Dosage Calculation

Unit: Basic Skills

Problem Area: Basic Mathematics Skills

Lesson: Dosage Calculation

Student Learning Objectives.

Instruction in this lesson should result in students achieving the following objectives:

1. **Calculate dosages based on body weight.**
2. **Calculate dosages based on body surface area (BSA).**
3. **Calculate dosages for various age groups (e.g., infants, children, adults, and the elderly).**

Resources.

The following resources may be useful in teaching this lesson:

Ansel, Howard and Stoklosa, Mitchell. *Pharmaceutical Calculations*, 12th ed. Lippincott Williams & Wilkins, 2006.

"Body Surface Area Calculator for Medication Doses," *halls.md*. Accessed July 1, 2010. <http://www.halls.md/body-surface-area/bsa.htm>.

Fred, Linda Y., ed. *Manual for Pharmacy Technicians*, 3rd ed. American Society for Health-System Pharmacists, 2005.

"Pharmacy Technician Math," *Pharmacy Tech Study*. Accessed July 1, 2010. <http://www.pharmacy-tech-study.com/math.html>.

Quan, Kathy. "Five Rights of Medication Safety," *Suite101.com*. Accessed July 1, 2010. <http://public-healthcare-issues.suite101.com/article.cfm/five_rights_of_medication_safety>.

"To Err Is Human: Building a Safer Health System," *The Institute of Medicine: The National Academies Press*. Accessed July 1, 2010. <http://www.nap.edu/openbook.php?record_id=9728&page=1>.

Equipment, Tools, Supplies, and Facilities

- ✓ Overhead or PowerPoint projector
- ✓ Visual(s) from accompanying master(s)
- ✓ Copies of sample test, lab sheet(s), and/or other items designed for duplication
- ✓ Materials listed on duplicated items
- ✓ Computers with printers and Internet access
- ✓ Classroom resource and reference materials

Key Terms.

The following terms are presented in this lesson (shown in bold italics):

- body surface area (BSA)
- dosage regimen
- dose
- dosing range
- solution
- suspension

Interest Approach.

Use an interest approach that will prepare the students for the lesson. Teachers often develop approaches for their unique class and student situations. A possible approach is included here.

> *Ask the students how many people they think are affected by medication errors. Perhaps they know someone with an unfortunate story regarding a medication error. Ask why they think medication errors occur and what things could be done to prevent them.*

> *Share the following with your students: In 1999, the Institute of Medicine issued an executive summary ("To Err is Human: Building a Safer Health System") and shocked the nation by bringing to light how common medical errors occur. Nearly a decade later, we heard about infant deaths due to wrong strengths of heparin given to them. Medication errors were again a hot topic when a heparin error occurred in the twins of Dennis Quaid and his wife. (On average, medication errors account for approximately 770,000 injuries and deaths each year in hospitals.)*

CONTENT SUMMARY AND TEACHING STRATEGIES

Objective 1: Calculate dosages based on body weight.

Anticipated Problem: What type of calculations would be needed to determine doses based on weight?

I. Calculating dosages based on body weight

A. A ***dose*** is a measured or calculated amount of medication that a patient receives for a desired medical effect.

1. The amount can be taken at one time or divided into two to four doses per day. The frequency of the medication depends on characteristics of the drug and the severity of the patient's illness.
2. The total dose is the amount of medication taken for the course of therapy. The ***dosage regimen*** is specific instructions regarding the dosage amount and the duration. For a urinary tract infection, the dosage regimen would be nitrofurantoin 100 mg by mouth two times daily for three days. The total daily dose is 100 mg (50 mg × 2), and the total dose would be 300 mg (100 mg daily × 3 days).

B. The amount of the dose (the number value associated with it) varies greatly. Some doses may seem small and others may seem large. Several factors determine the dosage:

1. The drug's potency
2. Its physical and chemical properties
3. The dosage form (e.g., tablet, injection, suppository, or liquid)

C. Dosage forms include tablets, capsules, suppositories, and liquids. The liquids can be separated further into a solution or a suspension.

