Lesson 14 Applications Using Percent

Language is very important when solving problems concerning price markups and price discounts. Notice particularly whether it is a percentage of the final cost or the original cost. This can be very tricky. In order to compare or combine you must be the same kind or same value. You must be talking from the same perspective comparing apples to apples and oranges to oranges. Recently I was explaining this concept to a contractor. He saw the percentage as one thing, and the customer saw it as something else. A disagreement ensued, yet they were both correct. This is what happened.

The wholesale cost of a light was $10.00 and the contractor charged $15.00 with the explanation that he had marked it up 1/3 or 33 1/3%. The customer disagreed and said it had been marked up 1/2 or 50%. Who was right?

The contractor was taking 33 1/3%, or 1/3, of the final cost and 1/3 of 15.00 is 5.00, which is the amount of the markup. The customer agreed that the profit was 5.00 but added that this was 1/2 or 50% of the original cost. Both were correct, but they began at different points, taking a percentage of two different costs, the original and the final. The final cost is the original cost plus the markup. In economic terms, the original cost is referred to as the wholesale price. This is what a store pays for products. The retail store then adds the markup, which is their profit, to the wholesale price. The final price, which the store charges, is called the retail price. So the wholesale price plus the profit equals the retail price.

Example 1 What percent of the retail price did you save if you bought a swimsuit for $27.00 that was priced at $36.00?

Solution A You saved $9.00. The equation is:

W_p (what percentage) x (of) 36.00 (retail price) = (is) 9.00 (savings)

$$W_p \times 36 = 9$$

$$W_p \times \frac{36}{1} = \frac{9}{36}$$ Divide by 36.

$W_p = 1/4$ or 25% Change the fraction to a percent.

Solution B Another way to solve this is based on the word percent, which means per cent or per hundred. When writing the equation write W_p as W_p /100.

$$\frac{W_p}{100} \times 36 = 9$$

$$100 \times \frac{W_p}{100} \times 36 = 9 \times 100$$ Multiply by 100.

$$W_p \times \frac{36}{1} = \frac{900}{36}$$ Divide by 36.

$$W_p = 25$$

Example 2 What percent of the final cost is the markup of the basketball? The wholesale price is $25.00, and the retail price is $35.00.

$W_p \times C_f = M$ (what percentage)(of)(final cost)(is)(markup)

Solution A $W_p \times \frac{35}{1} = \frac{10}{35}$

W_p = 2/7 or 28.6%

Solution B $\frac{W_p}{100} \times \frac{35}{1} = \frac{10}{35}$

$100 \times \frac{W_p}{100} \times 35 = 10 \times 100$

$W_p \times \frac{35}{1} = \frac{1{,}000}{35}$

W_p = 28.6

Example 3 What percent of the original wholesale cost is the markup of the basketball in example 2?

$W_p \times C_o = M$ (what percentage)(of)(original cost)(is)(markup)

Solution A $W_p \times \frac{25}{1} = \frac{10}{25}$

W_p = 2/5 or 40%

Solution B $\frac{W_p}{100} \times \frac{25}{1} = \frac{10}{25}$

$100 \times \frac{W_p}{100} \times 25 = 10 \times 100$

$W_p \times \frac{25}{1} = \frac{1{,}000}{25}$

$W_p = 40$

A variable can be identified further with another letter below it. This is called a subscript, "sub" meaning under, and "script" meaning write. So subscript is "written under". To represent cost we chose "C". To further distinguish "C" we added the subscript "o" for original and "f" for final.

Practice Problems

1) The wholesale price of the golf clubs is $254.00 and the retail price is $299.00. What percentage of the wholesale price is the profit, or markup?

2) The wholesale price of the golf clubs is $254.00 and the retail price is $299.00. What percentage of the retail price is the profit, or markup?

3) The final retail price was 22% above the original wholesale cost, which was $34.00. What is the final price?

4) The used car sold for $1,750.00. The car dealer made a profit of 12% of the original cost. What was the original cost?

Solutions

1) $W_p \times C_w = M$

Solution A

$$W_p \times \frac{254}{254} = \frac{45}{254}$$

$W_p = .177 = 17.7\%$

Solution B

$$\frac{W_p}{100} \times 254 = 45$$

$$W_p = \frac{4500}{254}$$

$W_p = 17.7$

2) $W_p \times C_r = M$

Solution A

$$W_p \times \frac{299}{299} = \frac{45}{299}$$

$W_p = .15 = 15\%$

Solution B

$$\frac{W_p}{100} \times 299 = 45$$

$$W_p = \frac{4500}{299}$$

$W_p = 15$

3) $P_f = P_o + M$

Final price = Original price + Profit

$P_f = P_o + 22\%(P_o)$

$P_f = 34.00 + 22\%(34.00)$

$P_f = 34.00 + 7.48 = \$41.48$

4) $P_f = P_o + M$

Final price = Original price + Profit

$P_f = P_o + 12\%(P_o)$

$1{,}750 = P_o\ (1 + .12)$

$$\frac{1{,}750}{1.12} = P_o \frac{(1.12)}{1.12}$$

$1{,}562.50 = P_o$

Percentages are also used in computing sales tax and tips at a restaurant, as well as in chemistry and many other applications. The key is how you verbalize the problem and create the equation.

