

Arabia Mountain High School	Department of Science
Mathematics Skills Test For Chemistry: 10 th Summer Assignment.	Chemistry knowledge is not required to complete this assignment
<p>DIRECTIONS: This test is designed to assess the student's proficiency in manipulating algebraic expressions relevant for success in general chemistry. <u>Refer to and study the significant figures notes before completing this exercise.</u> Please show all steps and reasoning in answering each question. Finally, <u>box in your final answer to each question.</u></p> <p><u>All students will be required to complete another version of this test for credit in class during the first week of school to validate comprehension and mastery of the mathematics skills necessary to be successful in chemistry.</u></p>	

Significant Figures

Rules

- All digits that are not zero, are significant.
 - 45678 → 5sf
- Zero's between non-zero digits are significant numbers.
 - 7804 → 4sf
 - 7804.004 → 7 sf
- Zeros to the left of the 1st non-zero digit are not significant.
 - 0.0078 → 2 sf
- Zeros to the right of a decimal point are significant if they are at the end of the number.
 - 0.2340 → 4 sf
 - 777.0 → 4 sf
- Always assume zeros at the end of a number to be non-significant
 - Compare 3400 and 3400.0
 - 3400 has 2 sig fig
 - 3400.0 has 5

Addition and Subtraction

- When adding or subtracting numbers, the answer should have as many places of decimal as the smaller or smallest place of decimal in the numbers being added or subtracted.
- Example:
$$12.34 + 2.4 + 45.610 = 60.4 \text{ NOT } 60.35$$

The correct answer should only have 1 place of decimal.

Multiplication and Division

- When multiplying or dividing numbers, the answer should have significant figures as many as the least number of significant figures in the numbers being multiplied or divided.
- For example: $24.22 \times 1.2 \times 2.23 = 65$ **NOT 64.81272**

Division

- Example
 $465.75/45.6$ must have 3 significant figures.
Therefore, $465.75/45.6 = 10.2$
NOT 10.2138....

Combined Multiple Operations

- If a problem combines addition or subtraction and multiplication or division, apply rules separately.
- That is, use places of decimal for addition and subtraction and significant figures for multiplication and division portion of the problem.

Example

$$(9.12 - 8.9)/8.9 = 0.2/8.9 = 0.02$$

Note: $(9.12 - 8.9) = 0.2$ based on 1 place of decimal

$$0.2/8.9 = 0.02 \text{ based on 1 sf in } 0.2$$

EXERCISE

USE YOUR ALGEBRAIC KNOWLEDGE AND THE RULES ABOVE TO COMPLETE THE QUESTIONS BELOW.

1. The density of an object is defined as mass per unit volume. Mathematically we write that: $D = M/V$. Rearrange this expression for: (a) $M = ?$ (b) $V = ?$

2. The number of mole of a molecule is defined as its mass per molar mass. Using # mol = n , mass = m and molar mass = M and given that $n = \frac{m}{M}$, rearrange this expression for
(a) $M = ?$ (b) $m = ?$ (c) If $n = 0.0021$ mol and $M = 44$ g/mol; what is the value of m ?

3. Given $^{\circ}\text{F} = 1.8^{\circ}\text{C} + 32$, what is the value of $^{\circ}\text{C}$ if $^{\circ}\text{F}$ is 106.6?

4. $\log_{10} X_f = \log_{10} X_o + n \log_{10} 0.5$. Write an expression to find n .

5. $n = t/T$. If $n = 8.00$ and $T = 2.30$ days, what is the value of t with proper units?

6. $M = \frac{\text{mol solute}}{L \text{ solution}}$. Rewrite this expression for L solution.

7. $P_1V_1 = P_2V_2$. If $P_1 = 1.2$ atm, $V_1 = 0.62$ Liter and $P_2 = 3.2$ atm ; what is the value of V_2 ?

8. $\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$. Rewrite this expression to find T_2 .

9. $PV = nRT$. If $P = 1$ atm, $V = 5.0$ liter, $R = 0.0821$ L.atm/mol.K, and $T = 293$ K; what is the value of n ?

10. $PV = nRT$ and $n = \frac{m}{M}$. What is M if $P = 1$ atm, $m = 13.5$ g, $V = 5.0$ liter,
 $R = 0.0821$ L.atm/mol.K, and $T = 298$ K. (**show all units**)

11. $q = cm\Delta T$ and $\Delta T = T_f - T_i$

Find the value of c if $q = 9600$ joule, $m = 120$ g and $T_i = 25.0$ °C and $T_f = 36.2$ °C

12. 1 atm = 760 mm Hg = 760 torr. How many atm are in 945 torr?

13. $\frac{V_1}{T_1} = \frac{V_2}{T_2}$. Find the value of V_2 if $V_1 = 250$ mL, $T_1 = 190$ K and $T_2 = 285$ K.

14. $X_f = X_o(0.5)^n$. What is the value of X_o if $X_f = 1.25$ g and $n = 4$?

15. $M_1V_1 = M_2V_2$. Write an expression for V_2 .

16. $c = v\lambda$. If $c = 2.998 \times 10^8$ m/s, $v = 4.41 \times 10^{14}$ s⁻¹; find a value for λ .

17. $E = hv$. If $h = 6.626 \times 10^{-34}$ J.s and $v = 5.71 \times 10^{14}$ s⁻¹; what is the value of E ?

18. $\text{pH} = -\log_{10}[\text{H}^+]$. If $[\text{H}^+]$ is 1.2×10^{-6} , what is the pH?

19. $\text{Rate} = k[\text{A}][\text{B}]^2$. What is $[\text{B}]$?

20. $\text{pH} = -\log_{10}[\text{H}^+]$. If pH 3.5 what is $[\text{H}^+]$?

21. Percent error = $\frac{\text{measured value} - \text{accepted value}}{\text{accepted value}} \times 100$

The accepted value for copper is 8.96 g/mL. Calculate the percent error if the density of a copper sample was measured as 8.86 g/mL. **Use the correct number of significant figures.**

22. A pool of water has a volume of $3.56 \times 10^{36} \text{ cm}^3$. What is the volume of this pool in m^3 if $1 \text{ m} = 100 \text{ cm}$. **Use the correct number of significant figures.**

23. A runner covered a distance of 10.0 km in 28.2 minutes during the Peachtree Road Race. How fast was the runner in mile per hour ($1 \text{ km} = 0.62 \text{ mile}$)? **Use the correct number of significant figures.**

24. Perform the following calculation and **report your answer to the proper number of significant figures:** $120 \text{ m} \times 0.10 \text{ m}$

25. Perform the following calculation and **report your answer to the proper number of significant figures:** $258.3 \text{ kg} + 257.11 \text{ kg} + 253 \text{ kg}$