1. A ***solution*** is a liquid preparation that contains medication dissolved in the vehicle, which is usually water. If the solution is listed on the bottle as syrup, it contains sugar and a tincture—a medical substance dissolved in alcohol. This is an important consideration for various groups (e.g., infants, youth, and diabetics).
2. A ***suspension*** is a liquid preparation that contains small drug particles dispersed evenly throughout the vehicle. It is important to shake this dosage form before it is given to the patient. If it is not shaken, the amount of drug in each dose will not be the same; the majority of the particles will settle to the bottom.

D. Calculating a patient's dose is one of the most important responsibilities and one of the most common calculations performed by pharmacy personnel. A few steps are involved when calculating or checking a patient's dose.

1. It is necessary to start with a dosing range that provides an approximate idea of how much to give the patient. A ***dosing range*** is a guideline usually supplied by the original manufacturer of the drug; it is based on studies conducted to find the optimal range for the desired therapeutic effect. Some examples of how this can be listed are mg/kg/dose, mg/kg/day, and mg/m^2.
    a. Many resources or references contain dosing guidelines. Some of the most widely used are Facts and Comparisons®, Lexi-comp Drug Information®, and Micromedex®. These references are available as hard copies and online, but online access requires a subscription. Lexi-comp® is a useful dosing application for smart phones or other portable media devices (e.g., ITouch®, Palm®, or Pocket PC®), but it also requires a subscription. Regardless of the work setting, there is usually a hard copy of at least one dosing reference.
    b. It is safest to use references specific to the patient population needing the dose (e.g., neonatal, pediatric, or geriatric).
2. It is essential to obtain the patient variable upon which the dose is dependent. Tell your students that the following example is calculating doses based on weight, so the patient's weight needs to be known.
3. With that information, it is possible to calculate the amount of drug the patient should receive for each dose and how much total drug is needed to fill the prescription.

E. Example 1: A patient is to receive a chemotherapy medication (cyclophosphamide) for breast cancer.

1. According to Micromedex, the following dose is recommended: 50 mg/kg intravenously (IV) in divided doses for 5 days.
2. The patient weighs 190 pounds.
3. Have your students calculate the dose required.

$$\frac{50\ \text{mg}}{\cancel{\text{kg}}} \times \frac{1\ \cancel{\text{kg}}}{2.2\ \cancel{\text{lb}}} \times 190\ \cancel{\text{lb}} = 4{,}320\ \text{mg (rounded) total dose}$$

4,320 mg divided by 5 = 864 mg each day for 5 days

F. Example 2: An antibiotic (daptomycin) is to be given at a dose of 5 mg/kg/day for 7 days. Ask the students: What would the patient's daily dose be if he or she weighs 245 pounds?

$$\frac{5\ \text{mg}}{\cancel{\text{kg}}} \times \frac{1\ \cancel{\text{kg}}}{2.2\ \cancel{\text{lb}}} \times 245\ \cancel{\text{lb}} = 560\ \text{mg (rounded) IV daily for 7 days}$$

G. A more common scenario is dose checking rather than calculating the dose. The steps are essentially the same. If the technician is filling a prescription for an adult female for cephalexin 500 mg (qid) four times daily, 40 should be dispensed.
   1. The dose should be checked in a reference. According to Lexi-comp Drug Information®, the dose would be 250 to 1000 mg every 6 hours.
   2. According to the above information, the dose is appropriate.

Teaching Strategy: *The key to mastering the objectives is practice and exposure to commonly encountered problems. Use VM–A and the following Web site for practice calculating doses: http://www.pharmacy-tech-study.com/math.html.*

Objective 2: Calculate dosages based on body surface area (BSA).

Anticipated Problem: How can dosages be calculated based on body surface area?

II. Calculating dosages based on body surface area (BSA)

A. ***Body surface area*** is the measured surface area of the body.
   1. Several calculations can be used to determine this, but the most commonly used is the DuBois & DuBois formula calculated as follows:

$$\text{BSA } (m^2) = 0.007184 \times \text{weight (kg)}^{0.425} \times \text{height (cm)}^{0.725}$$

   2. The average surface area varies with age and gender.
      Adult men: 1.9 m^2
      Adult women: 1.6 m^2
      Children (9 years): 1.07 m^2
      Children (10 years): 1.14 m^2
      Children (12 to 13 years): 1.33 m^2
   3. Few drug dosing calculations utilize BSA, with the main drug class being chemotherapy agents.

