

General Objective

After completion of this learning packet and the required math lab, the student will be knowledgeable in the theory and principles of accurate medication calculations. These include calculations necessary for safe administration of critical care medications including heparin, safe dosage ranges of medications, exact total infusion times, and medication titrations.

Instructions to the Student

Prior to Lab

First review and practice all math theory and principles covered in previous nursing courses. Use your current math textbook and available computer assisted learning materials. Seek help in a timely manner from lab personnel, classroom faculty, or clinical faculty if you have difficulty with this material. The Pre-Test is designed to test all previously learned math skills. It is a tool to enhance learning and to highlight areas of weakness that need additional time.

Upon completion of the review and Pre-Test study the new math theory and principles relevant to this course. Read and work through all chapters in the math textbook and the computer assisted learning materials that cover advanced IV calculations for critical care drugs including heparin, safe dosage ranges of medications, exact total infusion times, and medication titrations. This learning will be reinforced during the math lab. Complete the Post-Test once study of new content is finished and before the NURS 274 math lab.

During the Lab

Come to the lab prepared to apply new skills to learning exercises. This means bring all tools necessary to work with new concepts including the **Math Lab Learning Packet**, a calculator, pencils, and paper. If an individual thinks the math textbook will help bring that too. Some difficulties with the new content or the Post-Test should be clarified during the math lab.

After the math lab continue to review and practice all math theory and principles and to use all available resources to refine math skills prior to the math test. Use math skills in the clinical area with medications actually administered to patients. In this way those skills become part of the tools used to safely care for patients.

NURS 274

Some Key Points

1. Always place a zero before a decimal if it is not preceded by another number (0.5 is correct, .5 is incorrect)
2. Round appropriately and as directed to either the nearest tenth or hundredth. When using a calculator round the final answer only.
3. The item being solved for must always be included as part of an answer for the answer to be considered correct. (60 gtt/min is correct, 60 is incorrect; 1 tab is correct, 1 is incorrect; 2200 h is correct, 2200 is incorrect, etc.).
4. Check medication calculations in the clinical area with another professional person.
5. Therapeutic drug levels are checked periodically for many of the medications administered to patients with health problems studied this semester. Become familiar with those medications and review those levels in the clinical area when caring for patients receiving those medications.
6. Effects of critical care medications and heparin must be assessed frequently to promote therapeutic effects and to prevent complications.
7. The normal adult heparinizing dose is 20,000 to 40,000 units IV per 24 h.
8. Nursing students never titrate medications independently. This skill requires the attention of a registered nurse.
9. Critical care drugs, heparin, and any drugs administered via titration, must be placed on an infusion pump. For purposes of this course and math lab presume that these pumps operate with a drop factor of 60 gtt/ml and, when set up to administer an IV, the pump delivers ordered solutions in mL/h. Therefore, when no drop factor is specified for calculations in the Pre-Test, Post-Test, or on the NURS 270 math test use 60 gtt/mL.

Pre-Test

Conversions

Complete the following conversions.

- | | |
|-----------------------|-------------------------|
| 1. 150 lb = _____ kg | 11. gr 30 = _____ g |
| 2. 1g = _____ mg | 12. 1 kg = _____ lb |
| 3. 0.5 g = _____ gr | 13. 4 mg = _____ g |
| 4. 1500 mL = _____ qt | 14. 7.5cc = _____ mL |
| 5. 40 kg = _____ lb | 15. 1g = _____ gr |
| 6. 5 mL = _____ cc | 16. 30 mL = _____ ounce |
| 7. 0.5g = _____ mg | 17. gr 1 = _____ mg |
| 8. 1 t = _____ mL | 18. 1 in = _____ cm |
| 9. 120 mg = _____ gr | 19. 95 lb = _____ kg |
| 10. gr 12 = _____ g | 20. 170 mg = _____ g |

IV Flow Rates

Calculate the flow rates for the following IVs (df = drop factor)

