 1 mL, so 37 is certain and you are entitled to *estimate exactly one digit* past the smallest mark.
1 pt each. Answers of "37 mL" or "37.63 mL" lose part (a).

11. Comparing two instruments

3 pts · Target 5

a) **Thermometer D** is more precise.
b) **Thermometer C** has the greater uncertainty: it reads only to the tenths place (±0.1 °C) while D reads to the hundredths (±0.01 °C).
1 pt (a) | 1 pt (b) | 1 pt for naming the place value or the ± size as the reason.

12. Counting significant figures

5 pts · Target 6

a) 0.00450 → **3** (leading zeros out; trailing zero counts, decimal present) b) 60.07 → **4** (captive zeros count) c) 5000 → **1** (trailing zeros, no decimal point) d) 2.100 → **4** e) 8.0×10^5 → **2** (only the coefficient — the front number — counts)
1 pt each.
Convention check: some textbooks call a bare trailing zero ambiguous. Check which convention your own class uses — many teachers treat 3,200,000 as 2 sig figs and 710 as 2 sig figs, which makes "5000 → 1" the right call.

13. Rounding

3 pts · Target 6

a) 0.08346 to 2 sf → keep 8, 3; next digit 4 → down → **0.083**
b) 47.98 to 3 sf → keep 47.9; next digit 8 → up → **48.0** (**the trailing zero is required** — "48" alone is only 2 sf)
c) 1.0649 to 3 sf → keep 1.06; next digit 4 → down → **1.06**
1 pt each.

14. Calculating with significant figures

4 pts · Target 6

a) 8.7 + 12.34 = 21.04 → **fewest decimal places** (8.7 has 1) → **21.0 g**
b) 205.6 − 12.98 = 192.62 → **fewest decimal places** (205.6 has 1) → **192.6 mL**
c) 6.02 × 3.1 = 18.662 → **fewest sig figs** (3.1 has 2) → **19 cm²**
d) 88.4 ÷ 12.0 = 7.3666... → **fewest sig figs** (both have 3) → **7.37 g/mL**
*1 pt each. Award the point when she rounds **her own computed value** correctly — the rule is what is being tested, so a small arithmetic slip followed by correct rounding still earns it.*

15. Volume units

2 pts · Target 4

a) V = 4.00 × 3.00 × 2.00 = **24.0 cm³** b) **24.0 mL** — 1 cm³ = 1 mL exactly, so no conversion is needed.
1 pt each.

16. Identifying an unknown metal

4 pts · Target 8

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Step 1 — volume by displacement: V = 25.0 − 15.0 = 10.0 mL
Step 2 — density: D = 71.3 g ÷ 10.0 mL = 7.13 g/mL
Step 3 — look it up: zinc
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2 pts volume as a subtraction | 1 pt density | 1 pt identification.
The classic error: using 25.0 mL as the volume. The object displaces only the *rise* in level.

17. Thickness of aluminum foil

4 pts · Target 9

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1) V = m ÷ D = 1.30 ÷ 2.70 = 0.481481 cm³
2) A = 20.0 × 12.0 = 240. cm²
3) t = V ÷ A = 0.481481 ÷ 240. = 0.00200617 cm
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→ **2.01×10^{-3} cm** (3 sig figs), or 0.00201 cm
2 pts mass→volume | 1 pt area | 1 pt divide and round correctly.
Expect this one to be blank or abandoned on a baseline — it is the hardest item on the page, and this problem type shows up on unit exams often enough to be worth watching closely after studying.

Scoring Grid — by Learning Target

Add up the points per target, then fill in the percentage. The six shaded rows are the targets students most often leave blank on a learning-targets self-assessment — those are the ones to watch.

#	Learning Target	Questions	Possible	Scored	%
1	Define mass and volume, with units	Q1	5		
2	Represent and interpret class data on a histogram	Q5	4		
3	Law of conservation of mass	Q4	4		
4	Volume of a container (cm³) = volume of liquid (mL)	Q6, Q15	5		
5	**Instruments have a limit to their precision**	Q10, Q11	6		
6	**Round to the correct number of significant figures**	Q12, Q13, Q14	12		
7	**Determine density from a mass-vs-volume graph**	Q7	8		

8	**Density is a characteristic property — identify unknowns**	Q9, Q16	8		
9	**Use density to convert between mass and volume**	Q8, Q17	7		
10	**Particle diagrams for solids, liquids and gases**	Q2, Q3	5		
	TOTAL		**64**		

How to read the result. The total number matters less than the shape. Look for targets where the score is under about half — those are the slides to spend real time on. Targets 5, 6 and 9 are the fastest to move: they are rule-following skills that respond to an evening of practice. Targets 7 and 8 take a bit longer because they need the graph reasoning underneath.

Measuring the "after". The graded exam will not come back split by target, so use this same grid: as you go through the returned exam, tag each lost point with the target number from this table, then compare the two grids side by side. That is a much fairer read on progress than one percentage against another, because the two assessments are not the same length.

Progress tracker	Baseline (this test)	After studying	Real exam
Date			
Overall score			
Weakest target			
Strongest target			

Baseline Check scoring key — modeled on the class Unit 1 Review, extended to all ten Unit 1 learning targets.