B. The same steps as calculating doses by body weight should be used.
   1. A reference should be consulted for the dosing guideline (listed in mg/m^2).
   2. The patient's height in cm and weight in kg should be obtained to calculate a BSA.
   3. The dose from the dosing guideline should be multiplied by the BSA in m^2 for the desired dose.

C. One possible dosing regimen for stomach cancer is a combination of two chemotherapy drugs: docetaxol and cisplatin. The patient weighs 137 lb and is 5 feet and 5 inches.
   1. Per Micromedex, the dose for docetaxol is 75 mg/m^2, and the dose for cisplatin is 750mg/m^2 given intravenously for 5 days every 3 weeks.

2. Have your students calculate the patient's BSA using the DuBois & DuBois formula.
   a. Have your students calculate the height in cm.

      5 feet 5 inches = 65 inches

      $$64 \text{ inches} \times \frac{2.54 \text{ cm}}{1 \text{ inch}} = \underline{165.1 \text{ cm}}$$

   b. Have your students calculate the weight in kg.

      $$137 \text{ lb} \times \frac{1 \text{ kg}}{2.2 \text{ lb}} = \underline{62.3 \text{ kg}}$$

   c. Have your students calculate the BSA.

      $$\text{BSA } (m^2) = 0.007184 \times \text{weight } (kg)^{0.425} \times \text{height } (cm)^{0.725}$$

      $$0.007184 \times (62.5 \text{ kg})^{0.425} \times (165.1 \text{ cm})^{0.725} = \underline{1.68 \text{ m}^2}$$

   d. Have your students calculate doses:

      $$\text{Docetaxol: } \frac{75 \text{ mg}}{\text{m}^2} \times 1.68 \text{ m}^2 = \underline{126 \text{ mg}}$$

      $$\text{Cisplatin: } \frac{750 \text{ mg}}{\text{m}^2} \times 1.68 \text{ m}^2 = \underline{1260 \text{ mg}}$$

Teaching Strategy: *The key to mastering the objectives is practice and exposure to commonly encountered problems. You will also need to apply concepts and calculations from previous lessons. Assign LS–A, and use the following Web site for practice in calculating doses: http://www.halls.md/body-surface-area/bsa.htm.*

Objective 3:

Calculate dosages for various age groups (e.g., infants, children, adults, and the elderly).

Anticipated Problem: How would calculating dosages differ for various age groups (e.g., infants, children, adults, and the elderly)?

III. Calculating dosages for various age groups (e.g., infants, children, adults, and the elderly)

   A. Dosing for infants is quite different than dosing for other age groups. The need for accuracy cannot be overstated. One multiplication or decimal error could lead to serious injury or death. Because of this, many places of employment adopt the use of a double check system in infants and children when calculating doses to prevent errors. Most dosing is per body weight. For example, a newborn baby boy of normal gestational age has a fever and requires antibiotics. The physician calls and wants to know how much of the antibiotic, cefotaxime, would be required for this 6 lb 12 oz baby.

1. According to Neofax®, a drug reference specifically for neonates and most optimal for neonatal dosing, the dose for this baby would be 100 mg/kg/day divided every 8 hours intravenously.
2. Have the students convert the baby's weight to kg.
   a. First have them convert the ounces to lb.

$$12\ \cancel{oz} \times \frac{1\ lb}{16\ \cancel{oz}} = 12/16 = 0.75\ lb$$

   b. Tell them to add the number to 6 lb = 6.75 lb.
   c. Have them convert to kg.

$$6.75\ \cancel{lb} \times \frac{1\ kg}{2.2\ \cancel{lb}} = 3.1\ kg$$

3. Have them calculate the daily dose.

$$100\ \frac{mg}{\cancel{kg}} \times 3.1\ \cancel{kg} = 310\ mg$$

4. Have them calculate the dosage regimen.

   310 mg/day divided by 3 = <u>103 mg IV every 8 hours</u>

B. Dosing for children is also mainly per body weight. For instance, you have a prescription for Tylenol with Codeine® elixir, 1 to 2 tsp orally every 4 hours as needed for pain for a 6 year old, 35 pound female who just had her appendix removed. Lexi-comp® Pediatric Dosing reference recommends a dosing range of 0.5 to 1 mg/kg/dose and that Tylenol with Codeine® elixir contains 12 mg of codeine in each 5 ml of elixir.
   1. Lexi-comp® Pediatric Dosing reference recommends a dosing range of 0.5–1 mg/kg/dose for codeine in children under 6 years of age.
   2. Ask students to convert the weight from lb to kg.

