CHEM160 Quiz #0 (Review)

Summary:

The purpose of this quiz is to get you reacquainted with previous math material you should have been exposed to previously. You may not remember it and/or it may have never been covered in your previous classes. That is okay but we will be using and building on these topics so use this an opportunity to catch up. Use any resources you want (search engine, YouTube, tutor, etc.) and even work together using the Discord or other means but make sure you understand it because it will help during the semester. Keep the notes and links that you used to complete this for future use.

Instructions:

1. Quiz consists of four parts.
    1. Order Of Operations Worksheet
    2. Solving Simple Equations Worksheet
    3. Simplifying Expressions With Variables and Exponents Worksheet
    4. Math Preparation Problems
2. Complete Quiz #0 questions on a printed version of this quiz or your own sheets of paper. You must show your work neatly in pen and the answers must be boxed in a different colored pen or highlighted. If you don't think the problem needs any work, you must write 1-3 sentences of why you think it is the correct answer.
3. This will be due ~1 week after class starts. You can earn 20% extra credit on the quiz if you submit this by the first day of class.
4. After you have completed the Quiz #0 upload all of your work on Canvas as one document on or after the first day of class.

Order of Operations

If multiplication, division, powers, addition, parentheses, and so on, are all contained in one problem, the **order of operations** is as follows.

1. parentheses
2. exponents
3. multiplication } whichever comes first left to right
4. division
5. addition } whichever comes first left to right
6. subtraction

An easy way to remember the order of operations is **P**lease **E**xcuse **M**y **D**ear **A**unt **S**ally (**P**arentheses, **E**xponents, **M**ultiplication/ **D**ivision, **A**ddition/ **S**ubtraction).

Example 1

Simplify each of the following.

1. $16 + 4 \times 3$

2. $10 - 3 \times 6 + 10^2 + (6 + 1) \times 4$

1. First, the multiplication,

$16 + 4 \times 3 = 16 + 12$

Then, the addition,

$16 + 12 = 28$

2. First, the parentheses,

$10 - 3 \times 6 + 10^2 + (6 + 1) \times 4 = 10 - 3 \times 6 + 10^2 + (7) \times 4$

Then, the exponents,

$10^2 = 10 \times 10 = 100$,

so $10 - 3 \times 6 + 10^2 + (7) \times 4 = 10 - 3 \times 6 + 100 + (7) \times 4$

Then, multiplication,

$10 - 3 \times 6 + 100 + (7) \times 4 = 10 - 18 + 100 + 28$

Then, addition and subtraction left to right,

$$\begin{aligned} 10 - 18 + 100 + 28 &= -8 + 100 + 28 \\ &= 92 + 28 \\ &= 120 \end{aligned}$$

Order of Operations - Cliff's Notes: https://www.cliffsnotes.com/study-guides/basic-math/basic-math-and-pre-algebra/preliminaries/order-of-operations

1) $5(1 + 3)^2 =$

2) $8 + 32 \div (8 - 4)^2 =$

3) $4\{7 + [6(5 - 3) + 8]\} =$

4) $2 \cdot 4^2 + 8 \div 2 =$

5) $16 \div 2 \cdot 4 - 12 \div 2 + 2 =$

6) $288 \div [3(9+3)] =$

7) $2\{32 - (8 - 2)^2 \div [(7 - 4)^2 - 3 + 3]\}$

8) $(3+9^2) \div 4 =$

9) $\frac{(4-2^2)^2}{18-3+1^2} =$

10) $\frac{12[5^2+(3^2+4^2)]}{12[5^2-(3^2+4^2)]} =$

11) $9 \times 9 - 3 \times 3 =$

12) $4 \times [15 \div (3+2)]$

<u>Solving Simple Equations (39 problems)</u> - Cliffs Notes: https://www.cliffsnotes.com/study-guides/basic-math/basic-math-and-pre-algebra/variables-algebraic-expressions-and-simple-equations/solving-simple-equations

Solving Simple Equations

When solving a simple equation, think of the equation as a balance, with the equals sign (=) being the fulcrum or center. Thus, if you do something to one side of the equation, you must do the same thing to the other side. Doing the *same thing to both sides* of the equation (say, adding 3 to each side) keeps the equation balanced.

Solving an equation is the process of getting what you're looking for, or *solving for*, on one side of the equals sign and everything else on the other side. You're really sorting information. If you're solving for x, you must get x on one side by itself.

Addition and subtraction equations

Some equations involve only addition and/or subtraction.

Example 1

Solve for x.

$x + 8 = 12$

To solve the equation $x + 8 = 12$, you must get x by itself on one side. Therefore, subtract 8 from both sides.

#1)

To check your answer, simply plug your answer into the equation:

#2)

Example 2

Solve for y.

