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1. **Unit Conversions**

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Unit Conversions

- You **must** follow the same method shown below.

- We can convert from one unit to another by using relationships that are equivalent to each other then arranged as a ratio. The ratio is called the **conversion factor.**

- For example, with time we know the following relationships:

Relationship	Conversion Factor
1 min = 60 s	$\dfrac{1\,min}{60s}$ and $\dfrac{60s}{1\,min}$
1 hour = 60 min	$\dfrac{1hour}{60\,min}$ and $\dfrac{60\,min}{1hour}$
24 hours = 1 day	$\dfrac{1day}{24hours}$ and $\dfrac{24hours}{1day}$

Note that the values in the ratios are equal to each other (i.e. 1min = 60 s). Therefore, the ratio really has a value equal to 1. Multiplying any factor by the conversion factor is equivalent to multiplying by 1 and will not change the value of the expression.

The general formula for solving problems using the conversion factor method:

Unknown Amount = (initial amount given in the problem) x (conversion factor)

Examples:

1. How many seconds are there in 49.56 minutes?

$$49.56 \text{ minutes } \times \frac{60 \text{ seconds}}{1 \text{ minute}} = 2973.6 \text{ seconds} = 2974 \text{ seconds (4 sig figs)}$$

2. How many hours are there in 448.2 minutes?

3. How many minutes are there in 44 days? (2 steps)

4. How many seconds are there in 3 days? (3 steps)

5. How old are you in seconds?

Note:
- *All the units cancel each other except the desired unit (s).*
- *The expression " 3 days" is multiplied by three conversion factors that are all equivalent to "1". The final answer changed because the "expression" has a different unit, but the actual **value** is still the same.*

6. If the density of sea water is 1.2 g/mL, calculate the volume of 45g of sea water.

$$45g \ \times \frac{1mL}{1.2g} = 37.5 \text{ mL} = 38 \text{ mL (2 sig figs)}$$

7. If a car is moving at 50.0 km/h, calculate how far (in metres) the car moves in 5.00 seconds.

**ALWAYS INCLUDE THE UNITS FOR ALL THE CALCULATIONS WE DO IN CHEMISTRY.
DO NOT BE TEMPTED TO EXCLUDE THEM!**

More Examples:

8. How many minutes are there in 1.67 week?

9. How many centimeters are in 21.598 km?

10. If you have 45 dozen eggs, how many eggs do you have?

11. If a car can move 50.0 km/h, how far can the car go in 3.2675 hours?

12. One molecule of phosphorus has 4 atoms. How many molecules are there in 448 atoms of phosphorus?

13. If one mole of carbon has a mass of 12.0 g, what is the mass of 4.7 moles of carbon?

14. The density of aluminum is 2.7 g/mL. What is the volume of 7.4 g of aluminum?

15. If a car averages 60.0 km/h, how long will it take to cover 57 km?

"Only those who have the patience to do simple things perfectly will acquire the skill to do difficult things easily."

~ Johann von Schiller (German philosopher)

B. Multiple Unit Conversions

16. How many minutes are there in 3 days?

17. The energy needed to melt 1 kg of ice requires 334 kJ. The largest known iceberg has a volume of about 3.1×10^{13} m^3. How much heat was required to melt the iceberg if 1.0 m^3 of ice has a mass of 917 kg?

18. How far does a car go in 10.00 seconds if it is moving at 50.00 km/h?

19. If 1 yard = 3 feet, 1 foot = 12 inches, and 1 inch = 2.54 cm, how many meters are in 50.00 yards?

20. A sprinter can run 100. metres in 10.0 seconds. How fast is the sprinter moving in km/h?

21. A chicken farmer wished to purchase a gift for his wife. The gift was worth 2 horses. At the local market, 3 horses were worth 5 cows, 1 cow was worth 4 hogs, 3 hogs were worth 4 goats, and 1 goat cost 9 chickens. How much was the gift going to cost the farmer who had to pay in chickens?

22. **Try this this challenging conversion!**

Suppose 1 dip = 6 dops, 1 dop = 8 daps, 1 tick = 13 tocks, and 1 tock = 10 tacks.

Convert 21.1 dips/tack^2 into dops/tock^2.

1) 2974 sec 2) 7.470 hr 3) 63,000 min 4) 3×10^5 sec 5) 9.2×10^8 sec 6) 38 mL 7) 69.4 m
8) 1.68×10^4 min 9) 2.1598×10^6 cm 10) 540 eggs 11) 163.38 km 12) 112 molecules 13) 56 g
14) 2.7 mL 15) 0.95 hr 16) 4×10^3 min 17) 9.5×10^{18} J 18) 0.1389 km 19) 45.72 m 20) 36.0 km/h
21) 160 chickens 22) 1.27×10^4 dops/tocks^2