Example 4 I collected $142.08 in sales tax for the fourth quarter. Pennsylvania state sales tax is 6%. What were my gross sales during this quarter?

Sales x 6% = 142.08

$$\frac{.06}{.06} S = \frac{142.08}{.06}$$

$S = 2{,}368.00$

Example 5 The final bill at the restaurant was $35.09. This amount included a 15% tip and 6% sales tax. What was the cost of the food, the tip, and the tax? Round to the nearest cent.

$C + 15\%C + 6\%C = 35.09$

$C + .15C + .06C = 35.09$

$$C \frac{(1.21)}{1.21} = \frac{35.09}{1.21}$$

$C = 29.00$

Tax = 6% of 29.00

Tax = 1.74

Tip = 15% of 29.00

Tip = 4.35

Percentages of Elements in a Chemical Compound

A chemical compound is made up of elements. Each element has an atomic weight. When you add up the atomic weights for each of the elements in a compound, you get the molecular weight. The percentage of each element tells us how the mass or weight of the compound is distributed. Atomic weights for selected elements are given in a table below. Use this for future reference. The weights have been rounded to whole numbers for ease of use in the problems. For a complete guide to the elements consult a periodic table.

Symbol	Element	Atomic Weight
H	Hydrogen	1
Li	Lithium	7
Be	Beryllium	9
B	Boron	11
C	Carbon	12
N	Nitrogen	14
O	Oxygen	16
F	Fluorine	19
Na	Sodium	23
Mg	Magnesium	24
Si	Silicon	28
P	Phosphorus	31
S	Sulfur	32
Cl	Chlorine	35
K	Potassium	39
Ca	Calcium	40
Cr	Chromium	52
Fe	Iron	56

Example 1 Find the percentage of hydrogen in water.

H_2O is the chemical compound for water. This means there are 2 atoms of hydrogen and 1 atom of oxygen, H + H + O.*

The atomic weight of the whole compound is: 1 + 1 + 16 = 18

The weight of the hydrogen is 1 + 1 = 2.

The percentage of hydrogen is 2 of 18 or 2/18 = 1/9 = 11%.

The percentage of oxygen is 16 of 18 or 16/18 = 8/9 = 89%.

* In this compound the 2 tells how many hydrogen atoms, and is not a subscript.

Example 2 Find the percentage of carbon in C_2H_2.

C_2H_2 is the chemical compound. This means there are 2 atoms of carbon and 2 atoms of hydrogen, C+C+H+H.

The atomic weight of the whole compound is: 12+12+1+1 = 26

The weight of the hydrogen is 1+1 = 2.

The weight of the carbon is 12+12 = 24.

The percentage of carbon is 24 of 26 or 12/13 = 92%.

The percentage of hydrogen is 2 of 26 or 1/13 = 8%.

Practice Problems

1) Find the percentage of chlorine in NaCl.

2) Find the percentage of sodium in NaOH.

3) Find the percentage of nitrogen in KCN.

4) Find the percentage of potassium in KCN.

5) Find the percentage of oxygen in CO_2.

6) Find the percentage of carbon in CO_2.

Solutions

1) The atomic weight of the NaCl is: 23+35=58
The weight of the chlorine is 35.
The percentage of chlorine is 35/58 = .60 = 60%.

2) The atomic weight of the NaOH is: 23+16+1=40
The weight of the sodium is 23.
The percentage of sodium is 23/40 = .575 = 58%.

3) The atomic weight of the KCN is: 39+12+14=65
The weight of the nitrogen is 14.
The percentage of nitrogen is 14/65 = .215 = 22%.

4) The atomic weight of the KCN is: 39+12+14=65
The weight of the potassium is 39.
The percentage of potassium is 39/65 = .60 = 60%.

5) The atomic weight of the CO_2 is: 12+16+16=44
The weight of the oxygen is 32.
The percentage of oxygen is 32/44 = .727 = 73%.

6) The atomic weight of the CO_2 is: 12+16+16=44
The weight of the carbon is 12.
The percentage of carbon is 12/44 = .272 = 27%.