$y – 9 = 25$

To solve this equation, you must get y by itself on one side. Therefore, add 9 to both sides.

#3)

To check, simply replace y with 34:

#4)

Example 3

Solve for x.

$x + 15 = 6$

To solve, subtract 15 from both sides.

#5)

To check, simply replace x with –9 :

#6)

Notice that in each case above, *opposite operations* are used; that is, if the equation has addition, you subtract from each side.

Solving Simple Equations (39 problems) - Cliffs Notes: https://www.cliffsnotes.com/study-guides/basic-math/basic-math-and-pre-algebra/variables-algebraic-expressions-and-simple-equations/solving-simple-equations

Multiplication and division equations

Some equations involve only multiplication or division. This is typically when the variable is already on one side of the equation, but there is either more than one of the variable, such as 2 *x*, or a fraction of the variable, such as

$\frac{x}{3}$ or $\left(\frac{1}{2}\right)x$

In the same manner as when you add or subtract, you can multiply or divide both sides of an equation by the same number, *as long as it is not zero*, and the equation will not change.

Example 4

Solve for *x*.

$3x = 9$

Divide each side of the equation by 3.

#7)

To check, replace *x* with 3:

#8)

Example 5

Solve for *y*.

$\frac{y}{5} = 7$

To solve, multiply each side by 5.

#9)

To check, replace *y* with 35:

#10)

Example 6

Solve for *x*.

$\frac{3}{4}x = 18$

To solve, multiply each side by $\frac{4}{3}$.

#11)

Or, without canceling,

#12)

Notice that on the left you would normally not write $\frac{12}{12}$ because it would always cancel to 1 *x*, or *x*.

Solving Simple Equations (39 problems) - Cliffs Notes: https://www.cliffsnotes.com/study-guides/basic-math/basic-math-and-pre-algebra/variables-algebraic-expressions-and-simple-equations/solving-simple-equations

Combinations of operations

Sometimes you have to use more than one step to solve the equation. In most cases, do the addition or subtraction step first. Then, after you've sorted the variables to one side and the numbers to the other, multiply or divide to get only one of the variables (that is, a variable with no number, or 1, in front of it: *x*, not 2 *x*).

Example 7

Solve for *x*.

$2x + 4 = 10$

Subtract 4 from both sides to get 2 *x* by itself on one side.

#13)

Then divide both sides by 2 to get *x*.

#14)

To check, substitute your answer into the original equation:

#15)

Example 8

Solve for *x*.

$5x - 11 = 29$

Add 11 to both sides.

#16)

Divide each side by 5.

#17)

To check, replace *x* with 8:

#18)

Example 9

Solve for *x*.

$\frac{2}{3}x + 6 = 12$

Subtract 6 from each side.

#19)

Multiply each side by $\frac{3}{2}$.

#20)

To check, replace *x* with 9:

#21)

Solving Simple Equations (39 problems) - Cliffs Notes: https://www.cliffsnotes.com/study-guides/basic-math/basic-math-and-pre-algebra/variables-algebraic-expressions-and-simple-equations/solving-simple-equations

Example 10

Solve for *y*.

$\frac{2}{5}y - 8 = -18$

Add 8 to both sides.

#21)

Multiply each side by $\frac{5}{2}$.

#22)

To check, replace *y* with –25:

#23)

Example 11

Solve for *x*.

$3x + 2 = x + 4$

Subtract 2 from both sides (which is the same as adding –2).

#24)

Subtract *x* from both sides.

#25)

Note that $3x - x$ is the same as $3x - 1x$.

Divide both sides by 2.

#26)

To check, replace *x* with 1:

#27)

Example 12

Solve for *y*.

$5y + 3 = 2y + 9$

Subtract 3 from both sides.

#28)

Subtract 2 *y* from both sides.

#29)

Divide both sides by 3.

#30)

To check, replace *y* with 2:

#31)

Sometimes you need to simplify each side (combine like terms) before actually starting the sorting process.

Example 13

Solve for *x*.

$3x + 4 + 2 = 12 + 3$

First, simplify each side.

#32)

Subtract 6 from both sides.

#33)

Divide both sides by 3.

#34)

To check, replace *x* with 3:

#35)

Solving Simple Equations (39 problems) - Cliffs Notes: https://www.cliffsnotes.com/study-guides/basic-math/basic-math-and-pre-algebra/variables-algebraic-expressions-and-simple-equations/solving-simple-equations

Example 14

Solve for *x*.

$4x + 2x + 4 = 5x + 3 + 11$

Simplify each side.

#36)

Subtract 4 from both sides.

#37)

Subtract 5 *x* from both sides.