$$35\ \cancel{lb} \times \frac{1\ kg}{2.2\ \cancel{lb}} = 15.9\ kg$$

   3. Have them check the dose. The dosing range is 0.5 to 1 mg/kg/dose.

$$\frac{0.5\ mg}{\cancel{kg}} \times 15.9\ \cancel{kg} = 7.95\ mg \qquad \text{to} \qquad 1\ \frac{mg}{\cancel{kg}} \times 15.9\ \cancel{kg} = 15.9\ mg$$

   4. The dose ordered for this girl is 1 to 2 tsp. Using conversions from previous lessons, have students calculate how many mg of codeine are in the ordered dose.

$$1\ \cancel{tsp} \times \frac{5\ \cancel{ml}}{1\ \cancel{tsp}} \times \frac{12\ mg}{5\ \cancel{ml}} = 12\ mg \text{ in 1 tsp and } 24\ mg \text{ in 2 tsp}$$

   5. According to the reference, 1 tsp is within the recommended range, but 2 tsp would be too much. In this case, it would be the pharmacist's responsibility to

call the prescribing physician and recommend a smaller dose of 0.5 to 1 tsp every 4 hours as needed for pain.

C. Dosing for adults is different because many drugs are not dosed per body weight. There is often a range from which to choose because one dose is not always right for every patient. Dose checking examples are listed below.

   Example 1: An adult male with a bronchitis infection has a prescription for cefuroxime 500 mg twice daily for 10 days.

   1. First, have your students check a dosing reference for a dosage range. According to Lexi-comp® Drug Information, the adult dose for this medication is 250 to 500 mg twice daily.
   2. The prescription dose is within the reference guidelines and is, therefore, appropriate and safe to fill.

      Example 2: A young adult female (who weighs 150 lb) has a new diagnosis of seizures and is started on a medication called phenytoin. Ask your students to determine an appropriate starting dose for her.
   3. Per Micromedex, her dose would be 300 mg/day or 5 to 6 mg/kg/day in 2 divided doses.
   4. Have your students calculate her weight in kg.

      $$150 \cancel{\text{lb}} \times \frac{1 \text{ kg}}{2.2 \cancel{\text{lb}}} = 68.2 \text{ kg}$$

   5. Then have them calculate her dose based on body weight:

      5 mg/kg/day × 68.2 kg = 341 mg/day. This medication is available in 100 mg capsules, so an appropriate starting dose would be 300 or 400 mg divided into 2 doses or 200 mg (2 of the 100 mg capsules) twice daily.

D. Dosing in the elderly requires other considerations. Because drugs are broken down by the liver and eliminated by the kidneys, if these organs are not working properly, drugs can accumulate in the body and cause harm or side effects. With age, the liver and the kidneys begin to decline. Therefore, dosing in the elderly is often less than in younger adults. The safest strategy when dosing in the elderly is to start with a low dose and slowly increase to the dose needed for the desired effect (e.g., blood pressure in a patient with hypertension, glucose level in a diabetic patient, and heart rhythm in a patient who has an abnormal heart rhythm). Example: An elderly female brings in a prescription for paroxetine 30 mg daily for depression.

   1. According to Lexi-comp®, the dosing for this medication in an elderly person would be the following: Initial: 10 mg/day; increase if needed by 10 mg/day increments at intervals of at least 1 week; maximum dose: 40 mg/day.
   2. Although the dose on this patient's prescription would be high for an initial dose, it is within the recommended range. It would be important to find out if this patient has built up to this dose or if it is a new medication.

Teaching Strategy: *A good background on dosing calculations can be found in Chapter 8 of the Pharmaceutical Calculations textbook listed in the "Resources"*

section. Assign LS–A. You may also want to use the following Web site for additional student practice in calculating doses: http://www.pharmacy-tech-study.com/math.html.

Review/Summary. Use the student learning objectives to summarize the lesson. Have students explain the content associated with each objective. Student responses can be used in determining which objectives need to be reviewed or taught from a different angle. Questions at the ends of chapters in the textbook may also be used.