21. 1L D5W to infuse in 10 hours df 60 gtt/mL _____ gtt/min
22. 150 mL NS bolus IV to infuse in 45 min df 15 gtt/mL _____ gtt/min
23. 1240 mL hyperal to infuse in 12 h df 15 gtt/mL _____ gtt/min
24. 80 mL D5W antibiotic solution in 60 min df 60 gtt/mL _____ gtt/min
25. 3000 mL 0.45% NaCl to infuse in 24 h df 15 gtt/mL _____ gtt/min

26. 800 mL D5 1/3NS to infuse in 8 h df 20gtt/mL _____ gtt/min
27. 1200 mL NS to infuse in 24 h df 10 gtt/mL _____ gtt/min
28. Keflin 500 mg in 50 mL NS to infuse in 20 min df 20 gtt/mL _____ gtt/min
29. Ancef 1g in 100 cc D5W to infuse in 30 min df 60 gtt/mL _____ gtt/min
30. Oxacillin Sodium 900 mg in 125 mL D5W to infuse over 45 min df 20 gtt/mL _____
_____ gtt/min
31. 500 mL D5W IV q4h df 15 gtt/mL _____ gtt/min

For the next 4 items use the same order and four different possible drop factors to calculate the gtt/min. 2L D5NS to infuse in 20h

32. df 10 gtt/mL _____ gtt/min
33. df 15 gtt/mL _____ gtt/min
34. df 20 gtt/min _____ gtt/min
35. df 60 gtt/min _____ gtt/min

Solution Dilutions

Determine how much water must be added to dilute the ordered solution for administration.

36. 30% Ensure, available 320cc, add _____ cc water
37. 75% Vivonex, available 240cc, add _____ cc water
38. 60% Sustacal, available 480cc, add _____ cc water
39. 40% Pulmocare, available 360cc, add _____ cc water

Oral Medications

Calculate one dose of the following orders for oral medications.

40. Order: Synthroid 300 mcg p.o. q.d.
Available: Synthroid 0.3 mg tablets
Give: _____ tablet (s)
41. Order: Phenobarbital gr 1/6 p.o. t.i.d.
Available: Phenobarbital elixir 20mg/5mL
Give: _____ mL
42. Order: Amoxil 400 mg p.o. q.6h
Available: Amoxil 250 mg per 5 mL
Give: _____ mL
43. Order: Decadron 750 mcg p.o. b.i.d.
Available: Decadron 0.75 mg tablets
Give _____ tablet(s)
44. Order: Orinase 250 mg p.o. b.i.d.
Available: Orinase 0.5 g tablets
Give: _____ tablet(s)
45. Order: Neomycin 0.75 g p.o. b.i.d.
Available: Neomycin 500 mg tablets
Give: _____ tablet(s)
46. Order: Robaxin 1.5 g p.o. stat
Available: Robaxin 750 mg tablets
Give: _____ tablet(s)
47. Order: Codeine gr 1/4 p.o. b.i.d.
Available: Codeine 30 mg tablets
Give: _____ tablet(s)

Parenteral Medications

Calculate the amount to prepare for one parenteral dose.

48. Order: Cleocin 300 mg IM q.i.d.
Available: Cleocin 0.6 g/4 mL
Give: _____ mL
49. Order: Atropine gr 1/100 on call to O.R.
Available: Atropine 0.4 mg/mL
Give: _____ mL
50. Order: Lanoxin 0.4 mg IV stat
Available: Lanoxin 500mcg/2cc
Give: _____ mL
51. Order: MS gr 1/10 SC q.4h p.r.n. pain
Available: MS 6 mg/cc
Give _____ mL
52. Order: Lanoxin 0.6 mg IV now
Available: Lanoxin 500 mcg/2mL
Give: _____ mL
53. Order: Phenergan 35 mg IM p.r.n.
Available: Phenergan 50 mg/mL
Give: _____ mL
54. Order: Lasix 60 mg IV stat
Available: Lasix 20 mg/2mL
Give: _____ mL
55. Order: Vitamin B12 0.75 mg IM q.d.
Available: Vitamin B12 1000mcg/mL
Give: _____ mL

