Chapter 4

24 Hour Time, Exponents, & Scientific Notation

Even a broken clock is correct twice a day.
--Polish Proverb

The 24 Hour-Clock

The 24-hour clock is increasingly used in medical facilities. This time system avoids confusion between *A.M.* and *P.M.* time. Four digits are used to express time in this system. The first two digits indicate the hour, and the last two the minutes.

Here are some examples of A.M. time on the 24-hour clock:

24-Hour Time	**Reading**	***A.M.* Time**
0400	zero four hundred hours	4:00 A.M.
1130	eleven thirty hours	11:30 A.M.
0910	zero nine ten hours	9:10 A.M.

Notice several things:

1) A.M. times and 24 hour times *(excluding midnight to 12:59 A.M.)* possess the same digits except A.M. times drop the leading zero,
2) notice that when reading 24 hour time, you always say *'hours'* at the end,
3) military times that end in a double zero are read as *'hundred hours'*,
4) hours and minutes are read as groups,
5) if the number of hours and/or minutes are less than 9 then each digit is read separately *(example 0908 would be read as 'zero nine zero eight hours')*,
6) and if the number of hours and/or minutes are greater than 9 then each set is read as one number *(example 1132 would be read as 'eleven thirty two hours').*

Based on the information you've been given so far complete the following table:

24-Hour Time	**Reading**	***A.M.* Time**
0230		
1045		
0100		
1150		
0600		
1030		
0235		
1120		

The following illustrates how P.M. time is indicated on the 24-hour clock:

24-Hour Time	**Reading**	***P.M.* Time**
1300	thirteen hundred hours	1:00 P.M.
1830	eighteen thirty hours	6:30 P.M.
2150	twenty one fifty hours	9:50 P.M.

To obtain P.M. time from 24-hour time, subtract the number 1200 from the 24-hour time.

1300 – 1200 = 1:00 P.M.
1830 – 1200 = 6:30 P.M.
2150 – 1200 = 9:50 P.M.

Complete the following table:

24-Hour Time	**Reading**	***P.M.* Time**
1800		
1945		
1415		
2320		
1500		
1730		
2145		
2350		

The following are the answers to the above table: 1800 – eighteen hundred hours – 6:00 P.M.; 1945 – nineteen forty five hours – 7:45 P.M.; 1415 – fourteen fifteen hours – 2:15 P.M.; 2320 – twenty three twenty hours – 11:20 P.M.; 1500 – fifteen hundred hours – 3:00 P.M.; 1730 – seventeen thirty hours – 5:30 P.M.; 2145 – twenty one forty five hours – 9:45 P.M.; 2350 – twenty three fifty hours – 11:50 P.M.

The time between 12:00 midnight and 1:00 A.M. is written and read as follows:

24-Hour Time	**Reading**	***A.M.* Time**
0010	zero zero ten hours	12:10 A.M.
0045	zero zero forty five hours	12:45 A.M.

Complete the following table:

24-Hour Time	**Reading**	***A.M.* Time**
0020		
0008		
0030		
0015		

The following are the answers to the above table: 0020 – zero zero twenty hours – 12:20 A.M.; 0008 – zero zero zero eight hours – 12:08 A.M.; 0030 – zero zero thirty hours – 12:30 A.M.; 0015 – zero zero fifteen hours – 12:15 A.M.

Technically midnight is supposed to be *'zero zero zero zero hours'* but is often referred to as *'twenty four hundred hours'*. Expect to see both done at some point when working in a hospital.

Worksheet 4-1

Name:

Date:

Complete the following table:

24-Hour Time	**Reading**	***A.M./P.M. Time***
0315	zero three fifteen hours	3:15 A.M.
1140		
1400		
2230		
0030		
1050		
		6:15 A.M.
		10:50 A.M.
		9:45 P.M.
		1:15 P.M.
		12:15 A.M.
		12:05 A.M.
	zero nine thirty hours	
	twenty-two thirty hours	
	zero zero twenty hours	
	fourteen twenty-five hours	
	zero zero zero seven hours	
	zero one hundred hours	

Exponents

Exponents show how many times a number is multiplied by itself. A number with an exponent is said to be "raised to the power" of that exponent.

Example:

Three raised to the power of four would be written:
3^4
and it would equal:
$3^4 = 3 \times 3 \times 3 \times 3 = 81$

A couple of "powers" have their own names. If something is raised to the power of two, it may also be called "squared".

Example:

Three squared = $3^2 = 3 \times 3 = 9$

If something is raised to the power of three, it may also be called "cubed".

Example:

Three cubed = $3^3 = 3 \times 3 \times 3 = 27$

There are two additional rules to remember:

any number raised to the zero power (except 0) equals 1;

Example:

$3^0 = 1$

any number raised to the power of one equals itself.

Example:

$3^1 = 3$

Solve the following practice problems:

1) 2^3
2) 4^5
3) 6^2
4) 1^3
5) 3^5
6) 5^3
7) 7^4
8) 8^1
9) 9^0

1) 8 2) 1,024 3) 36 4) 1 5) 243 6) 125 7) 2,401 8) 8 9) 1

Scientific Notation

Scientific notation provides an easier way of writing very small and very large numbers and is sometimes referred to as “power-of-ten”. A number written in scientific notation is written as a product of a number between 1 and 10 and multiplied by a power of 10 .