Application. Use the included visual master(s) and lab sheet(s) to apply the information presented in the lesson.

Evaluation. Evaluation should focus on student achievement of the objectives for the lesson. Various techniques can be used, such as student performance on the application activities. A sample written test is provided.

Answers to Sample Test:

Part One: Matching

1. d
2. e
3. c
4. f
5. a
6. b

Part Two: Multiple Choice

1. b
2. c
3. d
4. d
5. a
6. d

Part Three: True/False

1. T
2. T
3. T
4. F
5. F
6. T

Sample Test

Name _____

Dosage Calculation

Part One: Matching

Instructions: **Match the term with the correct definition.**

a. dosing range
b. body surface area (BSA)
c. dose
d. solution
e. dosage regimen
f. suspension

_____1. A liquid preparation that contains medication dissolved in the vehicle, usually water

_____2. Specific instructions regarding the dosage amount and the duration

_____3. A measured or calculated amount of medication that a patient receives for a desired medical effect

_____4. A liquid preparation that contains small drug particles dispersed evenly throughout the vehicle

_____5. A guideline supplied by the original manufacturer of the drug; based on studies to find the optimal range for the desired therapeautic effect

_____6. The measured surface area of the body

Part Two: Multiple Choice

Instructions: **Circle the letter of the correct answer.**

_____1. The formula for calculating body surface area (BSA) is _____.

a. $BSA\ (m^2) = 0.007184 \times weight\ (lb)^{0.425} \times height\ (cm)^{0.725}$
b. $BSA\ (m^2) = 0.007184 \times weight\ (kg)^{0.425} \times height\ (cm)^{0.725}$
c. $BSA\ (m^2) = 0.007184 \times weight\ (kg)^{0.425} \times height\ (in)^{0.725}$
d. $BSA\ (m^2) = 0.07184 \times weight\ (kg)^{0.425} \times height\ (cm)^{0.725}$

_____2. The optimal reference for checking neonatal dosages is _____.

a. Briggs Pregnancy and Lactation® reference book
b. Lexi-comp® Drug Information
c. Neofax®
d. Facts and Comparisons®

_____3. The organs that decline and affect dosing in the elderly are the _____.

a. heart and lungs
b. eyes and ears
c. liver and heart
d. liver and kidneys

_____4. Dosing is mainly based on body weight for the _____ age groups.

a. infant and children
b. children and adult
c. adult and elderly
d. infant and elderly

_____5. Because the liquid formulation of _____ contains sugar, you would avoid this in diabetic patients.

a. syrup
b. elixir
c. water
d. suspension

_____6. Several factors determine how large a dose will be, including _____.

a. its potency
b. physical and chemical properties of the drug
c. the dosage form
d. All of the above

Part Three: True/False

Instructions: **Write *T* for true or *F* for false.**

_____1. The need for accuracy when calculating doses is always important, but it is even more critical in dosing for infants and children.

_____2. When looking for a dosing range, it is important to seek references specific to the patient population needing the dose.

_____3. Chemotherapy agents are the main class of medications that use BSA when calculating dosages.

_____4. Dosing in infants requires only the same considerations as dosing in adults.

_____5. All adult dosing is based on body weight or BSA.

_____6. The safest strategy when dosing in the elderly is to start with a low dose and slowly increase to the dose needed for the desired effect.

COMMON PHARMACY CONVERSIONS (AP = APOTHECARY; AV = AVOIRDUPOIS)

Measurement	Equivalent
Volume	
1 L	1000 ml
1 lb (AV)	16 oz
1 cup	8 oz
1 fl oz	30 ml
1 tsp	5 ml
1 TBS	15 ml
1 TBS	0.5 fl oz
1 pt	480 ml
1 pt	16 oz
2 pt	1 qt
4 qt	1 gal

Measurement	Equivalent
1 cup	8 fl oz = 240 ml
1 gal	3840 ml
Weight	
1 kg	1000 g
1 mg	1000 mcg
1 g	1000 mg
1 oz	30 g
16 oz	1 lb (AV)
1 lb	454 g
1 kg	2.2 lb
1 gr	64.8 mg
1 oz	480 gr
Length	
1 inch	2.54 cm
1 mile	~ 1.6 km
1 m	39.37 in
1 km	1000 m
1 m	1000 cm
1 cm	1000 mm

Name _____

Dosage Calculations

Purpose

The purpose of this activity is to calculate or check dosing for different age groups (e.g., infants, children, adults, and elderly).