Pre-Test Answers

Conversions

1. 68.18 kg; 2. 1000 mg; 3. 7.5 gr; 4. 1.5 qt; 5. 88 lb; 6. 5 cc; 7. 500 mg; 8. 5 mL; 9. 2 gr;
10. 0.8 g; 11. 2 g; 12. 2.2 lb; 13. 0.004 g; 14. 7.5 mL; 15. 15 gr; 16. 1 ounce; 17. 60 mg;
18. 2.5 cm; 19. 43.18 kg; 20. 0.17 g

IV Flow Rates

21. 100 gtt/min; 22. 50 gtt/min; 23. 26 gtt/min; 24. 80 gtt/min; 25. 31 gtt/min; 26. 33
gtt/min; 27. 8 gtt/min; 28. 50 gtt/min; 29. 200 gtt/min; 30. 56 gtt/min; 31. 31 gtt/min;
32. 17 gtt/min; 33. 25 gtt/min; 34. 33 gtt/min; 35. 100 gtt/min

Solution Dilutions

36. 747 cc; 37. 80 cc; 38. 320 cc; 39. 540 cc

Oral Medications

40. 1 tab; 41. 2.5 mL; 42. 8 mL; 43. 1 tab; 44. 1/2 tab; 45. 1-1/2 tabs; 46. 2 tabs; 47. 1/2
tab

Parenteral Medications

48. 2 mL; 49. 1.5 mL; 50. 1.6 mL; 51. 1 mL; 52. 2.4 mL; 53. 0.7 mL; 54. 6 mL; 55. 0.75
mL

Post-Test

Perform the following calculations. Document infusion times in military time.

1. The order is for 1000 mL D5W to infuse at 60 mL/h to begin at 0600. At what time, in hours and minutes, will this IV be completed? _____

2. At 1530 an IV of 2000 mL LR is started at 125 mL/h. At what time will this IV be completed? _____

Use the following order for the next four items.

500 mL 0.9% NS IV q4h. The df is 15 gtt/mL and the IV is started at 0700.

3. How much IV fluid will the patient receive in 24h? _____

4. The flow rate for the IV is _____

5. In hours and minutes, At what time will the first IV be completed? _____

6. How much IV fluid should be infused by 1730? _____

Use the following order for the next three items.

2000 mL of 0.45% NS at 90 mL/h. The first IV liter is started on 11/3 at 2100h.

7. What is the total infusion time in hours and minutes? _____

8. What day and time in hours and minutes will the first IV be completed? _____

9. What day and time in hours and minutes will the second IV be completed? _____

Use the following order for the next two items.

Administer one 8 ounce can of 3/4 strength Ensure via G-tube at 60 cc/hr.

10. How much water must be added to dilute to 3/4 strength? _____

11. In hours and minutes, how long will it take to complete the feeding? _____

Use the following order for the next two items.

Administer 30 mEq KCL in 250 cc D5W over 4 h. Dose of KCL available is 20 mEq in 15 mL.

12. How much KCL must be added to the IV solution? _____

13. At what rate must the IV be set to infuse if df is 60 gtt/mL? _____

Use the following information for the next three items.

A 27 lb child is to receive an antibiotic with a safety range of 20-40 mg/kg/day .

14. What is the lowest recommended dosage per 24 h? _____

15. What is the highest recommended dosage per 24 h? _____

16. Is 125 mg IV q6h within the safe range? _____

17. Order is for Gentamicin 18 mg IVPB q 8 h for a 20 lb child. Safe range is 2 mg/kg IV. Available is Gentamicin 20 mg/2 mL. What amount will be given? _____

18. Somophyllin 175 mg orally is ordered as a loading dose for a 66 lb child. Safety range indicates not to exceed 5 mg/kg for an initial loading dose. Is the dosage ordered safe?

19. Order is for Ampicillin 50 mg/kg/day in equally divided doses q 6 h. Child weighs 26 lb. Available is Ampicillin 125 mg/5mL. What amount will be given for one dose? _____

20. A 55 lb child is to receive Sandoglobulin 0.2 g/kg IV. Available is Sandoglobulin 6g/mL. What amount will be given? _____

The following four orders for heparin administration. Calculate the heparin flow rates and decide if the dosage is safe (Items numbered 21- 32).

Order is for 1 L D5W IV with heparin 25,000 U. Infusion pump is set at 120 mL/h.

