Remember: On NAPLEX, your answer may be expressed in a different set of units other than the ones you used to work the problem. For example, a problem that gives an answer of 100 mg may be expressed as 0.1 gram. Similarly, 0.5 mg could be expressed as 500 mcg or 0.0005 grams.

Use the information provided for questions 1 through 3. You receive an order for 500 mg of aminophylline in normal saline in a total volume of 250 ml. The patient weighs 132 pounds. The aminophylline is to be administered at a dose of 0.3 mg per kg per hour. Aminophylline Injection is supplied in vials with 25 mg per ml. The IV set you will use delivers 60 drops per ml.

1. How many milligrams of theophylline will the patient receive each hour?
2. How many hours will the 250 ml last if administered at the correct dose?
3. What will be the flow rate, in drops per minute, to administer the dose ordered?
4. A dose of 120 mg of gentamicin is administered IV. After 10 minutes, a blood sample is assayed for gentamicin content. The result is 8 mcg per ml. What is the volume of distribution for gentamicin?

Use the prescription shown for questions 5 through 8. You have tablets that contain 0.25 mg of reserpine per tablet. You can mix ground up reserpine tablets in cherry syrup to make a liquid that will be stable for at least 3 months. The patient is a child that weighs 22 pounds.

Reserpine Liquid		0.1 mg per ml
Disp:	60 ml	
Sig:	0.01 mg per kg per dose one dose twice a day	

5. How many reserpine tablets will be needed to compound the prescription?
6. What volume (ml) will be in each dose?
7. How long will this prescription last at the dose ordered?
8. If reserpine tablets cost $20.00 per 100 tablets, what will be the cost of the tablets used?

Questions 9 and 10. You need to prepare 30 grams of 0.25% triamcinolone in Cold Cream. Triamcinolone is available in a suspension of 40 mg per ml that has a specific gravity of 1.0.

9. How many ml of the triamcinolone solution will be needed?
10. How many grams of the Cold Cream will be needed?

Question 11 thru 13. You are to mix this IV using the materials shown. You must **ADD** the volumes of the dextrose and NaCl to the 1000 ml of Sterile Water.

Sterile Water for Injection	1000 ml
Dextrose	10 %
Sodium chloride	60 mEq
Administer over 24 hours	

Sterile Water for Injection, 1000 ml
Sod Chloride Inj, 23.4% (MW = 58.5)
Dextrose 70% in Water Injection

11. How many ml of the Sodium Chloride Injection, 23.4%, will you add to the sterile water?
12. How many ml of the Dextrose 70% in Water Injection will you add to the sterile water?
13. After all of the ingredients are mixed, what will be the flow rate in milliliters per hour?

Provide the correct conversion factor for each instance below:

14. 1 grain = ________________ milligrams

15. 1 avoirdupois pound = _______________ grams

16. 1 fluid ounce = __________ milliliters

17. 1 US gallon = __________________ fluid ounces

18. 1 US pint = _________________ milliliters

19. Digoxin Injection is supplied in ampules of 500 mcg per 2 ml. What quantity, in mL, must a nurse administer to provide a dose of 0.2 mg?

20. Gentamicin Injection is supplied in a concentration of 80 mg per 2 ml vial. How many milliliters are needed to give a single dose of 4 mg per kg to a patient weighing 165 pounds?

21. You have Sodium Phenobarbital Injection, 13%. How many ml will be needed to obtain 2 grains?

22. Concentrated Acetic Acid is supplied at a concentration of 90% weight/weight and has a specific gravity of 1.11. What volume is needed to obtain enough acetic acid to prepare 60 mls of Acetic Acid Solution, 5% (e.g., vinegar)?

Aspirin	300 mg
Caffeine	30 mg
Codeine	15 mg
DTD	15 caps
SIG: i cap q 4 hrs PRN pain	

Use the prescription to the left for questions 23 and 24.

23. How many milligrams of codeine will be needed to compound the prescription?

24. What will be the total final weight, in grains, of ingredients for one capsule?

25. A patient is to prepare one liter of a 1:5000 potassium permanganate ($KMnO_4$) solution as a foot soak. You have a stock solution of $KMnO_4$, 5%. How many milliliters of the stock solution must be used to prepare one liter of the foot soak?

Information For Problems 26 and 27. Your patient is receiving lithium carbonate (Li_2CO_3) capsules but needs to change to a liquid form (lithium citrate; $Li_3C_6H_5O_7$). Molecular weights: lithium = 7, carbon = 12, hydrogen = 1, oxygen = 16

26. If the patient's dose of lithium carbonate was 300 mg three times a day, how many millimoles of lithium did the patient receive in a day?

27. Lithium citrate syrup is available as 300 mg of lithium citrate per 5 ml of syrup. How many milliliters of syrup will be required per day to provide the dose calculated in No. 26?

28. You have a vial that contains 5 gms of drug and the chart to the right for mixing the drug for use. Nurses want to mix the vial so that it comes out with **200 mg per ml** and ask you how much diluent they should add to make that concentration.

Diluent Added	Concentration Resulting
9.6 ml	500 mg per ml
19.6 ml	250 mg per ml
49.6 ml	100 mg per ml

29. You receive an order for 30 grams of 0.1 percent hydrocortisone cream for use on an infant. You have available 1 percent hydrocortisone cream and cold cream that can be mixed with the hydrocortisone. How many grams of the cold cream will be needed to fill the order?

30. A physician orders one liter of 3% sodium chloride injection for a sodium depleted patient. You have 0.9% sodium chloride injection in one liter bags and sodium chloride injection, 23.4%, in 50 ml vials. How many milliliters of the 23.4% NaCl solution will you **ADD TO** the one liter bag of 0.9% NaCl to prepare the 3% sodium chloride injection? Molecular weights sodium = 23, chlorine = 35.5

31. In question number 30, you calculated the number of ml of 23.4% NaCl to make the 3% NaCl solution. How many milliequivalents of sodium chloride did you add to the bag?
Molecular weights sodium = 23, chlorine = 35.5

32. After you finished mixing the 3% sodium chloride, how many milliosmoles of sodium chloride, per liter, are in the final product? Molecular weights sodium = 23, chlorine = 35.5

33. You are out of Robitussin-AC, a cough syrup that contains 10 mg of codeine per 5 ml. You can make Robitussin-AC by adding codeine injection to Robitussin. If the codeine injection has 60 mg per ml, how many milliliters of the injection will you **ADD TO** a four fluid ounce bottle of Robitussin to produce the same amount of codeine as in Robitussin-AC?

Tetracycline HCl	2 per cent
NaCl to isotonicity	qs 30 ml
SIG: 2 drops into OS QID	

For questions 34 and 35, use the RX in the box to the left.

34. You have tetracycline HCl powder and sodium chloride crystals. How much sodium chloride will you need to add to make the final 30 ml volume isotonic? E value for tetracycline HCl = 0.12

35. In order to obtain the sodium chloride amount you calculated in No. 32, you will need to use Sodium Chloride Injection, 2.5 mEq per ml as your source for NaCl. How many ml will you use? MW Na = 23, Cl = 35.5

36. Pediatric Lanoxin Injection is supplied in ampules of 100 mcg per ml. What quantity must a nurse administer to provide a dose of 0.04 mg?

Hyoscine HBr	0.3 mg
Oxycodone	7.5 mg
Acetaminophen	300.0 mg
DTD:	caps no. XX
Sig:	i or ii caps q 4-6 hrs prn pain
	Dr Lotta Scripts

The information provided in the prescription shown to the left is for questions 37 and 38.

37. What will be the total amount of Hyoscine HBr used to fill the prescription?

38. You have Hyoscine HBr tablet triturates (similar to nitroglycerine tablets) that contain 1/150th grain per tablet. How many will you need for the RX?

39. A balance has a sensitivity of 5 milligrams. What is the least amount you can weigh on this balance if you need to work with an accurary of 2%?

Morphine Sulfate	7.5 mg
Acetaminophen	325 mg
DTD: XX caps	
Sig: one cap q 4 hrs prn pain	

Use the prescription shown for questions 40 and 41.

40. Morphine Sulfate is available in 15 mg tablets. How many tablets would provide the amount of morphine needed for this prescription?

41. If each morphine tablet weighed a total of 100 mg, what would be the weight of material in one capsule?

42. A drug product costs $62.20 an avoirdupois ounce. What will be the cost of the 60 mg of drug you need for a prescription?

43. A patient is to receive IV theophylline 24 mg every hour. If aminophylline is 80% theophylline, how much aminophylline must the pharmacist use to prepare a 24 hr supply?

44. Aminophylline Injection is supplied as 25 mg per ml. What volume of Aminophylline Injection will the pharmacist need to obtain the dose in Number 43 above?

45. A drug product has 0.05% active drug. If the dose is one-half (½) teaspoonful four times a day for ten days. How many milligrams will be consumed in total?

46. You have a stock drug solution that contains 10% active drug. What volume of this stock solution will you use to prepare 120 ml of a 1:1000 solution?

47. A formula calls for using 0.01% of hydrochloric acid in a formula for 1000 ml of a topical liquid. HCl has a specific gravity of 1.2 and is supplied as a 40% weight/weight solution. How many ml of hydrochloric acid are needed to prepare the 1000 ml?