Objectives

1. Perform dosage calculations for various age groups.
2. Verify if doses are correct for various age groups.

Materials

- lab sheet
- writing utensil
- VM–A for conversions as needed
- calculator (if permitted by your instructor)

Procedure

1. Use the conversions listed in VM–A to complete the problems below.
2. Apply pharmacy calculations (e.g., ratios, proportions, and conversions) to complete the following problems.

Dosage Calculations

1. Per Neofax®, the dose for a newborn who needs lansoprazole for reflux problems is 0.5 mg/kg/dose given once daily.
   a. If the baby weighs 8 lb 4 oz, what would the calculated dose be?
   b. You have compounded a 3 mg/ml suspension for this baby. How many ml would you need to draw up for the calculated dose?

c. If you send the baby home with a prescription for 30 days worth of medication, how many ounces would you need to fill the prescription? (Add 10 ml to the calculated amount for potential spillage.)

2. You have a prescription for chloral hydrate syrup 500 mg or 5 ml, 1 tbsp orally prior to a surgery appointment for sedation. The patient weighs 15 kg and is 3 years old. Per the pediatric reference, the dose for chloral hydrate as a sedative for children is 25 mg/kg/day, up to 500 mg per dose.

   a. Is the prescribed dose acceptable?
   b. If not, what should it be? What would the volume of the medication be in ml and tsp?

3. The dose for adults for an antibiotic called gentamicin is 5 to 7 mg/kg/day IV in 3 divided doses. What dosing regimen would be appropriate for a female who weighs 110 lb?

4. A 68-year-old male needs to receive chemotherapy for lung cancer with a drug called etoposide. The dosing regimen per Micromedex® is 100 mg/m^2 intravenously (IV) daily for 3 days. The patient is 5 feet 11 inches and weighs 205 lb. What would this patient's dosing regimen be?

5. Vancomycin needs to be given to a 10-year-old boy who has a methicillin resistant staph aureus (MRSA) infection on his foot. The dosing regimen per Lexi-comp® is 40 mg/kg/day in divided doses every 6 hours IV. What would be the dose for this child who weighs 95 lb?

6. A mother comes into your pharmacy and tells you she has been giving her 7-year-old daughter ibuprofen suspension, 100 mg/5ml, 2 tsp orally every 8 hours. She wants to know if that is correct for her 65 lb child. Pediatric dosing recommendations are 5 to 10 mg/kg/dose 3 to 4 times daily.

7. The dose for the chemotherapy agent vincristine is 1.4 mg/m^2 IV once weekly. How much should a 56-year-old man with leukemia receive if he weighs 250 lb and is 74 inches tall?

8. You need to give a 10-day-old infant, who weighs 3.6 kg, a prescription for caffeine citrate solution, 20 mg/ml, with the following directions: Give 7 mg/kg/dose orally once daily.

   a. What would be the baby's dose?
   b. How many tsp would the mother need to draw up?
   c. If you give 30 days worth of medication, how many ml would you need to fill the prescription?

9. A 6-year-old male is to receive nafcillin 500 mg IV every 8 hours. If he weighs 32 kg and the usual dose is 100 to 200 mg/kg/day, is the ordered dose appropriate?

10. Tetracycline 25 to 50 mg/kg/day in divided doses every 6 hours is the usual dose for children. What would an appropriate dose be for a 10-year-old girl who weighs 85 lb if the medication is available in 250 or 500 mg capsules?

Dosage Calculations

1. a. Convert lb to kg: 12 lb 4 oz = 8 + 4/16 = 8.25 lb; 8.25/2.2 = 3.75 kg
   Dose = 0.5 mg/kg × 3.75 kg = 1.9 mg
   b. 1.9 mg ÷ 3 mg/ml = 0.6 ml
   c. 0.6 ml × 30 days = 18 ml (round to 20 ml and add about 10 ml extra for potential spillage), so total ml to fill the prescription would be 30 ml, which equals 1 ounce.