21. What is the hourly heparin dosage? _____

22. What is the daily heparin dosage? _____

23. Are these doses in safe range for heparin administration? _____

Order is for 1000 mL 0.45% NS with heparin 25,000 U to infuse at 1000 U/h.

24. What is the flow rate? _____

25. What is the daily heparin dosage? _____

26. Is the daily dose in safe range? _____

Order is for 500 mL D5w IV with heparin 40,000 U to infuse at 2500 U/h. Infusion pump is set at 31 mL/h.

27. What is the daily heparin dosage? _____

28. Is the pump setting accurate? _____

29. Is the dosage safe? _____

Order is for 250 mL D5W with heparin 25,000 U to infuse at 1,000 U/h. Heparin vial indicates 5,000 U/mL.

30. How much heparin must be added to the D5W? _____

31. What is the hourly flow rate? _____

32. If started on Nov. 1 at 0800, when will the infusion be completed? _____

The following requires titration in addition to other calculations (for items 33 - 37).

Order is for Heparin bolus 5,000 U IV followed by heparin drip of 250 cc RL with heparin 25,000 U to start infusing at 1000 U/h.

33. How many units of heparin are there per mL? _____

34. What is the hourly flow rate? _____

To maintain a PTT range of 70 - 100 seconds the following titration is ordered:

PTT 70-100 leave at current infusion rate

PTT >100 reduce infusion by 200 U/h

PTT <70 increase infusion by 200 U/h

Check PTT once per day and 4 h after any infusion adjustment

During first 24 h do not reduce infusion for PTT >100

After first 24 h notify MD for PTT > 100

35. After 8 h therapy the initial PTT is 60. What nursing action is indicated?

36. During the first 24 h the PTT goes to 120. What nursing action must be taken?

37. The PTT at 36 h is still 120. What nursing action must be taken?

Use the following information to complete the next two items. A 150 lb. adult is to receive Dopamine 600 mg/0.5L D5W at 4 mcg/kg/min titrated to 12 mcg/kg/min to stabilize blood pressure.

38. What is the initial setting for the infusion pump? _____

39. What is the maximum flow rate ordered? _____

Use the following information to complete the next four items (40 - 43). On Jan 1, the order is written for Lanoxin 0.5 mg IV stat at 1200, followed by 0.125 mg IV q4h for a total dose of 1 mg. The client weighs 175 lb. The literature identifies the usual digitalizing dose as 8-15 mcg/kg in divided doses over 24 h. Round to whole numbers.

40. What is the lower digitalizing dose range? _____ mcg/kg/24h
41. What is the upper digitalizing dose range? _____ mcg/kg/24h
42. What date and time will the last dose be given? _____
43. According to the literature is this order safe in range and time?

Using the following information answer items 44 - 45. Order is for 225 mg medication in 250 mL IV solution administered a 3 mcg/kg/min, Patient weighs 110 lb.

44. How many mcg/min are ordered? _____
45. How many mL/h? _____
46. Order is for 500 mL D5W IV with Lidocaine 1 g to infuse at 30 mL/h. Normal dosage range for this drug is 1-4 mg/min. Is this dose within the safe range? _____

What is the hourly flow rate for the following medications administered via infusion pump?

47. Dopamine 800 mg in 500 mL NS IV at 15 mcg/kg/min. Weight 70 kg

48. Lidocaine 2 g IV per 1000 mL D5W at 4 mg/min. _____

Use the following information to answer items 49 - 51. 1000 mL D5W with Brethine 10 mg to infuse at 150 mL/h. Normal range is 10-80 mcg/min.

49. How many mg/min of Brethine is patient receiving? _____

50. How many mcg/min of Brethine is patient receiving? _____

51. Is the dosage of Brethine within the normal range? _____

Calculate the concentration of the IV solutions in items 52 - 55.

52. 200 mg nitroglycerin in 500 mL D5W: _____ mg/mL

53. 4 mg Isuprel in 1000 mL D5W: _____ mcg/mL

54. 2 g Lidocaine in 500 mL D5W: _____ mg/mL

55. 200 mg Yutopar in 1000 mL D5W: _____ mcg/mL

Use the following information to complete the next 3 items (56-58). Order is for 250 CC D5W with 200 mg Dopamine to infuse at 200 mcg/min.