#38)

To check, replace *x* with 10:

#39)

Simplifying Expressions with Variables and Exponents -
Purple Math: https://www.purplemath.com/modules/simpexpo.htm

To simplify with exponents, don't feel like you have to work only with, or straight from, the rules for exponents. It is often simpler to work directly from the definition and meaning of exponents. For instance:

- *Simplify*

$$a^6 \text{ x } a^5$$

The rules tell me to add the exponents. But I when I started algebra, I had trouble keeping the rules straight, so I just thought about what exponents mean. The " a^6 " means "six copies of *a* multiplied together", and the " a^5 " means "five copies of *a* multiplied together". So if I multiply those two expressions together, I will get eleven copies of *a* multiplied together. That is:

$a^6 \times a^5 = (a^6)(a^5)$

$= (aaaaaa)(aaaaa)$

$= aaaaaaaaaaa$

$= a^{11}$

Thus:

$a^6 \times a^5 = a^{11}$

- *Simplify the following expression:*

$$\frac{6^8}{6^5}$$

The exponent rules tell me to subtract the exponents. But let's suppose that I've forgotten the rules again. The " 6^8 " means I have eight copies of 6 on top; the " 6^5 " means I have five copies of 6 underneath.

$$\frac{6 \,x\, 6 \,x\, 6 \,x\, 6 \,x\, 6 \,x\, 6 \,x\, 6 \,x\, 6}{6 \,x\, 6 \,x\, 6 \,x\, 6 \,x\, 6}$$

How many extra 6's do I have, and where are they? I have three extra 6's, and they're on top. Then:

$$\frac{6 \,x\, 6 \,x\, 6}{1}$$

Unless the instructions also tell you to "evaluate", you're probably expected to leave numerical exponent problems like this in exponent form. If you're not sure, though, feel free to add "= 216", just to be on the safe side.

- *Simplify the following expression:*

$$\frac{t^{10}}{t^8}$$

How many extra copies of *t* do I have, and where are they? I have two extra copies, on top:

$$\frac{t \cdot t \cdot t \cdot t \cdot t \cdot t \cdot t \cdot t \cdot t \cdot t}{t \cdot t \cdot t \cdot t \cdot t \cdot t \cdot t \cdot t}$$

$$\frac{t \cdot t}{1} = t^2$$

Once you become comfortable with the "how many extras do I have, and where are they?" reasoning, you'll find yourself not needing to write things out and cancel off the duplicate factors. The answers will start feeling fairly obvious to you.

- *Simplify the following expression:*

$$\frac{5^3}{5^9}$$

This question is a bit different, because the larger exponent is on the term in the denominator. But the basic reasoning is the same.

Simplifying Expressions with Variables and Exponents -
Purple Math: https://www.purplemath.com/modules/simpexpo.htm

How many extra copies of 5 do I have, and where are they? I have six extra copies, and they're underneath:

$$\frac{5 \cdot 5 \cdot 5}{5 \cdot 5 \cdot 5 \cdot 5 \cdot 5 \cdot 5 \cdot 5 \cdot 5 \cdot 5}$$

$$\frac{1}{5 \cdot 5 \cdot 5 \cdot 5 \cdot 5 \cdot 5} = \frac{1}{5^6}$$

Note: If you apply the subtraction rule, you'll end up with $5^{3-9} = 5^{-6}$, which is mathematically correct, but is almost certainly not the answer they're looking for.

Whether or not you've been taught about negative exponents, when they say "simplify", they mean "simplify the expression so it doesn't have any negative or zero powers". Some students will try to get around this minus-sign problem by arbitrarily switching the sign to magically get " 5^6 " on top (rather than below a "1"), but this is incorrect.

Let's move on to expressions that are a bit more complex.

- *Simplify the following expression:*

$$\frac{5x^5}{3x^3}$$

- *Simplify*

$(-46x^2y^3z)^0$

- *Simplify*

$-(46x^2y^3z)^0$

- *Simplify the following expression:*

$$\frac{15a^5b^2c^4}{25a^3b^3c^4}$$

Recall that negative exponents indicates that we need to move the base to the other side of the fraction line. For example:

$$x^{-4} = \frac{1x^{-4}}{1} = \frac{1}{x^4}$$

$$\frac{1}{x^{-3}} = \frac{1}{1x^{-3}} = \frac{1x^3}{1} = x^3$$

(The "1's" in the simplifications above are for clarity's sake, in case it's been a while since you last worked with negative powers. One doesn't usually include them in one's work.)

