# Healthcare Math:

# Calculating Dosage



Industry: Healthcare

Content Area: Mathematics

**Core Topics**: Applying medical abbreviations to math problems, using formulas, solving algebraic equations

**Objective**: Students will be able to accurately calculate the dosage of medication in the correct form to fill a doctor's prescription

#### Materials included:

Instructor's notes Scenario: Pharmacy Technician Student worksheets Handouts Quiz Answer Keys

# Industry Overview:

According to the U.S. Department of Labor, the healthcare industry is expected to generate over 20% of all new jobs created in the U.S. economy between 2012 and 2022.\* The healthcare industry is comprised of a vast array of jobs, ranging from nursing assistants to physicians. Mathematics and literacy skills are essential for students who plan to pursue a career in this field. Healthcare professionals, including pharmacy technicians, need to understand medical terms, abbreviations, and metric measurements. They must also have the ability to use formulas to calculate the correct dosage of medication for patients.

\* Source: <u>http://www.bls.gov/news.release/ecopro.t06.htm</u>

#### Instructor's notes:

- The purpose of this module is to help students develop and apply math skills in a healthcare workplace setting. The learning activities were designed to be incorporated throughout multiple instructional periods as math concepts are taught in a healthcare context.
- After completing the module, students should be able to:
  - Interpret the essential information contained on a prescription
  - Apply medical abbreviations to solve mathematical problems
  - Use a formula to calculate the correct dosage of medication to fill prescriptions
- Setting the stage: Provide students with background information about the typical responsibilities of a pharmacy technician. You may want to have students use the occupational outlook handbook, O\*NET and/or other relevant websites to research the job responsibilities, educational/training requirements, salary, etc. for this position. In addition, you could have students view YouTube videos depicting the typical responsibilities of a pharmacy technician. (See links below)

Bureau of Labor Statistics – Occupational Outlook Handbook: <a href="http://www.bls.gov/ooh/">http://www.bls.gov/ooh/</a>

Occupational Information Network (O\*NET) http://www.onetonline.org/link/summary/29-2052.00

Pharmacy Technician videos: http://www.youtube.com/watch?v=DW81Hd2YENY

http://www.youtube.com/watch?v=E\_cBkSiaQD8

- For Activity 1: Prescription Abbreviations Have students work individually, or in pairs, to review and study common prescription abbreviations listed in the scenario. You may want students to make flash cards to quiz each other on the terms. Have students complete Worksheet 1.
- For Activity 2: Decoding Prescriptions As a class, review the sample prescription and decode the information. Using copies of Worksheet 2, have students practice translating the information on several prescriptions. Handouts 2A, 2B, & 2C have some sample prescriptions, or you may want to use others of your own choosing.
- For Activity 3: Calculating Dosage Explain the dosage formula to students. As a class, practice putting the information into the formula and calculating the dosage. One example is contained in the scenario. You may want to provide additional examples for students. Have students complete Worksheet 3A and Worksheet 3B.
- Assessment: Quiz Calculating Dosage

# Workplace Scenario: Pharmacy Technician

Maria is a pharmacy technician at a local pharmacy. Working under the supervision of a pharmacist, she fills a variety of prescriptions for customers each day. Currently, you are a pharmacy technician student receiving on-the-job training from Maria.

# Activity 1: Prescription Abbreviations

Maria tells you that filling prescriptions accurately is extremely important, even one small error could cause great harm, or even death to a patient. The first step in filling any prescription is to understand all the information contained on the prescription form, including the medical abbreviations. Maria gives you the following chart to help you learn some common abbreviations used on prescriptions. She then asks you to complete **Worksheet 1**.