48. Amikacin Injection is supplied as 500 mg in 2 ml. Mr. Johns weighs 198 lbs and is to receive a dose of 15 mg per kg. How many milliliters will be needed for the dose?

49. Calcium Chloride Dihydrate Injection is supplied as a 10% solution in water. How many milliosmoles are present in a single 10 ml vial? Ca = 40, Cl = 35.5, H = 1, O = 16

50. Sodium Bicarbonate Injection is an 8.4% solution. How many milliequialents of sodium are in a single vial of 50 ml? Na = 23, C = 12, O = 16, H = 1

51. Lidocaine Injection for cardiac use is a 4% solution. If the dose is 2 mg per minute, how long will a 500 ml bag run?

52. I have 10 ml of a solution that contains one gram per 5 ml. How many ml of water must I add to the 10 ml to make a solution that is 1:5000 in strength?

Total Parenteral Nutrition Formula	
Dextrose Injection, 50%	1000 ml
Amino Acids, 10%	400 ml
Electrolytes / Vitamins	200 ml
Sterile Water	800 ml

Information for questions 53 and 54 is contained in the box to the left. This formulation is for 24 hours of a total parenteral nutrition (TPN) formulation. Dextrose provides 3.4 calories (or kilocalories or kcals) per gram and Amino Acids provide 4 calories per gram. The electrolytes and vitamins do not provide any calories. (Fat provides 9 calories per gram.)

53. How many calories, from all sources, will the patient receive in 24 hours?

54. The IV set will deliver 10 drops per ml. What will be the flow rate, in drops per minute, to administer the formula above over 24 hours?

55. The proper concentration of benzalkonium to prevent bacterial contamination in an eye drop is 1:750. You have a stock solution of 17% benzalkonium chloride and a dropper that delivers 50 drops per ml. How many drops will you need for a 30 ml bottle of eye drops?

56. A patient has been receiving oral Aminophylline Tablets. Aminophylline is 80% theophylline. The doctor wants to change giving oral theophylline. If the patient has been receiving 500 mg of aminophylline, and theophylline is available in tablets of 100 mg. How many tablets will the patient need per dose? (NOTE: Bioavailability will be the same for both.)

57. Dimethyl Sulfoxide Liquid is supplied as a 50% **weight / weight** solution with a specific gravity of 1.40. What is the percent **weight / volume** of liquid dimethyl sulfoxide?

The prescription to the right has information for questions 58, 59 and 60.

Indomethacin		0.05%
Boric Acid		qs
Water	qs ad	15 ml

58. Boric Acid can be used as a preservative in ophthalmic solutions. It can also be used to replace NaCl when making a product isotonic. What quantity of boric acid will be needed to make the eye drop shown isotonic? E values are boric acid = 0.52, indomethacin = 0.16

59. You have boric acid in a saturated solution that is 5.5% boric acid. What volume of this solution will you need to use to obtain the needed amount of boric acid?

60. Indomethacin is available in an injection of 1 mg powder for solution per vial. How many vials will you need to obtain the needed amount of indomethacin?

Use the white blood cell differential count shown to answer questions 61, 62 and 63.

Total WBC Count	Bands	Segs	Basophils	Eosinophils	Lymphocytes	Monocytes
14,000/mm^3	5	65	1	2	24	3

61. This patient is most likely to have what type of infection – bacterial, viral, fungal?
    I. Bacterial
    II. Viral
    III. Fungal
    A. I only
    B. III only
    C. I and II only
    D. II and III only
    E. I, II and III only

62. What will be the absolute neutrophil count for a patient with the WBC result shown above?

63. What will be the absolute granulocyte count for a patient with the WBC result shown above?

Use the TPN formula shown for problems 64 to 69.

Ingredient	Quantity
Dextrose	200 grams
HepatAmine	60 grams
Sodium Chloride	50 mEq
Potassium Chloride	40 mEq
Sodium Acetate	20 mEq
Magnesium Sulfate	10 mEq
Sodium Phosphate	9 mMol
Potassium Acetate	15 mEq
Calcium Chloride	2 mEq
Multivitamins-12	5 ml
Trace Elements-5	1 mL
Vitamin K-1	0.5 mg
Pepcid	10 mg
Regular Insulin	20 units
Sterile Water qs ad	960 ml
Flow Rate = 80 ml per hour	

64. How many calories (or kilocalories; kcals) will the dextrose provide per 24 hours?

65. You have dextrose available as a 70% solution. What quantity will be needed to provide the required amount?

66. Magnesium sulfate is available as a 50% solution of magnesium sulfate heptahydrate (7 waters of hydration). What volume of this injection is needed for this formula? Mg = 24, S = 32, H = 1, 0 = 16

67. The pharmacist will be using Pepcid Injection, 40 mg per 4 ml vial, to prepare the product. What quantity of Pepcid Injection will be used?

68. How many ml of 23.4% Sodium Chloride Injection will be needed to prepare the TPN? Na = 23, Cl = 35.5

69. Sodium Phosphate is being added as Na_3PO_4. How many mEq's of sodium will be added as a result of using sodium phosphate? Na = 23, P = 31, O = 16

70. For adults, the maximum daily dose from a Beclovent Inhaler is 840 micrograms. A Beclovent Inhaler contains 8.4 milligrams of deliverable drug in 200 puffs. What is the maximum number of Beclovent puffs a patient may use in one day?

71. A physician has requested a 20 mL vial of Lidocaine 1% with Epinephrine 1:200,000 from your pharmacy. The shelf spot for that product is empty but you do have Lidocaine 1% Injection and Epinephrine Amps, 1%. How much of the Epinephrine Injection must you add to the vial of Lidocaine Injection to prepare the needed product?

72. Human Growth Hormone (somatropin, Nutropin-AQ) is dosed at a rate of 0.3 mg per Kg per week given in equally divided daily doses. Nutropin-AQ Injection is supplied at a strength of 10 mg per 2 mL. What will be the daily dose for a patient who weighs 55 pounds?

73. On a mercy mission to a Third World country you have been asked to calculate the correct amounts of ferric gluconate injection (Ferrlecit) to administer to severely anemic patients. You are given the following formula for such calculations. (NOTE: this is an old formula that is no longer used.) The first patient weighs 110 pounds and has a hemoglobin of 8 gms/dl. Ferrlecit contains 12.5 mg elemental iron per mL; what volume of drug will be given each dose?

    Normal Hgb (15 gm/dl) minus Patient's Hgb (gm/dl) = Hgb deficiency
    Hgb deficiency (x) Patient's weight (in kg) = milligrams of elemental iron required
    Give 5% of the total dose calculated every other day

74. Ms Thomas wants to take one gram of elemental calcium every day and thinks calcium citrate is the best way to do so. She is confused, however, by instructions on the container she is purchasing that say each tablet contains 560 mg of Calcium Citrate Tetrahydrate (20% calcium) and she should take three tablets 3 times a day to obtain 1 gram of elemental calcium daily. Ms Thomas thinks this is a very great overdose and wants you to explain the dose to her and tell her how much calcium the recommended dose would provide.

75. You need a 1:5000 solution of benzalkonium chloride as a preservative. You have 20 ml of a 1:200 solution in stock. How much of the 1:5000 solution can you prepare by using all 20 ml of the 1:200 solution?

76. You need a 1:750 solution of Zephiran Chloride to disinfect the pharmacy counters. Zephiran is available as a 17% concentrated solution. How much Zephiran concentrate will you mix with enough water to make one gallon of the 1:750 solution you need?

77. An IV solution containing potassium chloride is being administered at a rate of 30 drops per minute using IV tubing that delivers 15 drops per mL. At the end of 8 hours, the patient has received 30 mEq of potassium chloride. What was the initial concentration of potassium chloride in the IV fluid? K = 39, Cl = 36

78. You told your assistant to make a 3 percent morphine solution but something got misunderstood and the result is 80 mL of a 20 percent solution. How much water must you add to the 80 mL to reduce the concentration to 3 percent?

Use the information in the box provided to answer questions 79 through 81.

Atropine Sulfate	0.4 mg
Morphine Sulfate	5 mg
Acetaminophen	325 mg
DTD: 20 caps	
SIG: 1-2 caps q 4 hrs prn	
Dr Anodyne	

79. Approximately how much atropine sulfate, **IN GRAINS,** will you need to use to compound the prescription?

80. How many grams of acetaminophen will you need for the 20 capsules?

81. What will be the total weight of ingredients, in milligrams, to prepare the entire quantity?

Questions 82, 83 and 84 use the same information to demonstrate the differences, and similarities, between millimoles, milliosmoles and milliequivalents.

82. Lactated Ringer's Injection contains 20 mg of calcium chloride dihydrate per 100 ml of IV fluid. How many milliMoles of calcium are present in one liter of Lactated Ringer's Injection? Molecular weights: Ca = 40, Cl = 35.5, H = 1, O = 16

83. Lactated Ringer's Injection contains 20 mg of calcium chloride dihydrate per 100 ml of IV fluid. How many milliOsmoles of calcium chloride are present in one liter of Lactated Ringer's Injection? Molecular weights: Ca = 40, Cl = 35.5, H = 1, O = 16

84. Lactated Ringer's Injection contains 20 mg of calcium chloride dihydrate per 100 ml of IV fluid. How many mEq of calcium are present in one liter of Lactated Ringer's Injection? Molecular weights: Ca = 40, Cl = 35.5, H = 1, O = 16

85. You dilute 1 ml of Fungizone Injection (50 mg per 10 ml) to one liter. The concentration in the diluted solution will be ________________________ (express as N:XXXX, such as 1:1000)

86. Neupogen Injection is supplied at a concentration of 0.48 mg/1.6 ml. Your patient (weighs 132 pounds) and is to receive a dose of 5 mcg/kg/day. What volume of Neupogen Injection is required for this dose?