In the context of simplifying with exponents, negative exponents can create extra steps in the simplification process. For instance:

- *Simplify the following expression:*

$$\frac{x^{-3}}{x^{-7}}$$

The negative exponents tell me to move the bases, so:

$$\frac{x^{-3}}{x^{-7}} = \frac{x^7}{x^3}$$

Then I cancel as usual, and get:

$$\frac{x^7}{x^3} = x^4$$

When working with exponents, you're dealing with multiplication. Since order doesn't matter for multiplication, you will often find that you and a friend (or you and the teacher) have worked out the same problem with completely different steps, but have gotten the same answer in the end.

This is to be expected. As long as you do each step correctly, you should get the correct answers. Don't worry if your solution doesn't look anything like your friend's; as long as you both got the right answer, you probably both did it "the right way".

- *Simplify the following expression:*

$$(-3x^{-1}y^2)^2$$

I can proceed in either of two ways. I can either take care of the squaring outside, and then simplify inside; or else I can simplify inside, and then take the square through. Either way, I'll get the same answer. To prove this, I'll show both ways.

simplifying first:

$$= \left(\frac{-3y^2}{x}\right)^2$$

$$= \frac{(-3)^2(y^2)^2}{(x)^2}$$

$$= \frac{9y^4}{x^2}$$

squaring first:

$$= (-3)^2(x^{-1})^2(y^2)^2$$

$$= (9)(x^{-2})(y^4)$$

$$= \frac{9y^4}{x^2}$$

Simplifying Expressions with Variables and Exponents -
Purple Math: https://www.purplemath.com/modules/simpexpo.htm

- *Simplify the following expression:*

  $(-5x^{-2}y)(-2x^{-3}y^{2})$

Again, I can work either of two ways: multiply first and then handle the negative exponents, or else handle the exponents and then multiply the resulting fractions. I'll show both ways.

multiplying first:

doing the exponents first:

Either way, my answer is the same:

Neither solution method above is "better" or "worse" than the other. The way you work the problem will be a matter of taste or happenstance, so just do whatever works better for you.

- *Simplify the following expression:*

$$\frac{1}{2x^{-4}}$$

- *Simplify the following expression:*

$$\frac{-6}{x^{-2}}$$

- *Simplify the following expression:*

$$\frac{3x^{-2}y}{xy}$$

Math Preparation for Introductory Chemistry

1. In the number 267.83, the number 3 is in the _____ place

2. In the number 3572.01, the number 2 is in the____place.

3. Solve: 7 + (-3) =

4. Solve: 1 - (-3) =

5. Solve: -2 x -3 =

6. Solve: 2 x -3 =

7. Solve for n in the equation PV=nRT

8. Solve for F: $C = \frac{(F-32)}{1.8}$

9. Convert 0.01203 into scientific notation.

10. Convert 6.75×10^4 to regular notation.

11. Solve: $\frac{6.02 \text{ x } 10^{23}}{1.204 \text{ x } 10^{24}} =$

12. What are the correct units for the answer to this problem? 4 m x 5 m = 20___

13. What are the correct units for the answer to this problem? 4 m + 5 m = 9___

14. What are the correct units for the answer to this problem? 3 $\frac{mol}{L}$ x 4 L = 12___

15. What are the correct units for the answer to this problem? 4.184 $\frac{J}{g\cdot{}^{\circ}\mathrm{C}}$ x 10 g x 10 ^{0}C= 418.4 _____

16. What is the answer in correct units? $\frac{2500\ J}{(10\ g)(100\ {}^{\circ}\mathrm{C})} =$

17. If our class has 24 students and 15 of them are wearing jeans, what is the percent students who are wearing jeans?

18. If someone weighs 160 lb and has 15% body fat, how much fat does this person's body contain?

19. Solve the following equation for m: $d = \frac{m}{V}$

20. Solve the following equation for F: $T = \frac{U}{F}$

21. Solve the following equation for P_1: $\frac{P_1V_1}{n_1T_1} = \frac{P_2V_2}{n_2T_2}$

22. Solve the following equation for T_1: $\frac{P_1V_1}{n_1T_1} = \frac{P_2V_2}{n_2T_2}$

23. Solve the following equation for V_2: $\frac{P_1V_1}{n_1T_1} = \frac{P_2V_2}{n_2T_2}$

24. Solve the following equation for n_2: $\frac{P_1V_1}{n_1T_1} = \frac{P_2V_2}{n_2T_2}$

25. Simply the following expression: $\frac{x^3y^2zw}{z^3y^3}$

26. Simply the following expression: $\frac{x^2y^2zw^3}{z^2y^3x^4}$

27. Simply the following expression: $\frac{x^{-4}yzw^3}{z^2y^{-2}x}$

28. Simply the following expression: $\frac{x^3y^{-2}zw}{z^3x^{-1}yw}$

29. Solve for C in the following equation: $F = \frac{9}{5}C + 32$

30. Solve for G in the following equation: $D = \frac{7}{2}G + 42$