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## Thompson Health Medication Study Guide for Nursing Candidates

Thank you for your interest in employment with Thompson Health. As part of the screening process, all nursing candidates must pass a standardized medication exam before they begin employment. The timing of the exam may vary, but usually occurs on the same day as your physical with Employee Health. Your Recruiter will assist with coordinating this schedule.

### Exam Specifics:

The exam we use is from C-NET (Center for Nursing Education and Training) and is the most recent version that was updated in 2011 (Form #1411). If you have taken this version and can provide documentation of your passing result, you may not be required to re-test.

The exam consists of 3 (three) sections:

- Medication Knowledge (35 questions)
- Safety in Medication Administration (15 questions)
- Medication Calculations (10 questions)

Up to 90 minutes will be provided for the exam. When you have finished, a drug resource guide, provided by Thompson Health, will be made available for 15 minutes before you hand in your exam. You may bring a calculator to use for the calculations, and a pen or pencil but no other resources are allowed.

### Passing results are required for employment:

There will be 4 separate scores for the exam; the overall score and the 3 separate scores from the sections noted above. Candidates will need to pass *each* section with a score of 80.

If a passing score is not achieved with the first exam, remediation will be provided. Candidates will then have 5 business days to re-take a similar exam. If a passing score is not achieved with the second exam, the candidate will no longer be considered for employment.

### Study Necessity:

This study guide is meant to reduce anxiety and to provide a rough guide for information covered in the exam. This is a general medication exam taken by all nurses regardless of specialty area. All Candidates are strongly encouraged to spend at least 3 hours reviewing this study guide. Nurses who have been out of practice, who have not recently worked in direct patient care, or who provide specialized care are especially encouraged to review.

I speak for all of us at Thompson Health as I wish you well on your screening process!

Best regards,  
Deb Rasmussen RN, BSN  
System Clinical Educator  
585-396-6686

## **Drug Properties** (this section is used by permission from the University of Rochester's study guide)

Drug properties such as absorption, distribution, metabolism and excretion make up the pharmacokinetic profile of a drug. This affects the drug's onset of action, peak concentration, duration of action, and bioavailability.

**Absorption-** A drug must be *absorbed* into the bloodstream before it can act in the body.

- Oral tablets must first disintegrate into smaller particles and dissolve in the gastric juices before being absorbed.
- Most absorption of oral medication happens in the small intestine.
- Oral solutions are usually absorbed more quickly since they do not need to disintegrate first.
- Tablets that are enteric coated or have thick coatings are absorbed slowly to prevent disintegration in the stomach or to provide a timed release of the medication.
- Drugs given IM must first be absorbed through the muscle.
- Rectal suppositories must first dissolve to be absorbed through the mucosa.
- Drugs given IV do not need to be absorbed since they are given directly into the blood.
- Many factors affect absorption of drugs; such as the dosage form, chemical make up of the drug, route of administration, interactions with substances in the gastrointestinal tract, and patient characteristics.

**Distribution-** After being absorbed a drug is *distributed* into the blood and other tissues in the body. Patient variations can affect the amount of a drug that is distributed through the body.

- In an edematous patient a drug dose must be distributed to a larger volume than in a non-edematous patient. The dosage of a drug may need to be larger to account for this.
- In a dehydrated patient the dose of a drug is distributed into a smaller volume so the dose must be decreased.
- Patients who are obese need special consideration with some drug dosages since they may not distribute well into fatty tissue. Dosages of these drugs need to be based on lean body mass estimates. An example of a medication like this is digoxin.
- Remember, with both edema and dehydration the drug dosages need to be recalculated when the fluid status is corrected.

**Metabolism-** The liver *metabolizes* most drugs. Drug metabolism may be increased, decreased, or unchanged due to liver disease.

- Patients with liver disease must be monitored closely for desired drug effects or toxicity.

**Excretion-** *Excretion* by the kidneys is another way that a drug is eliminated from the body.

- Patients with decreased renal function need lower doses and maybe longer dosage intervals to avoid drug toxicity.

## **Other Factors**

Patient age: Elderly patients have decreased hepatic and renal perfusion which may result in the need to lower dosages and/or longer dosage intervals (decreased frequency) to avoid drug toxicity.