87. The parents of a child cannot read or speak English and a pediatrician knows the mother is going to give the child one teaspoonful of medication per dose no matter what dose is ordered. The pediatrician wants you to add enough water to make Biaxin Oral Suspension to a concentration of 150 mg per 5 mL. You have a container of Biaxin powder for oral suspension that says that addition of 55 mL of water will result in a final volume of 100 mL at a concentration of 250 mg per 5 mL. How much water must you use to change the final concentration of this container to 150 mg per 5 mL?

Information for questions 88 through 91.

A patient is receiving Dextrose 5% in 0.45% Sodium Chloride Injection and 40 mEq of potassium chloride in a total volume of 1000 mL through an IV set that delivers 15 drops per mL. The IV fluid has been running at a rate of 12 drops per minute for 15 hours. Molec Weights: Dextrose = 180, Na = 23, K = 39, Cl = 35.5

88. How many mEq of potassium chloride have been administered so far? K = 39; Cl = 35.5; Na = 23; Dextrose = 180

89. How many grams of KCl have been administered over the 15 hour period?

90. How many millimoles of KCl have been administered over the 15 hour period?

91. What is the total osmolarity of the IV fluid being administered? Express your answer as milliosmoles, rounded to the nearest whole number, per 1000 mL.

92. A formulation for an oral liquid of sumatriptan succinate (Imitrex – for migraine headaches) indicates that the final product should have a pH between 4.2 and 5.3. What pH would represent the middle of this range?

93. A table of pKa values gives 4.75 as the pKa for acetic acid. Use the Henderson-Hasselbach Equation to calculate the relative molar ratios of sodium acetate and acetic acid required to prepare a pH 4.75 buffer.

94. Determine the actual quantities, in grams, for a buffer that uses one mole of sodium acetate ($NaC_2H_3O_2$) and the corresponding amount of acetic acid ($C_2H_4O_2$). Molecular Weights: Na = 23, C = 12, H = 1, O = 16

Information for questions 95 and 96.

A physician wants to put 10 mEq of calcium into a 500 ml bag of Normal Saline Solution and administer the calcium at a rate of 0.5 mEq per hour. You have Calcium Chloride Dihydrate, 10% Injection in 10 mL vials. Ca = 40, Cl = 35.5, H = 1, O = 16

95. How many mLs of this injection must you add to the bag of IV fluid to make the desired product?

96. You have an IV set that delivers 12 drops per mL. At what flow rate (drops per minute) will the IV fluid be administered to give the desired dose?

Information for questions 97 through 99.

Mr Shirrah is very ill and needs antibiotic therapy for an infection. The microbiology lab reports that the infecting agent will require a higher than normal blood level to be effective. The attending physician asks you to determine exactly how often each dose of the antibiotic should be administered to keep the blood level at, or above, the determined minimum inhibitory concentration (MIC).

You receive the following pharmacokinetic data on Mr. Shirrah for a drug eliminated 100% by the kidney. Mr Shirrah has normal renal function.

IV bolus dose:0.5 gram;
Peak level: 12 mcg/mL;
Trough level at 12 hrs: 0.75 mcg/ml
Therapeutic MIC level: 3 mcg/ml

97. What is the volume of distribution of this drug?

98. Based on first order pharmacokinetics, what is the half life of this drug?

99. How often should a dose of the drug be administered in order to maintain the drug level at, or above, the therapeutic level? Use the half-life calculated in No. 97.

100. Charles Fox has an IV hanging that has 40 mEq of potassium chloride in 1000 mL of Dextrose 5% in Half Normal Saline. The IV has been running at a rate of 80 mL per hour for the past 6.5 hours. A recent lab report indicates that Mr. Fox's serum potassium level is only 3.5 mEq/L and his physician wants to increase the potassium dose. The physician ask you to slow the IV flow rate to 40 mL per hour and also add enough potassium chloride injection, 14.9%, so that Mr. Fox will receive a total of 80 mEq of potassium over the next 12 hours. K = 39, Cl = 35.5

Information for questions 101 through 104. You are told to prepare a double strength Dopamine IV drip because a patient is requiring large doses to obtain the drug's effects. The usual Dopamine drip concentration is 400 mg in 250 ml. The patient weighs 176 pounds and needs the pressor dose level of dopamine (10 mcg/kg/min). Dopamine Injection is available as 40 mg per mL in 10 mL vials. Answer the following questions:

101. How many mL of the 40 mg per mL Dopamine Injection should be added to a 500 mg bag of IV fluid to prepare the double concentration? (Ignore volume of the dopamine injection.)

102. To what IV fluid should the dopamine be added?

A. Dextrose 5% in Water
B. Sodium Bicarbonate Injection, 5% in Water
C. Sodium Chloride Injection, 3%
D. Sterile Water
E. Amino Acids Injection, 10%

103. What will be the dose, in ml per hour of dopamine, will the patient be receiving?

104. If the IV set delivers 15 drops per mL, what will be the flow rate for the dose ordered?

Information for questions 105, 106 and 107.

Ms. Roberta Snagg has a recurring mycotic infection of the bladder. Her physician wants to use a bladder irrigation of amphotericin B to be continuously run through the bladder for at least 24 hours. You are to prepare a 2 liter bag of amphotericin B irrigation solution, 1:5000 concentration, that will be administered at a rate of 80 mL per hour. You have vials of amphotericin B, 50 mg, that, when properly reconstituted, contain 50 mg of amphotericin B in a total volume of 10 mL.

105. How much amphotericin B must be mixed in the 2 liter bag to provide the desired concentration of irrigation solution?

106. Your irrigation set delivers 12 drops per mL. What will be the flow rate, in drops per minute, to administer the amphotericin B at the desired dose?

107. What type of catheter will be inserted into the patient's bladder and used for administration of the amphotericin B bladder irrigation?
   A. Swan-Ganz catheter
   B. PICC catheter
   C. Foley catheter
   D. Central catheter
   E. Robinson catheter

Information for questions 108, 109 and 110.

A patient (weight, 176 pounds) in cardiology is receiving a heparin drip, currently running at 15 units per kilogram per hour. The concentration of heparin in the IV drip is 10,000 units per 100 mL and the IV set delivers 15 drops per mL. The most recent partial thromboplastin time (PTT) indicates that the patient is being under dosed and that the heparin rate should be increased by 20% according to the hospital's weight based heparin protocol. Answer the following questions:

108. What will be the new dosage in units per kilogram per hour?

109. What will be the new flow rate in drops per minute?

110. Once the heparin drip was stopped, the physician wanted to change to a subcutaneous agent for further anticoagulation. A possible drug for this purpose would be
   A. Warfarin
   B. Alteplase
   C. Argatroban
   D. Daltaparin
   E. Lepirudin

Information for questions 111 through 117 is included in the box to the right.

A physician has found a new formula for an IV fluid to be administered after surgery that can be described as "TPN Lite". The formulation is shown in the box to the right. Use the formula provided to answer the following questions:

Dextrose, 15%	
Amino Acids, 4%	
Sod Chloride, 0.75%	
Pot Chloride, 0.2%	
MVI-12, 10 mL	
Sterile Water qs ad	1000 mls
Flow Rate: 1 mL per kg per hour	

111. How many mLs of Dextrose Injection, 700 mg/mL, will be needed to prepare one liter of the formula?

112. How many mLs of Amino Acids Injection, 10% will be needed to prepare one liter of the formula?

113. How many mLs of Sodium Chloride Injection, 4 mEq per mL, will be needed to prepare one liter of the formula? Na = 23; Cl = 35.5

114. How many mLs of Potassium Chloride Injection, 2 mEq/ml, will be needed to prepare one liter of the formula? K = 39; Cl = 35.5

115. How many mL of water will be required to prepare one liter of the formula?

116. The first patient to receive this IV fluid had GI tract surgery and needs to be NPO for 5 days. The patient weighs 85 kilograms. How many calories from the dextrose and the amino acids will the patient receive in 24 hours?

117. The IV set used to administer this solution delivers 12 drops per mL. What will be the flow rate to administer the solution at the dose ordered for this patient?

118. Don Smith is a 35 year old male who has been diagnosed with AIDS. Mr. Smith is 5 feet, 8 inches tall and weighs 180 pounds. Mr. Smith's physician wants to use Epivir and knows the drug must have its dose adjusted based on a patient's renal function. Mr. Smith's serum creatinine is 2.6 mg/dL and has held at that same level for 5 days. Calculate Mr. Smith's creatinine clearance.

119. The dosing literature for Epivir has the following information concerning use in renal failure. What is the appropriate dose for Mr. McClure?

Creatine Clearance	**Initial Dose**	**Maintenance Dose**
< 5 ml/min	50 mg	25 mg once daily
5 – 14 ml/min	150 mg	50 mg once daily
15 – 29 ml/min	150 mg	100 mg once daily
30 – 49 ml/min	150 mg	150 mg once daily

120. Mr Smith is unable to take his Epivir and will have a NG tube inserted to make oral drug administration more practical. If the physician prescribes Epivir Oral Solution, 10 mg per ml, what will be the actual volume administered to Mr Smith?