Abbreviation	Meaning
ac	before meals
bid	twice a day
cap	capsule
d	day (24 hours)
Exlir.	liquid or syrup
g	gram – dry measure used in tablets
gr	grains – dry weight of medication
gt	drop
h	hour
hs	at bedtime
IM	Intramuscular
mg	milligram – dry weight measure
mL	milliliter – liquid volume measure
ро	by mouth
рс	after meals
pil	pill
prn	as needed
q	every
q2h	every 2 hours
qd	every day
qh	every hour
Sig	patient instructions
qid	4 times a day
Supp.	medications inserted rectally
Ť	One tablet
tab	tablet
tid	3 times a day
U	Unit

# Some common abbreviations found on prescriptions

Directions: Put the letter of the definition next to the correct medication abbreviation

l.qid	A. by mouth or orally
2. hs	B. liquid or syrup
3. bid	C. every day
4.g	D. three times a day
5. mg	E. medication inserted rectally
6.po	F. milligram
7.qd	G. four times a day
8. gr	H. every 6 hours
9. U	I. milliliters
10. tid	J. as needed
11. Elix	K. grain
12. Supp	L. Unit
13.q6h	M. at the hour of sleep; bedtime
14. mL	N. gram
15.prn	O. twice a day

# Activity 2: Decoding Prescriptions

Maria wants you to learn how to accurately interpret the information contained on a typical prescription. This includes the name of the medication, the dosage and form of the medication, the amount to be taken, the method of administration, and the frequency and duration the medication will be taken. As a pharmacy technician, you need to read the prescription very carefully. Many medications have similar names or come in more than one form. For example, an older adult may take the capsule or tablet form of a medication, while a young child might be prescribed an elixir, the liquid form of a medication. She gives you the following sample prescription and asks, "How would you translate this information?"

Address:		MN 55804	)
Rx Amoxic	illin 250 m	CP I	# 42
11 tabl		u. A r uays	
Do Not Refill .	xó	(Sign)	M.D
Refill1 Date 10/3/00		D.E.A. Numb Print Last Na	

Maria explains:

The first part of a prescription is the name of the drug; it can be a brand name or generic. On this prescription, the drug name is Amoxicillin. The next part—250 mg—denotes the strength of the drug. In this case, it's 250 milligrams in the form of tablets. "TT" stands for two tablets. The "po" means the medication is taken by mouth "tid" or three times a day. The 'x' indicates this prescription is to be taken for a period of 7 days. Two tablets x 3 times a day for 7 days = 42, the total number of tablets to be dispensed.

Maria gives you several prescriptions and asks you to complete all the information on **Worksheet 2** for each prescription.

Name: \_\_\_\_\_

**Directions:** On your own paper, record the following information for each prescription your instructor gives you.

The patient's full name	
The date	
The drug name in manufacturer or generic format	
The doctor's order for dosage amount (how much medication)	
The administration route (by mouth, IV, injection)	
The frequency with which the patient is to take the medication	
The duration, the number of days that the patient is to take the medication	
The total quantity or amount that the pharmacist is to dispense	
A check-off or box allowing a generic substitute (if provided)	
The physician's name	
The physician's DEA number	

# Handout 2A: Sample Prescriptions

Phone 123-456-7890		DEA# 012345678
Р	atty Street, MD	
	Pediatrician	
Pt. name Tim Jones	Age 10	Date Aug. 30,
2014	_	_
Address: 2 Joyce Road,	Anyway, IL 620	00
•	• •	
$R_{y}$ Ceclor 10 mL bid x 10	0 d	
Refill: 0 <u>X</u> Generic ar	nd/or equivaler	nt allowed
<u></u> donorio di		
Physician's Signature	PStreet	
Pediatric Center		
123 Abbey Road		
Anvway II. 62000		

Phone 123-456-7890 DEA# 012345678		
Sarah Jean, MD		
Pt. name <u>Mary Brown</u> Age <u>47</u> Date <u>Sept. 20, 2014</u> Address: <u>789 6th Street</u> ,		
R <sub>x</sub> <u>Darvon 1 g tab. p.o. q4h for 3 days</u>		
Refill <u>Ø</u> Generic and/or equivalent allowed Physician's Signature S Jean		
SIMedical Associates 23South Street Anytown, IL 62222		