## **Drug Therapy in Children**

- Calculate children's dosages based on either body weight or body surface area.
- Measure infant doses in a syringe to provide an accurate dose.
- Administer oral drugs in liquid form to infants.
- A child may drink the oral medicine from a medication cup.
- Don't mix the drug with food or formula.

## **Medication Knowledge:**

You may expect any or all of the medications listed below to be contained in the test. When reviewing, it is helpful to understand the general drug class along with the side effects, nursing considerations and patient teaching instructions!

### **Antibiotics**

Vancomycin (\* rapid infusion may cause “red-neck syndrome”)

### **Anticholesterol/Antihyperlipidemics/Statins**

Lipitor

Zocor

### **Anti-coagulants**

Heparin and \* its antagonist (protamine sulfate)

Lovenox

Coumadin

### **Anti-convulsants**

Dilantin (\*monitor BP during & 1 hr after infusion due to small interval between therapeutic & toxic)

### **Antifungal agents** (\* monitor liver function studies)

### **Antihistamines**

### **Antiviral (HIV/AIDS) Medications** (\* neuropathy is a side effects that must be reported)

AZT

DDC

### **Benzodiazepines**

Versed

Valium

### **Beta blockers; Antihypertensive agents**

Atenolol

Lopressor

Inderal (\* increased risk for liver damage)

### **Bladder Medications**

Pro-Banthine (\* an anticholinergic medication that can cause orthostatic hypotension)

### **Cardiac**

Adenosine

Atropine (\* contraindicated with glaucoma)

Bretylol (\* given >10 mins will reduce nausea and vomiting)

Cardizem

Dobutrex

Dopamine

Verapamil

### **Glaucoma medications** (\* promote the outflow of aqueous humor to decrease ocular pressure)

### **Insulin** (\* when mixing in a syringe pull up regular (shorter acting) and then NPH (longer acting))

#### **Given by sliding scale**

Rapid acting: HumaLog, lispro and Novolog, aspart

Short acting: Humulin R, Novolin R, regular

#### **Given daily**

Intermediate acting: Humulin N, Novolin N, NPH

Long acting: Lantus, glargine (do not mix with other insulin)

### **NSAIDS** (\* use with caution in hx of aspirin allergy)

Ibuprofen

Naprosyn

**Oncology Medications** (\* side effects and special considerations)

Cytarabine

Growth Factors (Epogen, Folic Acid)

Hormone Therapy (Lupron)

Tamoxifen

**Pain Management Agents**

Opioids(\* use cautiously/avoid in presence of neuro problems)

Morphine (PCA doses)

**Psychotherapeutic Agents:** (\* review early side effects)

Lithium

**Steroids:** (review effect on body and tapering)

**Thyroid Hormone:** (\* need for long term medication)

Synthroid

**Misc:** Testosterone side effects, Kidney damage and its impact on serum half-life.

## **Safe Medication Administration:**

Remember the five rights! The right: patient drug dose route time

Also remember to:

1. Obtain a patient history
2. Review patient allergies and a family history of allergies  
Suspect a possible drug allergy if there is an immediate family member with this allergy
3. Be aware of interactions such as drug/drug or drug/food  
Grapefruit juice should be avoided with many meds; Avoid antacids before antibiotics, avoid NSADIS with blood thinners
4. Provide education about the med and review side effects and special considerations
5. Document each time you administer a medication

The route of administration affects the absorption of medication into the bloodstream and special techniques may pertain.

**Oral-** be consistent with the time the medication is given. Do not crush or break sustained release tablets or capsules.

**Nasal Drops-** nasal passages need to be clear to allow absorption thru the mucosa; tip head forward for spray and backward for drops; close nostril of opposite side during administration

**Ear (otic) Drops-** administer in side-lying position with affected ear exposed; avoid extreme temperatures due to stimulation of the central nervous system

**Eye (ophthalmic) Drops-** ask the patient to look up, gently pull the lower lid down and administer the drop into the lower conjunctival sac; avoid direct contact of the dropper with the conjunctiva; apply gentle pressure at the inside bridge of the nose for 1-2 mins (promotes adequate absorption and minimizes systemic absorption)

**Rectal-** administer while pt is in left lateral Sims position; a suppository must be inserted beyond the anal sphincter to be absorbed into the rectal mucosa. May apply water or

lubrication to the suppository, but the formula in the suppository will melt with body heat so this is not required.