2. a. Ordered dose = $1\ \cancel{\text{tbsp}} \times \frac{15\ \cancel{\text{ml}}}{1\ \cancel{\text{tbsp}}} \times \frac{500\ \text{mg}}{5\ \cancel{\text{ml}}} = 1500\ \text{mg}$

   Dose per reference: 25 mg/kg/day × 15 kg = 375 mg
   ** Ordered dose is too high! **

   b. $375\ \cancel{\text{mg}} \times \frac{5\ \text{ml}}{500\ \cancel{\text{mg}}} = 3.75\ \text{ml}$

   $3.75\ \cancel{\text{ml}} \times \frac{1\ \text{tsp}}{5\ \cancel{\text{ml}}} = 0.75\ \text{tsp}$ or ¾ tsp

3. 110 lb / 2.2 = 45.5 kg

   Dose = 5 mg/kg/day × 45.5 kg = 227 mg
   227 mg / 3 = 76 mg IV every 8 hr

   Dose = 7 mg/kg/day × 45.5 kg = 318 mg
   318 mg / 3 = 106 mg IV every 8 hr

   Acceptable range would be 76 to 106 mg IV every 8 hr. It is often convenient to round to the nearest 10 mg (in adults only). Therefore, an acceptable dose would be 80, 90, or 100 mg IV every 8 hours.

4. a. BSA (m^2) = 0.007184 × weight $(kg)^{0.425}$ × height $(cm)^{0.725}$
   weight in kg = 205 lb/ 2.2 = 93.2 kg
   height in inches = 5 feet 11 inches = 71 inches
   height in cm = 71 inches × 2.54 cm/inch = 180.34 cm

   BSA (m^2) = 0.007184 × weight $(93.2)^{0.425}$ × height $(180.34)^{0.725}$
   = 0.007184 × 6.87 × 43.21
   = 2.13 m^2

5. 95 lb / 2.2 = 43.2 kg

   40 mg/kg/day = 1728 mg/day

   1728 mg / 4 times/day = 432 mg (round to 430 mg) IV every 6 hours

6. 65 lb/2.2 = 29.5 kg

   Dose taking: 2 tsp × 5 ml/tsp = 10 ml; 100 mg/5 ml × 10 ml = 200 mg

   Recommended dose: 5 mg/kg/day × 29.5 kg = 148 mg to

   10 mg/kg/day × 29.5 kg = 295 mg

   The dose being given is within the recommended range and is therefore appropriate.

7. 74 inches × 2.54 cm/inch = 187.96 cm

   250 lb/ 2.2 = 113.6 kg

   BSA (m^2) = 0.007184 × weight $(113.6)^{0.425}$ × height $(187.96)^{0.725}$

   = 0.007184 × 7.473 × 44.534

   = 2.39

8. a. 7 mg/kg/dose × 3.6 kg = 25.2 mg

   b. $25\ \cancel{mg} \times \frac{1\ \cancel{ml}}{20\ \cancel{mg}} \times \frac{1\ tsp}{5\ \cancel{ml}} = 0.25$ tsp or ¼ tsp

   c. $25\ \cancel{mg} \times \frac{1\ ml}{20\ \cancel{mg}} = 1.25$ ml × 30 = 37.5 ml (plus 5 to 10 ml for accidental spillage)

9. 500 mg × 3 = 1500 mg/day

   1500 mg / 32 kg = 47 mg/kg/day

   100 to 200 mg/kg/day recommended range so dose would be too low

10. Tetracycline 25 to 50 mg/kg/day in divided doses every 6 hours is the usual dose for children. What would an appropriate dose be for a 10 year who weighs 85 lb and the medication is available in 250 or 500 mg capsules?

    85 lb / 2.2 = 38.6 kg

    25 mg/kg/day × 38.6 kg = 965 mg/day ÷ 4 times/day = 241 mg every 6 hours

    50 mg/kg/day × 38.6 kg = 1930 mg/day ÷ 4 times/day = 482 mg every 6 hours

    Because the medication comes in 250 mg or 500 mg capsules, it would be appropriate to round the dose to 250 mg 4 times daily. 500 mg 4 times daily may also be appropriate, but because it is slightly higher than the recommended dose, it would need to be verified with the prescriber.