And Now – The Answers

1. 132 lbs (div by) 2.2 lbs/kg = 60 kg   60 kg (x) 0.3 mg Aminophylline/kg = 18 mg/hr

   Question calls for theophylline dose per hour   18 mg Amin (x) 0.8 = 14.4 mg Theo

   NAPLEX will expect you to know that Aminophylline (MW = 420) is theophylline ethylenediamine and that the amount of theophylline (MW = 180) in aminophylline is 80%. The ethylenediamine is the other 20% of the total molecular weight. There are two molecules of theophylline per molecule of ethylene diamine in aminophylline.

2. 500 mg Amino (div by) 18 mg/hr = 27.77 hrs

3. 250 ml fluid (x) 60 drops/ml = 15000 drops   27.77 hrs (x) 60 mins/hr = 1666 mins

   15000 drops (div by) 1666 mins = 9 drops per minute

   ALTERNATIVELY: 250 ml (div by) 27.77 hrs = 9 ml per hour

   9 ml/hr (x) 60 drops/ml = 540 drops per hour (div by) 60 mins/hr = 9 drops/min

   NOTE: with a pediatric IV set (delivers 60 drops per ml) ml/hour and drops/min are the same number.

When doing flow rates you wind up expressing your answer in ml per hour, ml per minute, or drops per minute. The most common flow rates for large volume IV fluids range from 75 to 125 ml per hour but smaller and larger rates are possible to correct volume deficits (rarely greater than 250 ml per hour) or to simply keep an IV line open and flowing (KVO, or keep vein open rate) at 42 ml per hour.

IV sets generally deliver 10, 12, 15 or 20 drops per ml (for adult IV sets) and 60 drops per ml (for pediatric IV sets). Since a drop rate implies that the nurse is going to actually count the drops falling in the drop chamber, ask this simple question – how high can you count in one minute? Few people would say they could count to 100 in one minute, Therefore, your drops per minute rate must by less than 100 to be realistic and 60 is a more likely number. **NOTE:** With a pediatric IV set (60 drops per ml) flow rate in ml per hour = drops per minute.

If one liter (1000 ml) of fluid is to be administered, then 125 ml/hr = 8 hr; 100 ml/hr = 10 hr; 84 ml/hr = 12 hr; 75 ml/hr = 14 hr; and 42 ml/hr = 24 hr.

4. $Vd = \frac{Dose}{Co}$ 8 mcg/ml = 8 mg/liter $Vd = \frac{120\ mg}{8\ mg/L} = 15$ liters

5. 60 ml (x) 0.1 mg/ml = 6 mg reserpine needed $\frac{6\ mg}{0.25\ mg/tab} = 24$ tabs needed

6. 22 lbs (div by) 2.2 lbs/kg = 10 kg 10 kg (x) 0.01 mg/kg/dose = 0.1 mg per dose

Since liquid is 0.1 mg per ml and dose is 0.1 mg, then there will be 1 ml per dose.

7. 0.1 mg/dose (x) 2 doses per day = 0.2 mg needed per day

6 mg in Rx (div by) 0.2 mg per day = 30 days

ALTERNATIVELY: 60 ml (div by) 1 ml/dose = 60 doses (div by) 2 doses/day = 30 days

8. $\frac{\$X}{24\ tabs} = \frac{\$\ 20.00}{100\ tabs} = \$\ 4.80$

9. 0.25% = 2.5 mg/gram (x) 30 grams = 75 mg needed (div by) 40 mg/ml = 1.875 ml

10. 1.875 ml (x) Sp Grav of 1.0 = 1.875 grams of weight for triamcinolone injection

30 grams total (minus) 1.875 grams = 28.125 grams of cold cream needed

NOTE: This problem can be changed by changing the specific gravity of the drug being added. Always multiply volume (x) specific gravity to get weight. Rearrange for other values.

11. MW of NaCl = 58.5, so 58.5 mg = 1 millimole

Na^+ is monovalent (one charge), thus 58.5 mg (div by) 1 = 58.5 mg = 1 milliequivalent

60 mEq (x) 58.5 mg/mEq = 3510 mg needed   23.4 % = 234 mg per ml

3510 mg (div by) 234 mg/ml = 15 ml required

Another way to work No. 11 $\frac{234\text{ mg}}{58.5\text{ mg/mEq}}$ = 4 mEq per ml

60 mEq (div by) 4 mEq/ml = 15 ml required

12. Best solved by using alligation

70%		10 parts
	10%	
0%		60 parts

$\frac{60\text{ parts}}{70\text{ parts}}$ = 1015 ml (1015 ml includes the NaCl added) (will be total volume after all additions = 1184.17 ml)

$\frac{X\text{ ml}}{10\text{ parts}} = \frac{1015\text{ ml}}{60\text{ parts}}$ = 169.17 ml

13. 1000.00 ml of sterile water
169.17 ml of dextrose 70%
15.00 ml of NaCl 23.4%
1184.17 ml Total Volume

1184.17 ml (div by) 24 hrs = 49.34 ml/hr

Would really run at 49 or 50 ml per hour. NAPLEX answers are multiple choice and would include 49 or 50, but not both.

14. 1 grain = 64.8 mg exactly   65 mg is usable, 60 mg only in some circumstances

15. 1 avoirdupois pound (one we all know) = 454 grams   (exact is 453.6 grams)

16. 1 fluid ounce = 29.57 milliliters exactly   30 ml routinely used

17. 1 US gallon = 128 fluid ounces   (also 3785 ml, 4 quarts, 8 pints)

18. I US pint = 473 mls   480 mls – 16 fluid ounces (x) 30 ml/ounce) – is often used

19. 0.2 mg = 200 micrograms
500 mcg = 0.5 milligrams

Use either one $\frac{X\text{ ml}}{200\text{ mcg}} = \frac{2\text{ ml}}{500\text{ mcg}}$ = 0.8 ml needed

20. 165 pounds (div by) 2.2 lbs/kg = 75 kg

75 kg (x) 4 mg/kg = 300 mg needed $\frac{X\text{ ml}}{300\text{ mg}} = \frac{2\text{ ml}}{80\text{ mg}}$ = 7.5 ml needed

21. 1 grain = 65 mg (x) 2 = 130 mg needed   13% = 130 mg per ml; so you need 1 ml

22. % weight/weight (x) specific gravity = % weight/volume

90% wt/wt (x) 1.11 (SpGr) = 99.9 % wt/vol -or- 100%

% = grams per 100 ml, so 100% = 100 grams per 100 ml -or- 1 gram per ml

60 ml (x) 0.05 (= 5%) = 3 grams needed; if concentration is 1 gm/ml, then need 3 ml

23. DTD means the formula is for one capsule   15 mg/cap (x) 15 caps = 225 mg needed

(MFT was once used to mean the formula was for 15 caps but is now routinely used to simply indicate to "mix and make" capsules.)

MPJE Law Note on No. 23: You probably would use C-II codeine to prepare the product, but after mixing the codeine with other drugs you would now have a C-III product (equivalent to Tylenol No. 2 tablets.) BUT, If you simply dissolve codeine in water, cherry syrup or some other diluent with no active ingredients, then the product would remain a C-II because codeine only converts to a C-III or C-V when mixed with other active ingredients that limit abuse of the codeine.

24. 300 mg + 30 mg + 15 mg = 345 mg per capsule

345 mg (div by) 65 mg per grain = 5.3 grains per capsule

25. 1: 5000 means 1 gram in 5000 ml 1 gram = 1000 mg, thus we would have 1000 mg in 5000 ml, but we are only making one liter (1000 ml)

$$\frac{X\text{ mg}}{1000\text{ ml}} = \frac{1000\text{ mg}}{5000\text{ ml}} = 200\text{ mg for 1000 ml}$$

5% = 50 mg/ml

$$\frac{200\text{ mg}}{50\text{ mg/ml}} = 4\text{ ml needed}$$

26. MW of Li $_{\text{(two)}}$ carbonate = 74 Thus, 74 mg of Li Carb = 2 millimoles of lithium

300 mg (x) 3 doses/day = 900 mg per day

$$\frac{X\text{ mMoles}}{900\text{ mg}} = \frac{2\text{ mMoles}}{74\text{ mg}} = 24.3\text{ mMoles per day}$$

27. MW of Li $_{\text{(three)}}$ citrate = 210   Thus, 210 mg of Li citrate = 3 millimoles of lithium

$$\frac{X\text{ mg}}{24.3\text{ mMoles}} = \frac{210\text{ mg}}{3\text{ mMoles}} = 1701\text{ mg of Li citrate needed daily}$$

$$\frac{X\text{ ml}}{1701\text{ mg}} = \frac{5\text{ ml}}{300\text{ mg}} = 28.35\text{ ml per day}$$

(NAPLEX could ask for a specific dose. In this case 10 ml TID would be a good dose.)

28. At a concentration of 500 mg per ml, and 5 grams of drug, there would be a total volume of 10 ml. But only 9.6 ml of diluent was added, so the powder contributed 0.4 ml to the final volume. Similarly, at 250 mg/ml, there would be 20 ml of volume and at 100 mg/ml there would be 50 ml of volume. In each case the amount of diluent added was 0.4 ml less than the final volume. Therefore, the powder will contribute 0.4 ml to the volume.