**Intravaginal-** lying flat for 30 mins will help retain the suppository

**Subcutaneous-** use 25-27 gauge ½-5/8”needle. Administer at 45 degrees with average weight patients; 90 degrees if obese or when gathering the skin of a thin patient. Don’t aspirate when administering heparin or insulin.

**IM-** use 18-23 gauge 1 ¼-3” needle; avoid >3mls at one site; aspirated blood during an IM injection may contaminate the medication, or be incompatible so a new medication is needed

**IV-** direct route into the bloodstream, so there is a greater risk of sepsis. This does not always require a smaller amount of the drug, nor is there a greater risk for anaphylaxis.

**PICC-** Peripherally inserted central line catheters are removed by credentialed staff members. Removal of the catheter should be slow and at 1-2 inches increments to prevent spasms. Warm packs can be used to dilate the vessel for easier removal. Do not flush the catheter with heparin before removal.

\*Medications with a short half life will be quickly excreted and side effects will be brief.

## Medication Calculations:

**Common Conversions:** \*Know how to convert grams to mg and ml to tsp!

To change g to mg multiply by 1000 To change mg to g divide by 1000

	Equals	Also Equals
<b>1 kilograms (kg)</b>	<b>1000 grams (g)</b>	<b>2.2 pounds (lb)</b>
1 gram (g)	1000 milligrams (mg)	1,000,000 micrograms (mcg)
0.001 grams (g)	1 milligram (mg)	1000 micrograms (mcg)
1 microgram (mcg)	0.001 milligrams (mg)	
4 cups (C)	1 liter (L)	1000 milliliters (ml)
2 cups (C)	16 ounces (oz)	1 pound (lb)
1 cup (C)	8 ounces (oz)	240 milliliters (ml)
<b>1 ounce (oz)</b>	<b>30 milliliters (ml)</b>	450 drops (gtts)
<b>1 ml = 1 cc</b>	<b>15 drops (gtts)</b>	
<b>1 tablespoon (tbsp)</b>	<b>15 milliliters (ml)</b>	
<b>1 teaspoon (tsp)</b>	<b>5 milliliters (ml)</b>	
1 grain (gr)	60 milligram (mg)	

## Ratios and Proportions:

Ratios are comparing 2 things. In daily life ratios are often expressed as fractions

i.e.: 1 to 6 or 1/6

In terms of medicine we use ratios to explain things like mg per pill

i.e.: 1 pill is 10 mg, so 1 pill

10mg

Proportions are comparing 2 ratios. The equal sign between them shows this relationship.

$\frac{1}{2} = \frac{2}{4}$   
(is the same as)

With proportions you can cross multiply to find a missing value! Proportions also allow us to check our answer by cross multiplying. The answer on both sides after cross multiplying should be the same!

### Example:

**A doctor's order reads: Phenobarbital 100 mg elixir po Q day**

**On hand: Phenobarbital 20 mg/5 ml**

**How many ml(s) will you administer?**

Set up what we know... In words "20 mg is to 5 ml as 100 mg is to **X ml** (the unknown)

The proportion:  $\frac{20 \text{ mg}}{5 \text{ ml}} = \frac{100 \text{ mg}}{\mathbf{X \text{ ml}}}$

Cross Multiply  $(20 \text{ mg}) \times (\mathbf{X \text{ ml}}) = (5 \text{ ml}) \times (100 \text{ mg})$

You are left with  $20\mathbf{X} = 500$

Divide both sides by 20 to isolate the X ....  $\frac{20\mathbf{X}}{20} = \frac{500}{20}$

The 20s cross themselves out leaving you with an X on the left .  $\mathbf{X} = \frac{500}{20}$

Do the division: When you enter this in a calculator... you will type 500 / 20... **and X=25 ml!**

Check your answer by cross multiplying →  $(20) \times (\mathbf{25}) = 500$   $(100) \times (5) = 500$