Phone 123-456-7890 DEA# 0123456	78	
Sarah James, MD		
Pt. name Jeff Howard Age 53 Date Sept. 20,	2014	
Address: 1234 5th Street,		
R <sub>x</sub> <u>Ampicillin 250mg po qid x 10 days</u>		
Refill $\underline{\emptyset}$ Generic and/or equivalent allowed		
Physician's Signature Stames		
SJMedical Associates 23South Street Anytown, IL 62222		

March 5, 2005 John Smith, MD 555 5th Ave Anywhere, USA 12345 (555)555-5555 For: Jane Doe Rx: Lasix 20 mg. P.O., Daily Disp: #30 Refills: 2 MD signature Provider number Generic

# Handout 2C: Sample Prescriptions



J.Q. Physicia 1234 Any Austin, Texa (512) 123	Street s 78701
Name: M.Y. Patient	Date: 6/15/02
Address: 789 Happy Dr	., Austin, TX
A generically equivalent drug prod the practitioner hand writes the 'Brand Medically Necessary' on	words 'Brand Necessary' or
Procardia 1 #30	0mg
1 daily in a.	m.
Brano	l Necessary
Refill 2_times	Q. Physician
The second se	Signature

## Activity 3: Calculating Dosage

Maria says you are now ready to learn the dosage formula used to calculate the amount of medication needed to fill a prescription.

## Dosage Formula:

<u>Doctor's Order (D)</u> x quantity(Q) = individual dosage to be administered Supply on Hand (H)

Short version:  $\underline{D} \times \mathbf{Q} = \mathbf{one} \ \mathbf{dose}$ 

The formula can be read as: The <u>doctor's order</u> (the numerator) divided by the <u>supply on hand</u> (the denominator), multiplied by <u>the quantity</u> equals <u>the amount of one dose of medication</u>.

# Understanding the parts of the Dosage Formula

Doctor's Order (D) is the name and amount of the medicine prescribed by the doctor

Supply on Hand (H) is the amount per item of the medication that is available in the pharmacy

Quantity (Q) is the form of the medication, such as tablet, capsule, or milliliter.

Dosage is the amount of medication to be given in one dose

**Important**: The doctor's order and the supply on hand must be in the same unit of measure, such as grams (g), milligrams (mg), and milliliters (mL). Answers must include the correct unit notation.

Maria gives you the following example: Dr. Smith has prescribed 30 mg of medicine for her patient. The drug label on the medicine indicates that the medicine is supplied in 60 mg per tablet. We will use the dosage formula to calculate the correct amount of medication for one dose.

(D) 30 mg x (Q) 1 tablet = 0.5 mg. Therefore, one dose will be one half (1/2) tablet (H) 60 mg

**Important**: In the medical field, any decimal number that is not greater than 1 should have a 0 in front of the decimal point. Thus, the correct form for the dosage in this example is 0.5 mg, **not** .5 mg

#### Worksheet 3A: Calculating Dosage

Name

(H) 250 mg

(D) 500 mg x (Q) 1 tablet =

Maria gives you several prescriptions for you to practice using the formula to calculate the dosage. Make sure you include the correct form (g, mg, mL, etc.) when making your calculations. The first one has been set up for you. Note: If the quantity (Q) is larger than 1, you may want to simplify (cancel) before multiplying.

Dosage formula: <u>D</u> x Q = one dose H

- 1. Order:500 mgSupply on hand:250 mg per tablet
- 2. Order: 1 g Supply on hand: 0.5 g per capsule
- 3. Order:50 mgSupply on hand:25 mg per 5 mL
- 4. Order: 1000 mg Supply on hand: 2000 mg per scored tablet
- 5. Order: 500 mg Supply on hand: 125 mg per caplet
- 6. Order: 250 mg Supply on hand: 125 mg per capsule
- 7. Order: 25 mg Supply on hand: 100 mg per 20 mL
- 8. Order: 75 mg Supply on hand: 5 mg per 20 mL
- 9. Order: 5 mg Supply on hand: 32 mg per 8 mL
- 10. Order:500 mgSupply on hand:50 mg per 2 mL

Maria now wants you to calculate the individual dose, the daily dose, and the total amount needed to fill the complete prescription for several patients. Refer to your abbreviations list to help you decode the prescription information, if needed. Remember to write the form of medication in your answer.