Here are some examples of large numbers:

$$100 = 1 \times 10 \times 10 = 1 \times 10^2$$

$$100{,}000 = 1 \times 10 \times 10 \times 10 \times 10 \times 10 = 1 \times 10^5$$

$$427{,}000 = 4.27 \times 10 \times 10 \times 10 \times 10 \times 10 = 4.27 \times 10^5$$

There is an easy shortcut to scientific notation, move the decimal point so that there is only one digit to the left of it. Count the number of spaces the decimal has been moved, and this becomes the exponent on the base 10.

- If you move the decimal to the left, the exponent will be positive.
- If you move the decimal to the right, the exponent will be negative.

The mass of the Earth would be a very large number:

$$5{,}973{,}600{,}000{,}000{,}000{,}000{,}000{,}000 \text{ kg} = 5.9736 \times 10^{24} \text{ kg}$$

Here are some examples of small numbers:

$$0.008 = 8 \times 10^{-3}$$

$$0.000234 = 2.34 \times 10^{-4}$$

The mass of an electron would be a very small number:

$$0.000000000000000000000000000000091093826 \text{ kg} = 9.1093826 \times 10^{-31} \text{ kg}$$

Write the following numbers in scientific notation:

1) 1,000,000
2) 1
3) 807,000
4) 0.1
5) 6,100,000
6) 0.0303
7) 0.0018
8) 0.00014

1) 1×10^6 2) 1×10^0 3) 8.07×10^5 4) 1×10^{-1} 5) 6.1×10^6 6) 3.03×10^{-2} 7) 1.8×10^{-3} 8) 1.4×10^{-4}

Worksheet 4-2

Name:

Date:

Solve for the values of the following exponential numbers.

1) 1^1 = _____

2) 2^1 = _____

3) 1^2 = _____

4) 2^2 = _____

5) 2^3 = _____

6) 3^2 = _____

7) 3^3 = _____

8) 3^4 = _____

9) 10^2 = _____

10) 6^3 = _____

11) 5^0 = _____

12) 5^2 = _____

13) 4^0 = _____

14) 9^2 = _____

15) 9^0 = _____

16) 12^4 = _____

17) 12^3 = _____

18) 10^4 = _____

19) 7^0 = _____

20) 7^3 = _____

Convert the following numbers to scientific notation.

21) 1,000 = _____

22) 1 = _____

23) 67,000,000 = _____

24) 0.1 = _____

25) 0.00306 = _____

26) 1,000,000 = _____

27) 909,000 = _____

28) 0.001 = _____

29) 0.00028 = _____

30) 0.000000614 = _____

Convert the following scientific notation to regular numbers.

31) 6.14×10^{-7} = _____

32) 3.06×10^{-3} = _____

33) 2.8×10^{-4} = _____

34) 1×10^{-1} = _____

35) 1×10^{-3} = _____

36) 6.7×10^{7} = _____

37) 9.09×10^{5} = _____

38) 1×10^{0} = _____

39) 1×10^{6} = _____

40) 1×10^{3} = _____

Worksheet 4-3

Name:

Date:

Complete the following table.

24-Hour Time	**Reading**	***A.M./P.M. Time***
0315	zero three fifteen hours	3:15 A.M.
1040		
2100		
1230		
		7:15 A.M.
		10:45 P.M.
	zero eight thirty hours	
	twenty-two fifteen hours	
1020		
2200		
1130		
		7:15 P.M.
		10:45 A.M.
	twelve thirty hours	
	twenty-two ten hours	

Solve for the values of the following exponential numbers.

1) 6^3 = _____

2) 5^2 = _____

3) 4^7 = _____

4) 3^4 = _____

5) 10^2 = _____

6) 6^2 = _____

7) 5^3 = _____

8) 4^5 = _____

9) 3^3 = _____ 10) 10^4 = _____

Express the following numbers in scientific notation.

11) 10,000,000 = _____ 17) 1,000,000 = _____

12) 351 = _____ 18) 35 = _____

13) 7,100 = _____ 19) 6,100 = _____

14) 0.037 = _____ 20) 0.37 = _____

15) 0.3750 = _____ 21) 0.375 = _____

16) 0.0064 = _____ 22) 0.0056 = _____

Worksheet 4-4 (tougher problems)

Name:

Date:

Solve the following problems to further your knowledge on 24 hour time, exponents, and scientific notation.

1) While working in the pharmacy, you receive an order to give a medication every four hours around the clock. If the patient's nurse tells you that she wants to give the first dose at 1 p.m., what times will you schedule the medication? *(give your answers in 24-hour time)*

2) Avogadro's Number is very useful in pharmaceutical chemistry as it provides a means for accurately determining the number of atom's that exist in a mass of a specific substance. If you have 6.02×10^{23} atoms of a pure substance it will have the same mass (in grams) as its SI number found on the periodic table. Write out Avogadro's Number (6.02×10^{23}) without using scientific notation.

3) $27^2 \div 3^2 =$

4) Whenever two problems written in scientific notation are multiplied you may multiply the initial numbers normally and add the exponents to get your answer. An example would be:

   $(2 \times 10^2)(3 \times 10^4) = 6 \times 10^6$

   With that in mind solve the following problem:

   $(1.2 \times 10^5)(5 \times 10^7) =$

5) Whenever two problems written in scientific notation are divided you may divide the initial numbers normally and subtract the exponents to get your answer. An example would be:

   $(6 \times 10^6) \div (3 \times 10^4) = 2 \times 10^2$

   With that in mind solve the following problem:

   $(6 \times 10^{12}) \div (1.2 \times 10^5) =$