**Example: A medication comes in tablets of 150 mg.**

**The dose ordered is 375 mg. How many tablets are needed?**

Set up what we know... In words "150 mg is to 1 tablet as 375 mg is to X tablet(s)

The proportion:  $\frac{150 \text{ mg}}{1 \text{ tablet}} = \frac{375 \text{ mg}}{\mathbf{X \text{ tablet(s)}}}$

Cross multiply  $(150 \text{ mg}) \times (\mathbf{X \text{ tablets}}) = (1 \text{ tablet}) \times (375 \text{ mg})$

You are left with  $150\mathbf{X} = 375$

Divide both sides by 150 ...  $\frac{150\mathbf{X}}{150} = \frac{375}{150}$  Do the division and  $\mathbf{X} = 2.5$  tabs

Check your answer by cross multiplying →  $(150) \times (\mathbf{2.5}) = 375$   $(375) \times (1) = 375$

## Drip Rates:

To calculate a rate, such as an IV gtt factor, use the formula below:

$$\frac{\text{Volume (ml)}}{\text{Time in minutes}} \quad \times \quad \frac{\text{Drip factor (gtts/ml)}}{1 \text{ ml}}$$

Multiply *straight* across!

**Example: Ordered: Zovirax 500 mg IV in 90 ml of D5W over 60 minutes.**

**The Drip Factor is 15 gtts/ml.**

**How many drops per minute should this drug infuse?**

Fill in the numbers:

$$\frac{90 \text{ ml}}{60 \text{ min}} \quad \times \quad \frac{15 \text{ gtts}}{1 \text{ ml}}$$

Multiply straight across:

$$\frac{(90) \times (15)}{(60)} = \frac{1350}{60}$$

Complete the division:

$$\frac{1350}{60} = 22.5 \text{ gtts per minute}$$

**Example: Ordered: Lactated Ringers 1000 ml over eight hours.**

**The Drip Factor is 15 gtts/ml**

First, change the hours to minutes: 8 hrs x 60 mins = 480 mins

Fill in the numbers:

$$\frac{1000 \text{ ml}}{480 \text{ min}} \quad \times \quad \frac{15 \text{ gtts}}{1 \text{ ml}}$$

Multiply straight across:

$$\frac{(1000) \times (15)}{(480)} = \frac{15,000}{480}$$

Complete the division:

$$\frac{15,000}{480} = 31.25 \text{ gtts per minute}$$

**\*\* A different type of drip calculation that you may see:**

**Example: If you have a drip rate of 20 gtts/min and your IV set delivers 15 gtts/ml.**

**How many mls will the patient receive in 2 hours?**

1. Determine how many minutes are in 2 hours. 60 mins x 2 = **120 minutes in 2 hours.**
2. In 2 hours, if something drips at 20 gtts/min, how many drops will occur in 120 minutes?  
Multiply the number of minutes by the drip rate.  
**120 minutes x 20 gtts/min = 2400 total drops in 2 hours.**
3. Now take into account the tubing ("your set delivers 15 gtts/ml") which converts the drips to ml.

Divide the total drops by the set delivery.

**2400 gtts / 15 (gtts per ml) will give you the total ml given in 2 hours. This is what you are looking for!**

Answer: 160 ml in 2 hours

## Pediatric Dosing:

**Since our hospital does not have a unit specifically dedicated to pediatrics, it is important that all nurses understand how to calculate a safe pediatric dose at Thompson.**

Pediatric dosing is based on weight and it is usually expressed in a range. There are several steps to determining if an ordered medication and dose are within the safe range for the patient's weight...

### **Example:**

**Physician Order: Cefuroxime 2 Grams every 8 hours**

**Safe dose for this drug: 75-150 mg/kg/day**

**Patient weight: 30 kg**

1. Determine what the safe dose is with *this* patient's weight.

Multiply the weight in kg by the low safe dose and the high safe dose. This will give you the range.

$$(30 \text{ kg}) \times (75 \text{ mg/kg/day}) = 2250 \text{ mg per day}$$

$$(30 \text{ kg}) \times (150 \text{ mg/kg/day}) = 4500 \text{ mg per day}$$

**The safe range for *this* patient's weight is 2250-4500 mg (2.250g-4.5 g) per day**

2. You just calculated a range PER DAY. Is this how the drug is ordered? If not, then calculate how much you would give PER DOSE.