56. How many mcg/h is ordered? _____

57. How many mg/h will be infused? _____

58. Hourly rate in mL/h is: _____

Use the following information to complete the next three items (59-61). The order is for 250 mL NS with Dopamine 400 mg to infuse at 2 mcg/kg/min. Client weighs 165 lbs.

59. What is the dosage per minute in mcg? _____

60. What is the dosage per hour in mcg? _____

61. What is the hourly flow rate? _____

62. The order is for 500 mL NS with Intropin 800 mg to infuse at 2mcg/kg/min. The client weighs 154 lb. What is the hourly flow rate? _____

63. The order is for Lidocaine 2 mg/min. Available are pre-mixed bags of 500 mL D5W with 2 g Lidocaine. What is the hourly infusion rate? _____

64. Order is for Synthroid 0.05 mg po q AM. Available is Synthroid 25 mcg/tab.
Give: _____ tab(s)

65. Order is for Betapen-VK 100 mg p.o. q.6h. Available is Betapen-VK 125 mg in 5 mL.
Give: _____ mL

66. Order is for Atropine gr 1/100 IM stat. Available is atropine 0.4 mg/mL.
Give: _____ mL

Use the following information to complete items 67-70. At 1430 a patient is started on Demerol PCA IV pump at 10 mg q.10 min. The PCA pump contains 300mg Demerol in 30 mL solution.

67. How many mL can the patient receive every 10 minutes? _____

68. Five doses in one hour will deliver _____ mg and _____ mL Demerol.

69. How many total doses at 10 mg/dose can this patient receive? _____

70. Five doses every h will empty the PCA at what time? _____

Use the following information to complete items 71-72. Order is for 1 L D5 1/2NS with 20 mEq KCL IV to un at 30 cc/h. Available 250 mL bags of D51/2NS for calculations.

71. How many mEq KCL must be added? _____

72. Available is KCL 2 mEq/mL. How much KCL must be added? _____

Post-Test Answers

1. 2240 h; 2. 0730 h; 3. 3000 mL; 4. 31 gtt/min; 5. 1100 h; 6. 1312.5 cc; 7. 22.22h = 22h 13 min.;
8. 11.11h = 0807 on Nov 4; 9. Nov 4 at 1914h; 10. 80 cc; 11. 5h 20 min.; 12. 22.5 mL;
13. 63 gtt/min; 14. 245.45 mg/kg/day; 15. 490.9 mg/kg/d 16. No, too high; 17. 1.8 mL;
18. No; 19. 5.9 mL; 20. 0.8 mL; 21. 3000 U/h; 22. 72,000 U/24h; 23. No; 24. 40 mL/h;
25. 24,000 U/24h; 26. yes; 27. 60,000; 28. yes; 29. no; 30. 5 mL; 31. 10 mL/h; 32. Nov 2, 0900;
33. 100 U/mL; 34 10 mL/h; 35. Increase infusion 2 mL/h to 12 mL/h; 36. observe patient; keep infusion same rate;
37. reduce infusion by 2 mL and notify physician; 38. 14 mL/h; 39. 41 mL/h; 40. 636;
41. 1193; 42. Jan 2, 0400; 43. yes dose, no time (the safe range should be spread out over 24h); 44. 150 mcg/min; 45. 10 mL/h;
46. yes; 47. 39 mL/h; 48. 120 mL/h; 49. 0.025 mg/min; 50. 25 mcg/min; 51. yes; 52. 0.4 mg/mL;
53. 4 mcg/mL; 54. 4 mg/mL; 55. 200 mcg/mL; 56. 12,000 mcg/h; 57. 12 mg/h; 58. 15 mL/h; 59. 150 mcg/min; 60. 9,000 mcg/h;
61. 6 mL/h; 62. 5 mL/h; 63. 30 mL/h; 64. 2 tabs; 65. 4 mL; 66. 1.5 mL; 67. 1 mL; 68. 50 mg and 5 mL;
69. 30; 70. 2030 h; 71. 5 mEq; 72 2.5 mL