5 grams = 5000 mg   5000 mg (div by) 200 mg/ml = 25 ml of total volume

25 ml (minus) 0.4 ml (the powder volume) = 24.6 ml of diluent to add to make 200 mg/ml

29. Can be done by alligation

1%		0.1 parts
	0.1%	
0%		<u>0.9 parts</u>
		1 part = 30 grams

$$\frac{X\text{ grams}}{0.1\text{ parts}} = \frac{30\text{ grams}}{1\text{ part}} = 3\text{ grams of 1\% hydrocortisone}$$

30 gms (minus) 3 gms = 27 grams of cold cream needed

29. (cont) Another Method that can be used

0.1% = 1 mg per gram (x) 30 grams = 30 mg hydrocortisone needed
1% Hydrocortisone = 10 mg hydrocortisone per gram
30 mg needed (div by) 10 mg hydrocortisone per gm of cream = 3 gm cream
30 gms (minus) 3 gms = 27 grams of cold cream needed

30. Alligation again

23.4%		2.1 parts
	3%	
0.9%		20.4 parts = 1000 ml

$\frac{X\ ml}{2.1\ parts} = \frac{1000\ ml}{20.4\ parts}$ = 102.9 ml to add to 1000 ml

31. 23.4% = 234 mg per ml (x) 102.9 ml = 24,078.6 mg NaCl added

23 + 35.5 = 58.5 mg per mMole NaCl   One charge, so divide by one = 58.5 mg = 1 mEq

24,078.6 mg (div by) 58.5 mg/mEq = 411.6 mEq of NaCl

32. 3% NaCl = 30 mg per ml (x) 1000 mls = 30, 000 mg (or 30 grams) per liter

MW of NaCl = 58.5 mg per millimole (Na = 23, Cl = 35.5)

NaCl —> Na^+ and Cl^- (two particles per millimole), so 58.5 mg = 2 milliosmoles

$\frac{X\ milliosmoles}{30,000\ mg} = \frac{2\ milliosomoles}{58.5\ mg}$ = 1,025.64 milliosmoles

NOTE that the question asked for milliosmoles per LITER. The problem could be changed to ask for the total number of milliosmoles in the BAG .... 9000 mg from the Normal Saline plus 24,078 mg added to the bag = 33, 078 mg in the bag, comes out to be 1130.87 milliosmoles in the bag.

33. 10 mg per 5 ml = 2 mg per 1 ml   2 mg/ml = 0.2% solution

60 mg per ml = 6% solution

4 fluid ounces = 120 ml

6%		0.2 parts
	0.2%	
0%		5.8 parts = 120 ml

$\frac{X\ ml}{0.2\ parts} = \frac{120\ ml}{5.8\ parts}$ = 4.14 ml of codeine injection   (This method allows for the increased final volume of adding the codeine.)

34. 2% = 20 mg per ml (x) 30 ml = 600 mg needed (x) 0.12 = 72 mg of NaCl equivalency

Normal = 0.9% NaCl = 9 mg/ml (x) 30 ml = 270 mg NaCl to make 30 ml Normal Saline Saline

270 mg (minus) 72 mg from tetracycline = 198 mg NaCl needed

35. MW NaCl = 58.5 and monovalent; thus 58.5 mg per mEq (x) 2.5 mEq/ml = 146.25 mg/ml

198 mg (from No. 34) (div by) 146.25 mg per ml = 1.35 ml needed

36. 100 mcg = 0.1 mg per ml
0.04 mg = 40 mcg per dose

Can use either one

$\frac{X\ ml}{40\ mcg} = \frac{1\ ml}{100\ mcg}$ = 0.4 ml

37. DTD means formula is for one capsule   0.3 mg/cap (x) 20 caps = 6 mg needed

NOTE: When unsure about is the formula for one capsule or for several capsules, just go by the dose per capsule. In this case, 300 mg is the usual dose of acetaminophen. If you divided that by 20, you would get a dose of 20 mg for the acetaminophen and that is just too low.

38. 6 mg (div by) 60 mg per grain = 1/10th of a grain   (6 mg was determined in No. 37, above)

$$\frac{X\text{ tabs}}{1/10\text{th grain}} = \frac{1\text{ tab}}{1/150\text{th grain}} = \frac{1/10\ (x)\ 1}{1/150} \quad \text{Invert and multiply} \quad \frac{1}{10}\ (X)\ \frac{150}{1} = 15\text{ tabs}$$

NOTE: Hyoscine HBr is a potent alkaloid and, as such, the grain to mg equivalent is reduced to 60 mg per grain to provide a safety factor when administering the drug. This same concept is the usual reason for drug products where 60 mg = 1 grain. Again, with NAPLEX being multiple choice, you can get the answer they want. NAPLEX would likely set up the answer to be based on the 64.8 mg grain.

39. $\frac{100\%}{2\%}$ = 50 (Accuracy Factor)   50 (x) 5 mg sensitivity = 250 mg least amount that can be weighed with 2% accuracy

40. DTD = 20 caps (x) 7.5 mg/cap = 150 mg needed (div by) 15 mg/tab = 10 tabs needed

41. 10 tabs (x) 100 mg/tab = 1000 mg for the morphine
325 mg (x) 20 caps = 6500 mg for the acetaminophen

1000 mg
<u>6500 mg</u>
7500 mg (div by) 20 = 375 mg per capsule

42. 1 avoirdupois ounce = 28.35 grams = 28,350 mg $\frac{\$\ X}{60\text{ mg}} = \frac{\$\ 62.20}{28{,}350\text{ mg}}$ = \$ 0.13 (13 cents)

43. 24 mg/hr (x) 24 hrs = 576 mg theophylline

576 mg (div by) 0.8 = 720 mg of aminophylline needed

44. $\frac{X\text{ ml}}{720\text{ mg}} = \frac{1\text{ ml}}{25\text{ mg}}$ = 28.8 ml

45. 0.05% = 0.5 mg per ml one teaspoonful = 5 ml, so one-half teaspoonful = 2.5 ml

2.5 ml/dose (x) 0.5 mg/ml = 1.25 mg per dose (x) 4 doses/day (x) 10 days = 50 mg

46. 1:1000 means 1 gram in 1000 ml -or- 1000 mg in 1000 ml -or- 1 mg per 1 ml

120 ml are to be prepared, so you will need 120 mg

10% = 100 mg per ml in stock solution   120 mg (div by) 100 mg/ml = 1.2 ml needed

47. 0.01% = 0.1 mg/ml (x) 1000 ml = 100 mg HCl needed

40% wt/wt (x) 1.2 sp grav = 48% wt/vol   48% = 480 mg per ml

100 mg (div by) 480 mg/ml = 0.21 ml HCl needed

48. 198 lbs (div by) 2.2 lbs/kg = 90 kg (x) 15 mg/kg = 1350 mg needed

500 mg in 2 ml = 250 mg/ml   1350 mg (div by) 250 mg/ml = 5.4 ml

49. $CaCl_2 * 2\ H_2O$ = MW of 147   Dissociates into Ca + Cl + Cl or 3 milliosmoles/millimole (Water does not count as particles)

10% = 100 mg per ml or 1000 mg per 10 ml vial   (147 mg = one millimole)

$$\frac{X \text{ mOsms}}{1000 \text{ mg}} = \frac{3 \text{ mOsms}}{147 \text{ mg}} = 20.4 \text{ milliosmoles}$$

50. $NaHCO_3$ = MW of 84, thus 84 mg = 1 milliequivalent (sodium is monovalent)

8.4% = 84 mg per ml, thus there is 1 mEq per ml (84 mg/ml, 84 mg = 1 mEq)

50 ml therefore = 50 mEq   (NOTE: The reason sodium bicarbonate injection is 8.4% is to make the concentration 1 mEq per ml for easy dosing.)