In step #1 we determined the dose PER DAY.

In the *ordered* example the drug is given Q 8 hrs.

We need to take the dose determined in step 1 and divide it by 3 because there are 3 eight hr periods in a day. So... Divide 2250-4500 mg by 3

**The safe range for this patient is 750-1500 mg (0.75g-1.5 g) per dose**

3. Compare our calculated safe range with the ordered dose. Does the ordered dose fall within our calculated range? If so- it is a safe dose. If not- it is not a safe dose!

**This order is not within the safe range because the order is greater than the safe range.**

### **\*\*Another Example:**

**A child is to receive an ordered antibiotic of 500 units/kg/day. Child's weight is 66 lb or 30 kg. The medication comes in a powder in 5000 unit vials. The nurse reconstitutes by adding diluent to yield 2 ml of solution. How many ml should the child receive per day?**

1. Determine total dose for this child.  $500 \times 30 = 15000$  units per day

2. Set up the proportion:  $\frac{5000}{2} = \frac{15000}{X}$

$$5000 X = 30000$$

Divide both sides by 5000 to isolate the X. This leaves  $\frac{30000}{5000}$

3. Do the division and the answer is **6 ml per day**

**Calculation Practice** \* If you are able to come up with the correct answer for the following problems, you will be well prepared for the exam. The solutions are found on the following pages- however, you may have used a different method to achieve the correct answer. For purposes of the

exam, there is no need to round. Be specific in answer details such as 2 ml per dose or 5 tabs per day. Be sure to work the problem all the way through- what is the question asking?

1. A medication comes in 25 mg tabs and is ordered 2 times a day for a total of 200mg per day. How many tabs should a patient receive with *each* dose?
2. A patient is to receive 2000 mg of a medication in 4 divided doses. The capsules are 500 mg each. How many capsules will be given with *each* dose?
3. A medication order is 600 mg po every 3 hours. How many grams is given *per day*?
4. A child is to receive a total of 240 mg per day of a medication. The medication is given every 8 hours and is available in a solution of 80 mg per 10 ml. How many teaspoons will the child receive with *each* dose?
5. An IV tubing lists its delivery rate as 20 gtts/ml. The drip rate for a medication is set at 60 gtts/min. How many ml (s) will the patient receive in 6 hours.
6. A patient is to receive 750 ml of Lactated Ringers over 4 hours. The gtt factor is 20gtts/ml. How many gtts/min would the patient receive?
7. A patient who weighs 150 lbs is to receive 50mg/kg of a medication every 8 hours. How many mg does the patient receive each day?
8. A child is to receive penicillin IV at a dose of 50,000 units/kg/day. The child's weight is 70 lbs or 32 kg. The medication is available as a powder in 2,000,000 unit vials. The nurse reconstitutes by adding diluent to yield 2 ml of solution. How many ml should the child receive per day?
9. A patient is receiving an infusion of 200 units of heparin per hour. The concentration of heparin is 20,000 units per 500 ml. The infusion pump will be set to infuse at how many ml per hour?
10. A patient is to receive heparin at a bolus dose of 200 units per kg. The patient weighs 200 lb or 91 kg. The concentration of heparin is 1000 units per ml. How many ml should the patient receive?

## Answers

1. A medication comes in 25 mg tabs and is ordered 2 times a day for a total of 200mg per day. How many tabs should a patient receive with *each* dose?

(200 mg) divided by 2 (times a day) = 100mg per dose  
 100 (mg per dose) divided by 25 (mg per tab) = 4 tabs per dose

2. A patient is to receive 2000 mg of a medication in 4 divided doses. The capsules are 500 mg each. How many capsules will be given with *each* dose?

2000 mg / 4 (doses) = 500 mg per dose. The capsules are 500mg  
 So, 1 capsule is given at each dose.

3. A medication order is 600 mg po every 3 hours. How many grams will the patient receive *per day*?

24 (hrs a day) / 3 (given q 3 hrs) = 8 doses a day  
 8 (doses a day) x 600 (mg per dose) = 4800 mg per day  
 4800 (mg per day) / 1000 (mg per g) = 4.8 g per day

4. A child is to receive a total of 240 mg per day of a medication. The medication is given every 8 hours and is available in a solution of 80 mg per 10 ml.