Prescription	Single dose	Daily dose	Complete prescription
Ampicillin 500 mg po qid x 5 d On hand: 250 mg capsules			
Digoxin elixir 150 mcg po tid x 10 d On hand: 50 mcg/mL			
Codeine sulfate 60 mg po q4h x 7 d On hand: 30 mg tablets			
Clondine 0.4 mg po bid x 3 d On hand: 0.1 mg tablets			
Amoxicillin 250 mg po qid x 10 d On hand: 125 mg capsules			
Lasix 40 mg po qd x 30 d On hand: 20 mg tablets			
Ampicillintrihydrate 250 mg po qid x 10 d On hand: 125 mg per 5 mL	k		

Name \_\_\_\_\_

For each of the following doctor's orders, calculate the individual dose of medication.

- 1. Dr. Jones prescribed Plendil 7.5 mg. The drug label reads: Plendil 2.5 mg tab.
- 2. The doctor ordered Dilaudid 1.5 mg IM from a vial that is labeled 0.6 mg per mL
- 3. Dr. Sam prescribed 20 mg of a medication. You have 10 mg per 5 mL.
- 4. The physician ordered Procardia XL 60 mg. The drug on hand is Procardia XL 30 mg tablets.
- 5. Dr. Garza prescribed 30 mg of Phenobarbital. The pharmacy has 15 mg capsules available.

For each of the following prescriptions, calculate the individual dose, the daily dose, and the total amount needed to fill the complete prescription.

		Single dose	Daily dose	Total amount
6.	Amoxicillin 500 mg capsule po tid x 10 d On hand: 500 mg/1 capsule			
7.	Prednisone 40 mg po bid x 3 d On hand: 10 mg tablet			
8.	Ciprofloxin 750 mg po qd x 10 d On hand: 500 mg scored tablet			
9.	PenVK 250 mg po qid x 10 d On hand: PenVK 250 mg/1 tsp			
10	. Acetaminophen 500 mg tab po q4h x 5 d On hand: 250 mg/1 tablet	l 		

l.qid <u>G</u>	A. by mouth or orally
2.hs <u>M</u>	B. liquid or syrup
3. bid <u>O</u>	C. every day
4.g <u>N</u>	D. three times a day
5. mg <u>F</u>	E. medication inserted rectally
6.po <u>A</u>	F. milligram
7.qd <u>C</u>	G. four times a day
8.gr <u>K</u>	H. every 6 hours
9.U <u>L</u>	I. milliliters
10. tid <u>D</u>	J. as needed
11. Elix. <u>B</u>	K. grain
12. Supp. <u>E</u>	L. Unit
13.q6h <u>H</u>	M. at the hour of sleep; bedtime
14. mL <u>I</u>	N. gram
15. prn	O. twice a day

# Answers will vary depending on the prescriptions used for this activity

The patient's full name	
The date	
The drug name in manufacturer or generic format	
The doctor's order for dosage amount (how much medication)	
The administration route (by mouth, IV, injection)	
The frequency with which the patient is to take the medication	
The duration, the number of days that the patient is to take the medication	
The total quantity or amount that the pharmacist is to dispense	
A check-off or box allowing a generic substitute (if provided)	
The physician's name	
The physician's DEA number	

Dosage Formula:  $\underline{D} \times \mathbf{Q} = \mathbf{drug} \, \mathbf{dose}$ 

- 1. Order:500 mgSupply on hand:250 mg per tablet2 tablets
- 2. Order:
   1 g

   Supply on hand:
   0.5 g per capsule
- 3. Order:
   50 mg

   Supply on hand:
   25 mg per 5 mL
   10 mL
- 4. Order:1000 mgSupply on hand:2000 mg per scored tablet ½ tablet
- 5. Order:500 mgSupply on hand:125 mg per caplet4 caplets
- 6. Order:250 mgSupply on hand:125 mg per capsule2 capsules
- 7. Order:
   25mg