51. 4% = 40 mg per ml (x) 500 ml = 20,000 mg in the bag

20,000 mg (div by) 2 mg/min = 10,000 mins (div by) 60 mins/hr = 166.7 hrs

52. 1:5000 means one gm in 5000 ml   You have 10 ml with 1 gm per 5 ml = 2 gm

thus; 1:5000 would mean 2 gm in 10,000 ml   You must add 9,990 ml of water

53. Dextrose 50% means 50 gm in 100 ml or 500 gm in 1000 ml
Amino Acids 10% means 10 gm in 100 ml or 40 gm in 400 ml

500 gm dextrose (x) 3.4 cals per gm = 1700 cals   1700 + 160 = 1860 cals per day
40 gm amino acids (x) 4 cals per gm = 160 cals

54. 1000 ml + 400 ml + 200 ml + 800 ml = 2400 ml per day

2400 ml/day (div by) 24 hours = 100 ml per hour (x) 10 drops/ml = 1000 drops/hr

1000 drops/hr (div by) 60 mins/hr = 16.7 (or 17) drops per min

55. 1:750 = 1 gm in 750 ml -or- 1000 mg in 750 ml $\frac{X\ mg}{30\ ml} = \frac{1000\ mg}{750\ ml}$ = 40 mg for the 30 ml

17% = 170 mg per ml and 170 mg in 50 drops

$\frac{X\ drops}{40\ mg} = \frac{50\ drops}{170\ mg}$ = 11.76 (or 12) drops needed

56. 500 mg aminophylline (x) 0.8 (for 80% theophylline) = 400 mg theophylline

400 mg theophylline (div by) 100 mg per tab = 4 tabs

57. 50% wt/wt (x) 1.40 Sp Gr = 70% wt/vol

58. 0.05% = 0.5 mg per ml (x) 15 ml = 7.5 mg of indomethacin needed

7.5 mg (x) 0.16 (E-value) = 1.2 mg Thus, 7.5 mg indomethacin replaces 1.2 mg NaCl

Norm Saline = 0.9% or 9 mg/ml (x) 15 ml = 135 mg NaCl needed if no drug present

135 mg (minus) 1.2 mg = 133.8 mg NaCl needed after allowing for indomethacin

Boric Acid E-value is 0.52; thus, 1 mg of boric acid = 0.52 mg of NaCl for isotonicity

$\frac{X\ mg\ Boric\ Acid}{133.8\ mg\ NaCl} = \frac{1\ mg\ Boric\ Acid}{0.52\ mg\ NaCl}$ = 257.3 mg of boric acid needed

59. 5.5% = 55 mg per ml 257.3 mg (div by) 55 mg/ml = 4.68 ml needed

60. 7.5 mg of indomethacin needed 1 mg per vial so need equal to 7.5 vials but you must use 8 vials to have 7.5 mg available

61. Bacterial – due to the increased number of neutrophils.

62. Bands and Segs are neutrophils, thus 5 + 65 = 70

This means that 70% of the white blood cells are neutrophils

WBC count = 14,000 cells per cubic millimeter (yes, milliMETER) (x) 0.7 = 9800 neutrophils cells

63. Granulocytes are bands, segs, basophils and eosinophils (5 + 65 + 1 + 2 = 73) so 73% of white blood cells are granulocytes. Thus 14,000 (x) 0.73 = 10,200

64. 200 gm (x) 3.4 cals/gm = 680 cals in 12 hrs (x) 2 = 1360 calories in 24 hours

65. 70% = 70 gm per 100 ml $\frac{X\ ml}{200\ gm} = \frac{100\ ml}{70\ gm}$ = 285.7 ml

66. $MgSO_4 * 7 H_2O$ = MW of 246 Mg is divalent, thus 246 mg = 2 mEq of Mg sulfate

246 mg (div by) 2 = 123 mg per mEq   123 mg/mEq (x) 10 mEq = 1230 mg needed

50% = 500 mg per ml   1230 mg (div by) 500 mg/ml = 2.46 ml needed

67. 40 mg per 4 ml = 10 mg per ml   10 mg (div by) 10 mg/ml = 1 ml needed

68. MW of NaCl = 58.5   Na is monovalent, thus 58.5 mg = 1 mEq

58.5 mg/mEq (x) 50 mEq = 2925 mg needed

23.4% = 234 mg per ml   2925 mg (div by) 234 mg/ml = 12.5 ml needed

69. MW of Na phosphate = 164   So, 164 mg = 3 millimoles of Na per millimole Na phosphate

9 mMoles of Na phosphate (x) 3 = 27 mMoles of sodium

1 mMole of Na = 1 mEq of Na because Na is monovalent

Thus, 27 mMoles = 27 mEq of sodium added with the Na phosphate

70. 8.4 mg = 8,400 mcg (div by) 200 puffs = 42 mcg per puff

840 mcg limit per day (div by) 42 mcg per puff = 20 puffs per day

71. 1:200,000 = 1 gram per 200,000 ml -or- 1000 mg per 200,000 ml -or- 1 mg per 200 ml

$$\frac{X\ mg}{20\ ml} = \frac{1\ mg}{200\ ml} = \frac{20\ ml\ (x)\ 1\ mg}{200\ ml} = 0.1\ mg$$

Epinephrine Amps, 1% = 10 mg per ml

$$\frac{X\ ml}{0.1\ mg} = \frac{1\ ml}{10\ mg} = \frac{0.1\ mg\ (x)\ 1\ ml}{10\ mg} = 0.01\ ml$$

How best to obtain such a small volume? Take 1 ml of Epinephrine, dilute to 100 ml with sterile water, then use 1 ml of the diluted solution.

72. $$\frac{55\ pounds}{2.2\ lbs/kg} = 25\ kg\ of\ patient\ (x)\ 0.3\ mg\ per\ kg = 7.5\ mg\ per\ week$$

7.5 mg/week (div by) 7 days/week = 1.1 mg per day (approx)

$$\frac{X\ ml}{1.1\ mg} = \frac{2\ ml}{10\ mg} = 0.22\ ml\ per\ dose\ per\ day$$

73. Ideal Hgb (15) minus Patient Hgb (8) = 7 gram Hgb deficit (x) 55 kg = 385 mg total iron needed

385 mg iron (x) 0.05 (or 5%) = 19.25 mg iron per dose

19.25 mg per dose (div by) 12.5 mg elemental iron per ml = 1.54 ml per dose

74. 560 mg Ca Citrate Tetrahydrate (x) 0.2 (for 20%) = 112 mg of elemental calcium per tablet

$\frac{\text{1000 mg of elemental calcium per day}}{\text{112 mg of elemental calcium per tablet}}$ = 8.93 (or nine) tablets per day

The explanation is that the tablets are not pure calcium and most of the tablet is not calcium but the citrate and the water.

75. 1:200 = one gram in 200 ml -or- 1000 mg in 200 ml $\frac{\text{X mg}}{\text{20 ml}} = \frac{\text{1000 mg}}{\text{200 ml}}$ = 100 mg in the 20 ml

1:5000 = one gram in 5000 ml -or- 1000 mg in 5000 ml $\frac{\text{X ml}}{\text{100 mg}} = \frac{\text{5000 ml}}{\text{1000 mg}}$ = 500 ml would be produced

76. 1:750 = 1 gram in 750 ml $\frac{\text{X grams}}{\text{3785 ml (1 gal)}} = \frac{\text{1 gram}}{\text{750 ml}}$ = 5.0467 grams per gallon of 1:750

$\frac{\text{X ml}}{\text{5.0467 gm}} = \frac{\text{100 ml}}{\text{17 grams (17\%)}}$ = 29.69 ml ~ 1 ounce would be added to one gallon of water to make the 1:750 solution

77. KCl = 39 + 36 = 75 for the molecular weight; it is a monovalent salt, so 75 mg = one mEq

30 mEq (x) 75 mg per mEq = 2,250 mg (2.25 grams) that have been administered over 8 hours

IV set is 15 drops per ml, running at 30 drops per minute = 2 ml per minute

8 hours (x) 60 minutes per hour = 480 minutes 480 mins (x) 2 ml/min = 960 ml infused

No 77 continues –

To change to percent $\frac{\text{X grams}}{\text{100 ml}} = \frac{\text{2.25 grams}}{\text{960 ml}}$ = 0.234 grams per 100 ml -or- 0.234%

78. Best done by alligation, but also done with mathematics

ALLIGATION METHOD

20 3 = 80 ml

3

0 17 = **453.33 ml**

20 = 533.33 ml

MATHEMATICS METHOD

80 ml (x) 0.20 (= 20%) = 16 grams of morphine

$\frac{\text{X ml}}{\text{16 gms}} = \frac{\text{100 ml}}{\text{3 gm}}$ = 533.33 ml total volume

533.33 ml total volume (minus) 80 ml = **453.33 ml**

79. 0.4 mg (x) 20 caps = 8 mg total 8 mg (div by) 64.8 mg = 1/8th grain

80. 325 mg (x) 20 caps = 6,500 mg (div by) 1000 mg/gram = 6.5 grams

81. Atropine, 8 mg + Acetaminophen, 6500 mg + Morphine 100 mg (5 mg/cap (x) 20 caps) = 6608 mg

82. Molecular weight $CaCl_2 + 2\ H_2O = 147$ 20 mg per 100 ml = 200 mg per 1000 ml (liter)

One millimole = 147 mg 200 mg (div by) 147 mg per millimole = 1.36 millimoles per liter

83. $CaCl_2 = Ca^{++}$ plus Cl^- plus Cl^- = 3 particles per millimole (147 mg) = 3 milliosmoles

$\frac{X\ \text{particles}}{200\ \text{mg}} = \frac{3\ \text{particles}}{147\ \text{mg}}$ = 4 particles per 200 mg = 4 milliosmoles

84. MW = 147, calcium is divalent, hence 147 mg = 2 mEq of calcium (and calcium chloride)

$\frac{\text{mEq}}{200\ \text{mg}} = \frac{2\ \text{mEq}}{147\ \text{mg}}$ = 2.72 mEq per liter

85. 50 mg in 10 ml = 5 mg in 1 ml diluted to 1000 ml, so 5 mg in 1000 ml is the actual concentration must raise the 5 mg to 1000 mg (1 gram) to express ratio concentration; 1000 mg (div by) 5 mg = 200; since you multiplied the 5 mg by 200, must also multiply the 1000 ml by 200

Final expression of concentration is 1:200,000

86. Weight = 132 pounds (div by) 2.2 lbs per kg = 60 kg of patient (x) 5 mcg/kg/day = 300 mcg/day

0.48 mg = 480 mcg per 1.6 ml $\frac{X\ \text{ml}}{300\ \text{mcg}} = \frac{1.6\ \text{ml}}{480\ \text{mcg}}$ = 1 ml per day