How many teaspoons will the child receive with *each* dose?

1. 240mg (total) / 3 (times a day) = 80mg per dose = 10ml per dose

2. *But* the question asks how many teaspoons?

There are 5 ml per teaspoon so...

$$\frac{5\text{ml}}{1 \text{ teasp}} = \frac{10\text{ml}}{X \text{ teasp}}$$

$$5X = 10$$

$$\frac{5X}{5} = \frac{10}{5}$$

$$X = \frac{10}{5}$$

X=2 teaspoons per dose

5. An IV tubing lists its delivery rate as 20 gtts/ml. The drip rate for a medication is set at 60 gtts/min. How many ml (s) will the patient receive in 6 hours.

1. 6 (hours) x 60 (minutes per hour) = 360 minutes in 6 hours

2. If your drip rate is 60 gtts/min- then multiply the number of minutes by the drip rate.

360 (minutes) x 60 (gtts/min) = 21600 total gtts given in 6 hours.

3. If your set delivers 20 gtts/ml, then divide the total gtts given by the gtts/ml

21600 (total gtts) / 20 (gtts per ml) will give you the total ml given in 6 hours.

Answer: 1080 mls in 6 hours

6. A patient is to receive 750 ml of Lactated Ringers over 4 hours. The gtt factor is 20gtts/ml. How many gtts/min would the patient receive?

60 (minutes) x 4 (hours) = 240 minutes in 4 hours

$$\frac{750 \text{ ml}}{240 \text{ min}} \times 20 \text{ gtts/ml} = 15000$$

240 minutes

1 ml

240

$$62.5 = 63 \text{ gtts/min}$$

7. A patient who weighs 150 lbs is to receive 50mg/kg of a medication every 8 hours. How many mg does the patient receive each day?

Change pounds to kg  $\rightarrow 150 \text{ (pounds)} / 2.2 \text{ (kg per pound)} = 68 \text{ kg}$

$68 \text{ kg} \times 50 \text{ mg per kg} = 3400 \text{ mg per dose}$ . The medication is given 3 times within 24 hours, so  $3400 \text{ mg} \times 3 \text{ times per day} = 10,200 \text{ mg per day}$

8. A child is to receive penicillin IV at a dose of 50,000 units/kg/day. The child's weight is 70 lbs or 32 kg. The medication is available as a powder in 2,000,000 unit vials. The nurse reconstitutes by adding diluent to yield 2 ml of solution. How many ml should the child receive per day?

$50,000 \text{ units} \times 32 \text{ kg} = 1,600,000 \text{ units per day}$

$$\frac{2,000,000}{2\text{ml}} = \frac{1,600,000}{X\text{ml}}$$

$$(2,000,000) \times (X) = (1,600,000) \times (2)$$

$$2,000,000X = 3,200,000$$

$$X = \frac{3,200,000}{2,000,000}$$

$$X = 1.6 \text{ ml}$$

9. A patient is receiving an infusion of 200 units of heparin per hour. The concentration of heparin is 20,000 units per 500 ml. The infusion pump will be set to infuse at how many ml per hour?

$$\frac{20,000 \text{ units}}{500 \text{ ml}} = \frac{200 \text{ units}}{X \text{ ml}}$$

$$20,000 X = 200 \times 500 \rightarrow 20,000 X = 100,000$$

$$X = \frac{100,000}{20,000}$$

$$X = 5 \text{ ml}$$

10. A patient is to receive heparin at a bolus dose of 200 units per kg. The patient weighs 200 lb or 91 kg. The concentration of heparin is 1000 units per ml. How many ml should the patient receive?

$200 \text{ units} \times 91 \text{ kg} = 18200 \text{ units}$

$$\frac{1000 \text{ units}}{1 \text{ ml}} = \frac{18200 \text{ units}}{x \text{ ml}}$$

$$1000 X = 18200 \times 1\text{ml} \rightarrow 1000 X = 18200$$

$$X = \frac{18200}{1000}$$

$$X = 18.2 \text{ ml}$$