   Supply on hand:
   100 mg per 20 mL
   5 mL
- 8. Order:75 mgSupply on hand:5 mg per 20 mL
- 9. Order:
   5 mg

   Supply on hand:
   32 mg per 8 mL
   1.25 mL
- 10. Order:
   500 mg

   Supply on hand:
   50 mg per 2 mL
   20 mL

<u>300 mL</u>

Worksheet 3B: Filling Complete Prescriptions

Answer Key

Prescription	Single dose	Daily dose	Complete prescription		
Ampicillin 500 mg po qid x 5 d On hand: 250 mg capsules	2 capsules	<u>8 capsules</u>	40 capsules		
on hand. 200 mg capsules	2 04930103	0 000000	<u>+0 capsules</u>		
Digoxin elixir 150 mcg po tid x 10 d					
On hand: 50 mcg/mL	<u>3 mL</u>	<u>9 mL</u>	<u>90 mL</u>		
Codeine sulfate 60 mg po q4h x 7 d					
On hand: 30 mg tablets	<u>2 tab</u>	<u>12 tab</u>	<u>84 tab</u>		
Clondine 0.4 mg po bid x 3 d					
On hand: 0.1 mg tablets	<u>4 tab</u>	<u>8 tab</u>	<u>24 tab</u>		
Amoxicillin 250 mg po qid x 10 d					
On hand: 125 mg capsules	<u>2 tab</u>	<u>8 tab</u>	<u>80 tab</u>		
Lasix 40 mg po qd x 30 d					
On hand: 20 mg tablets	<u>2 tab</u>	<u>2 tab</u>	<u>60 tab</u>		
Ampicillintrihydrate 250 mg po qid x 10 d					
On hand: 125 mg per 5 mL	<u>10 mL</u>	<u>40 mL</u>	<u>400 mL</u>		

For each of the following doctor's orders, calculate the individual dose of medication:

- Dr. Jones prescribed Plendil 7.5 mg. The drug label reads: Plendil 2.5 mg tab.
   3 tab
- 2. The doctor ordered Dilaudid 1.5 mg IM from a vial that is labeled 0.6 mg per mL

2.5 mL

- Dr. Sam prescribed 20 mg of a medication. You have 10 mg per 5 mL.
   10 mL
- 4. The physician ordered Procardia XL 60 mg. The drug on hand is Procardia XL 30 mg tablets.

2 tab

Dr. Garza prescribed 30 mg of Phenobarbital. The pharmacy has 15 mg capsules available.
 2 capsules

For each of the following prescriptions, calculate the individual dose, the daily dose, and the total amount needed to fill the complete prescription.

	Single dose	Daily dose	Total amount
<ol> <li>Amoxicillin 500 mg capsule po tid x 10 On hand: 500 mg/1 capsule</li> </ol>	d <u>1 capsule</u>	<u>3 capsules</u>	<u>30 capsules</u>
<ol> <li>Prednisone 40 mg po bid x 3 d</li> <li>On hand: 10 mg tablet</li> </ol>	<u>4 tabs</u>	<u>8 tabs</u>	<u>24 tabs</u>
<ol> <li>Ciprofloxin 750 mg po qd x 10 d</li> <li>On hand: 500 mg scored tablet</li> </ol>	<u>1 ½ tabs</u>	<u>1 ½ tabs</u>	<u>15 tabs</u>
<ol> <li>PenVK 250 mg po qid x 10 d</li> <li>On hand: PenVK 250 mg/1 tsp</li> </ol>	<u>1 tsp</u>	<u>4 tsp</u>	<u>40 tsp</u>
10. Acetaminophen 500 mg tab po q4h x 5 On hand: 250 mg/1 tablet	d <u>2 tabs</u>	<u>12 tabs</u>	<u>60 tabs</u>