87. 250 mg per 5 ml = 50 mg per ml 50 mg per ml (x) 100 ml = 5000 mg of drug in the bottle

$\frac{X\ \text{mL}}{5000\ \text{mg}} = \frac{5\ \text{mL}}{150\ \text{mg}}$ $X\ \text{mL} = \frac{5\ \text{mL (x) } 5000\ \text{mg}}{150\ \text{mg}}$ = 166.67 ml will be total final volume

166.67 ml (new volume) minus 100 ml (original volume) = 66.67 ml of additional volume needed

55 ml (original amount to add) plus 66.67 ml (additional amount) = 121.67 ml is amount to add

ALTERNATE METHOD:

100 mL (volume of product) minus 55 mL (vol of water added) = 45 mL (vol of drug powder)

250 mg per 5 ml = 50 mg per ml 50 mg per ml (x) 100 ml = 5000 mg of drug in the bottle

$\frac{X\ \text{mL}}{5000\ \text{mg}} = \frac{5\ \text{mL}}{150\ \text{mg}}$ $X\ \text{mL} = \frac{5\ \text{mL (x) } 5000\ \text{mg}}{150\ \text{mg}}$ = 166.67 mL will be total final volume

166.67 mL (final volume) minus 45 mL (powder volume) = 121.67 mL of water to add

88. $\frac{X \text{ mL}}{12 \text{ drops}} = \frac{1 \text{ mL}}{15 \text{ drops}} = 0.8 \text{ mL per minute}$

0.8 mL per minute (x) 60 minutes per hour (x) 15 hours = 720 mL infused in 15 hours

$\frac{\text{mEq KCl}}{720 \text{ mL}} = \frac{40 \text{ mEq KCl}}{1000 \text{ mL}} = 28.8 \text{ mEq KCl}$

89. 39 + 35.5 = 74.5 molecular weight of KCl; monovalent salt so 74.5 mg = 1 mEq

74.5 mg per mEq (x) 28.8 mEq = 2,145.6 mg (divide by 1000 mg/gram) = 2.1456 grams

90. 39 + 35.5 = 74.5 molecular weight of KCl; so 74.5 mg = 1 millimole (and 1 milliequivalent)

74.5 mg per mEq (x) 40 mEq = 2980 mg in the 1000 mL

$\frac{X \text{ mL}}{12 \text{ drops}} = \frac{1 \text{ mL}}{15 \text{ drops}} = 0.8 \text{ mL per min (x) 60 min per hr (x) 15 hr} = 720 \text{ mL in 15 hr}$

$\frac{\text{milligrams}}{720 \text{ mL}} = \frac{2980 \text{ mg}}{1000 \text{ mL}} = 2{,}145.6 \text{ mg}$ $\frac{\text{millimoles}}{2145.6 \text{ mg}} = \frac{1 \text{ millimole}}{74.5 \text{ mg}} = 28.8 \text{ millimoles}$

91. **(A)** Since KCl —> two particles, then 1 millimole or milliequivalent = 2 milliosmoles

28.8 millimoles (from Que 90) (x) 2 milliosmoles per millimole = **57.6 milliosmoles for KCl**

(B) Dextrose is 5% or 5 gm per 100 ml (x) 10 = 50 gm in 1000 ml; 50 gm = 50,000 mg

Dextrose, MW = 180, is not an electrolyte, so 1 millimole (180 mg) = 1 milliosmole

$\frac{50{,}000 \text{ mg}}{180 \text{ mg/mmole}}$ = **277.78 milliosmoles for the dextrose**

(C) One liter of Normal Saline (0.9% NaCl) = 154 mEq of sodium chloride; thus, one liter of half Normal Saline (0.45%) = 77 mEq of sodium chloride (154 div by 2). Further, since Na+ is monovalent, 1 millimole = 1 milliquivalent

NaCl —> Na+ and Cl–, so 1 millimole (or milliequivalent) of NaCl = 2 milliosmoles

77 millimoles of NaCl (x) 2 milliosmoles per millimole = **154 milliosmoles for NaCl**

TOTAL for the Answer: 57.6 (KCl) + 277.78 (dextrose) + 154 (NaCl) = 489.38 milliosmoles

NOTE: Osmolarity of blood is 308. Thus, this solution is about 1.6 times hypertonic

92. 5.3 minus 4.2 = 1.1 1.1 divided by 2 = 0.55 4.2 + 0.55 = 4.75

Selecting a pH of 4.75 would be choosing the middle ground. Using any of several chemical reference texts, one can determine that acetate buffers (sodium acetate plus acetic acid) are commonly used to achieve such a pH.

93. pH = pKa + log $\frac{\text{Conc Base}}{\text{Conc Acid}}$ 4.75 = 4.75 + 0 (0 = log of 1); thus the molar concentrations of (BASE) Sodium Acetate and (ACID) Acetic Acid should be the same (e.g., one mole of each agent)

94. For Sodium Acetate: (Na = 23 x 1) + (C = 12 x 2) + (H = 1 x 3) + (O = 16 x 2) = 23 + 24 + 3 + 32 = 82
Thus, 82 grams = one mole of sodium acetate

For Acetic Acid: (C = 12 x 2) + (H = 1 x 4) + (O = 16 x 2) = 24 + 4 + 32 = 60
Thus, 60 grams = one mole of acetic acid

These quantities would be dissolved in sufficient water to make one liter to prepare the buffer solution.

95. Ca Chloride Dihydrate = $CaCl_2 * 2\ H_2O$, so 40 + 35.5 + 35.5 + 4 (4 H) + 32 (2 O) = 147 mg for MW

Since Calcium is divalent, then 147 mg of Ca Chloride dihydrate contains 2 mEq of calcium

$\frac{\text{X mg of Ca Chloride}}{\text{10 mEq}} = \frac{\text{147 mg of Ca Chloride}}{\text{2 mEq}}$ so, X = $\frac{\text{10 mEq (x) 147 mg}}{\text{2 mEq}}$ = 735 mg is 10 mEq

10% = 100 mg per mL $\frac{\text{735 mg}}{\text{100 mg/ml}}$ = 7.35 ml needed

96. 10 mEq in 500 ml = 1 mEq per 50 ml = 0.5 mEq per 25 ml, so flow rate is 25 ml per hour

25 ml/hour (x) 12 drops/ml = 300 drops per hour (div by) 60 mins/hr = 5 drops per minute

Pharmacokinetic data on Mr. Shirrah: IV bolus dose: 0.5 gram; Peak level: 12 mcg/mL; Trough level at 12 hrs: 0.75 mcg/mL; Therapeutic drug level: 3 mcg/mL

97. Vol Dist = $\frac{\text{Dose}}{\text{Conc Orig (peak)}}$ Vd = $\frac{\text{0.5 gram = 500 mg}}{\text{12 mcg/ml = 12 mg/Liter}} = \frac{\text{500 mg}}{\text{12 mg/liter}}$ = 41.67 liters

98. Cannot directly calculate because needed formula requires use of logarithms. So do by hand method.

Peak at time O	= 12 mcg/ml
One half life	6 mcg/ml
Two half lives	3 mcg/ml
Three half lives	1.5 mcg/ml
Four half lives (12 hr later)	0.75 mcg/ml

Since it took four half lives to fall from peak to trough, and 12 hours passed between peak and trough, then 12 hrs divided by 4 half lives gives 3 hours per half live: t½ = 3 hrs

99. In No. 98, we found it takes two half lives for the drug level to decline to the MIC of 3 mcg per ml. Since one half live is 3 hours, then   3 hrs (x) 2 half lives = 6 hours as time between doses

100. 80 ml/hr (x) 6.5 hr = 520 ml administered (480 ml remain) $\frac{\text{480 ml}}{\text{40 ml/hr}}$ = 12 hours of fluid available

40 mEq KCl in 1000 ml = 4 mEq per 100 ml

$\frac{\text{X mEq}}{\text{520 ml}} = \frac{\text{4 mEq}}{\text{100 ml}}$ = 20.8 mEq of KCl have been given   40 mEq (minus) 20.8 mEq = 19.2 mEq that remain in the bag

No 100 continued:

Could also do for KCl still in the bag $\frac{X\ mEq}{480\ ml} = \frac{4\ mEq}{100\ ml}$ = 19.2 mEq of KCl remaining in the bag

80 mEq (minus) 19.2 mEq = 60.8 mEq needed to add to the bag

K = 39 + Cl = 35.5 = 74.5 mg per mEq (x) 60.8 mEq = 4529.6 mg needed

14.9% = 149 mg per ml (This is same as 2 mEq/ml)   4529.6 mg (div by) 149 mg per ml = 30.4 ml

101. $\frac{X\ mg}{500\ ml} = \frac{400\ mg}{250\ ml}$ = 800 mg dopamine needed (div by) 40 mg per ml = 20 ml needed

102. To what IV fluid should the dopamine be added?

A. Dextrose 5% in Water YES, preferred diluent

B. Sodium Bicarbonate Injection, 5% in Water NO, basic (hi pH) solution incompatible

C. Sodium Chloride Injection, 3% NO, normal saline okay

D. Sterile Water NO, could result in hemolysis of RBCs due to low osmolarity

E. Amino Acids Injection, 10% NO, used for TPN formulations and usually diluted

103. 176 pounds (div by) 2.2 lbs per kg = 80 kg   80 kg (x) 10 mcg/kg/min = 800 mcg per min

800 mcg/min (x) 60 min/hr = 48,000 mcg (= 48 mg) per hour

$\frac{X\ ml}{48\ mg} = \frac{500\ ml}{800\ mg}$ = 30 ml per hour

104. 30 ml/hr (x) 15 drops/ml = 450 drops per hour (div by) 60 min/hr = 7.5 drops per minute (would actually run at either 7 or 8 drops per minute

105. 1:5000 means 1 gram in 5000 ml $\frac{X\ grams}{2000\ ml} = \frac{1\ gram}{5000\ ml}$ = 0.4 grams (or 400 mg)

106. 80 ml/hour (x) 12 drops per ml = 960 drops per hour $\frac{960\ drops/hr}{60\ mins/hr}$ = 16 drops / minute

107. What type of catheter will be inserted into the patient's bladder and used for administration of the amphotericin B bladder irrigation?

A. Swan-Ganz catheter – NO, inserted thru right side of the heart into the pulmonary artery

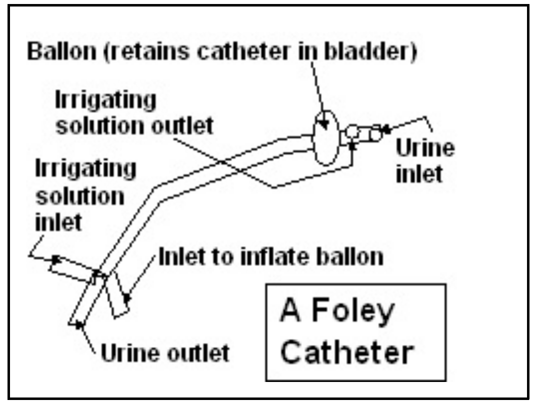
B. PICC catheter – NO, PICC means peripherally inserted central catheter; goes into a vein and terminates just outside the heart

C. Foley catheter – YES, indwelling urinary bladder catheter that would have 3 heads. Head 1 is the outflow point for the urine; Head 2 is the inflow point for the irrigation solution; Head 3 is used to inflate the ballon that keeps the catheter in the bladder.

D. Central catheter – NO, goes into a vein and terminates just outside the heart

107. (Continued from above)

E. Robinson catheter – NO, this is a “straight” catheter that is inserted into the bladder to drain urine but is not intended to remain in the bladder and also does not have a second channel for use for inflation of the balloon or as an irrigation line.



108. 15 units per kg per hr (x) 1.2 (= 20% increase) = 18 units per kg per hr

109. What will be the new flow rate in drops per minute?

176 lbs (div by) 2.2 lb/kg = 80 kg

10,000 units (div by) 100 ml = 100 units per ml

18 units/kg/hr (x) 80 kg = 1440 units/hr

$\frac{\text{1440 units/hr}}{\text{100 units per ml}}$ = 14.4 ml per hour (x) 15 drops/ml = 216 drops per hour (div by) 60 min/hr = 3.6 drops per minute (NAPLEX would increase dose to get bigger and rounded off number.

110. Once the heparin drip was stopped, the physician wanted to change to a subcutaneous agent for further anticoagulation. A possible drug for this purpose would be

A. Warfarin	NO, oral and IV only		
B. Alteplase	NO, IV only	**D. Daltaparin**	YES, subQ route only
C. Argatroban	NO, IV only	E. Lepirudin	NO, IV only

111. 700 mg/ml = 70% so can do by alligation

Dextrose, 15%
Amino Acids, 4%
Sod Chloride, 0.75%
Pot Chloride, 0.2%
MVI-12, 10 ml
Sterile Water qs ad 1000 ml
Flow Rate: 1 ml per kg per hr

```
70          15
      15
 0          55
            70 = 1000 ml
```

$\frac{\text{X ml}}{\text{15 parts}} = \frac{\text{1000 ml}}{\text{70 parts}}$ = 214.3 ml

Could also do by mathematical method:
1000 ml (x) 0.15 (= 15%) = 150 grams of dextrose needed

$\frac{\text{X ml}}{\text{150 gm}} = \frac{\text{100 ml}}{\text{70 gm}} = \frac{\text{15,000 gm/ml}}{\text{70 gm}}$ = 214.3 ml

112.
```
10          4
      4
 0          6
           10 = 1000 ml
```

If 10 parts = 1000 ml, then 4 parts = 400 ml; so need 400 ml

113. 1000 ml (x) 0.0075 (= 0.75%) = 7.5 gm (7500 mg) per 1000 ml

Na = 23, Cl = 35.5 = 58.5 mg per one milliequivalent since Sodium is monovalent

58.5 mg/mEq (x) 4 mEq per ml = 234 mg/ml

7500 mg (div by) 234 mg/ml = 32 ml needed

114. 1000 ml (x) 0.002 (= 0.2%) = 2 gm (2000 mg) per 1000 ml

K = 39, Cl = 35.5 = 74.5 mg per one milliequivalent since Potassium is monovalent

74.5 mg/mEq (x) 2 mEq/ml = 149 mg per ml

2000 mg (div by) 149 mg per ml = 13.4 ml needed

115. How many mL of water will be required to prepare one liter of the formula?

Dextrose	214.3 ml	Total vol	1000 ml
Amino Acids	400 ml	Tot additives	669.7 ml
Sod Chloride	32 ml	Water to add	330.3 ml
Potassium	13.4 ml		
MVI-12	10 ml		
Total additives	669.7 ml		

Dextrose, 15%
Amino Acids, 4%
Sod Chloride, 0.75%
Pot Chloride, 0.2%
MVI-12, 10 ml
Sterile Water qs ad 1000 ml
Flow Rate: 1 ml per kg per hr

116. The first patient to receive this IV fluid had GI tract surgery and needs to be NPO for 5 days. The patient weighs 85 kilograms. How many calories from the dextrose and the amino acids will the patient receive in 24 hours?

1 ml (x) 85 kg (x) 24 hrs = 2040 ml in 24 hours

2040 ml (x) 0.15 (15% dextrose) = 306 gms of dextrose (x) 3.4 cals/gm = 1040.4 cals per 24 hrs

2040 ml (x) 0.04 (4% amino acids) = 81.6 gms amino acids (x) 4 cals/gm = 326.4 cals per 24 hr

Total calories in 24 hours = 1040.4 + 326.4 = 1366.8 cals in 24 hours

117. The IV set used to administer this solution delivers 12 drops per mL. What will be the flow rate to administer the solution at the dose ordered for this patient?

2040 mls (x) 12 drops per ml = 24,480 drops in 24 hours or 1440 minutes (24 hr x 60 min/hr)

24,480 drops (div by) 1440 minutes = 17 drops per minute

118. The Cockcroft-Gault equation is commonly used to estimate the clearance of creatinine in the kidney. If the serum creatinine is stable, the creatinine clearance is a good approximation of the glomerular filtration rate. The usual form of the equation is given below:

$$\text{Clcr (mL/min)} = \frac{[(140 - \text{age}) \times \text{weight (kg)}]}{[72 \times \text{serum Cr (mg/dL)}]} \times 0.85 \text{ (for women)}$$

The weight used should be the ideal body weight (IBW) for the patient involved. **BUT,** NAPLEX has not consistently demanded use of the ideal body weight. Since the math problems on NAPLEX are multiple choice, you should work the problem using the actual body weight given and the ideal body weight. Then see which answer is provided as one of the choices. If both answers are provided, then choose the ideal body weight answer.

For Don Smith: Ideal Body Weight IBW in kg = 50 + (2.3 x 8 inches) = 68.4 kg

$$\text{Clcr (ml/min)} = \frac{[(140 - 35) \times 68.4 \text{ kg}\}]}{72 \times 2.6 \text{ mg/dL}} = \frac{7182}{187.2} = 38.3654 \text{ ml/min}$$

Several methods of calculating ideal body weight from actual body weight and height exist. A common set of formulas is as shown below:

Males 1-18 yrs and > 5 ft tall	IBW in kg = 39 + (2.27 (x) inches over 5 ft)
Males $\geq$ 18 yrs and > 5 ft tall	IBW in kg = 50 + (2.3 (x) inches over 5 ft)
Females 1-18 yrs and > 5 ft tall	IBW in kg = 42.2 + (2.27 (x) inches over 5 ft)
Females $\geq$ 18 yrs) and > 5 ft tall	IBW in kg = 45.5 + (2.3 (x) inches over 5 ft)
Children, 1-18 yrs and < 5 ft tall	IBW in kg = $\frac{(\text{height in cm})^2 \text{ (x) } 1.65}{1000}$

119. 150 mg once, then 150 mg once daily for a creatinine clearance between 30 and 49 ml/min (read this from the chart; no calculations required).

120. 150 mg dose (div by) 10 mg per ml = 15 ml per dose

A NG (nasograstic tube; also N/G) is inserted through the nose into the stomach. Care must be exercised to avoid placing the NG tube in the lung. One method to determine is the NG tube is in the lung is to put the end of the tube extending from the patient's nose into a cup of water and check for bubbles. If the bubbles occur, they represent air coming out of the lungs and the tube needs to be repositioned.