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CURRICULAR CONSTRUCTION WITH VEE HEURISTICS: LINKING SCIENTIFIC THEORY AND SKILL PERFORMANCE

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Introduction

Educators realize the significance of theory driven critical thinking for students as they learn skill performance in laboratory experiments, technical skills, and practice professions. In order for skill performance to take on rational meaning, the learner needs to be able to identify the specific scientific theory base upon which skill performance is built. Consequently, educators stress connecting underlying scientific theory and skill performance.

Students at the State University of New York at Binghamton's Decker School of Nursing are taught nursing skills in an upper division nursing major after completing two years of prerequisite work including natural sciences courses. Knowledge of physics, anatomy, physiology, biology, microbiology is fundamental to nursing as a practice profession (Smith, 1992). Theoretical input from the sciences should guide nursing students to understand concepts, principles, and theories so as to clarify rationales for nursing practice ("more than mere knowledge of the reasons") (Akinsanya, 1987, p. 272).

In addition to the emphasis on theory driven practice, teaching skills focuses on accurate performance which is essential to safe practice. However, students often are motivated simply to do procedurally driven, rote mode steps of a skill rather than theory driven performance of that skill. Teaching and learning strategies are needed which foster theory driven skill performance.

Theoretical Framework

This paper is based on the cognitive educational theories of Ausubel, Novak & Hanesian (1986) and Novak and

Gowin (1984) which claim (a) meaningful learning occurs when new knowledge is connected to prior knowledge in ways that strongly link the two, and (b) links between theory and practice can be constructed with the use of Vee heuristics.

Although many curricula include prerequisite courses, students often do not make connections between prior course content and present course work. When learning is focused on skill acquisition, learners typically are more comfortable with rote mode performance than recalling and integrating prior theoretical knowledge with the new knowledge.

To guide students to identify and build on scientific theory learned in prerequisite courses, students can be taught skill performance with a strategy that connects theory and practice, namely the Vee heuristic, which concretely identifies the theory and practice components of a given skill. Concepts, principles, theories and philosophies are specified on the left side of the Vee which forms the theory base undergirding practice. The right side of the Vee denotes the actual performance criteria of the skill by recording the event (observing the skill performance), transforming the data (evaluating the performance), making knowledge claims (identifying each step of the skill to be performed), and value claims (validating the worth of the performance). Fundamental to the Vee is the focus question (how to perform a skill) which is answered by the educative event (learning accurate skill performance). The interconnectedness of theory and practice in the Vee reinforces the theory driven nature of the procedure.

Methodology

Research Questions: Are students who are taught the practice of basic skills in a simulated college laboratory setting with Vee heuristics rather than with traditional modes better able to (1) identify the scientific theory base for specific [nursing] skills, and (2) perform basic [nursing] skills in practiced situations.

Research Design: The research was quasi-experimental with a nonequivalent control group design (n=42). Three instructors each taught weekly labs for a semester long nursing practice course in (a) a traditional mode (demonstration, practice, return demonstration), and (b) a treatment mode (demonstration, practice and return demonstration with the discussion of instructor-made Vees about weekly skills). Short answer questionnaires were administered in which students were asked to state the underlying scientific principles for ten skills. Qualitative analysis of answers was based on inclusion of specific theoretical knowledge from the natural sciences. Analysis of variance (SAS general Linear Models Procedure) was used controlling for groups and instructors (see Appendix A). Taped clinical interviews were conducted to collect subjective data from students who learned with Vee heuristics. Return demonstrations of skill performances were studied to see if performance was significantly different for students taught with traditional or treatment modes.

As part of the research, extensive Vee heuristics were produced (as shown in Appendix B) for a semester long basic skills course.

Findings and Implications

Students using Vee heuristics were significantly better able to articulate the scientific principles specifying why actions were appropriate. Students answered ten short answer questions by explaining theoretical principles underlying why certain skills were performed as they were. For example, one question asked "Why do you bend your knees and shift your weight when moving a client up in bed?" Answers ranged from vague replies such as "to be more steady" to clearly articulate understanding of principles such as "bending the knees lowers center of gravity and shifting weight keeps the line of gravity over the base of support both of which increase stability". Analysis of variance for the short

answers (Appendix A) indicates the mean of responses for all ten short answer questions given by all students. Students who learned with Vees gave answers that were significantly better (with a level of significance of $p=.005$).

TABLE

Analysis of Variance for Short Answers
(SAS General Linear Model Procedure)
By Group and Instructor
(n=42)

Short Answer Questions	$\bar{X}_c$	$\bar{X}_t$	F	p
1 Body mechanics	2.77	3.65	5.44	.03 *
2 Palpation of pulses	2.77	3.60	5.23	.03 *
3 Orthostatic hypotension	2.64	2.70	.02	.90
4 Clean/sterile gloves	3.28	3.40	.07	.79
5 Choice of stethoscope	2.55	3.60	5.97	.02 *
6 Pressure sores	2.59	3.40	3.10	.09
7 Skin inspection	2.41	2.90	4.30	.05 *
8 Blood pressure	3.09	3.75	2.63	.11
9 Percussion technique	2.09	3.35	7.17	.01 *
10 Isolation precautions	3.41	2.65	2.34	.14
Mean of Short Answers	2.76	3.30	8.98	.005 *

* $p<.05$

(Note: This table also appears as Appendix A.)

Data from taped clinical interviews showed that students felt positively about learning with Vee heuristics (81%). Student response to instructor-made Vee heuristics included such comments as "Vees helped make me see why we do it, and what's not so important", "Vees pointed out exactly why;... I need to know why I do things; used them to review for the mid term", and "since I learn by figuring out, they helped me to see why to do certain things".

Students who learned with Vee heuristics did not perform skills significantly better in return demonstrations. Satisfactory performance of specific skills was necessary to pass the course and proceed to sequential nursing courses.

The researcher was not surprised that all students performed skills satisfactorily since students practiced in a mastery learning mode until able to perform skills satisfactorily. What cannot be understood by the educator observing a skill performance is the theoretical meaning underlying the action. Actions with theoretical bases are theory driven rather than procedurally driven. Without an accurate theory base, student could perform steps of a procedure accurately but not understand the significance of the actions. Consequently, when critical thinking and judgement are necessary in actual patient care situations, students performing without theory driven skill performance may chose an unsafe performance alternatives.

The implication for teaching and learning skill performance is that a strategy is available which advances meaningful learning by linking prior scientific knowledge to present learning. Vee heuristics help students see the interrelationships between prerequisite natural science courses and skill performance. The incorporation of theory into practice results in theory driven skill performance.

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APPENDIX A

TABLE

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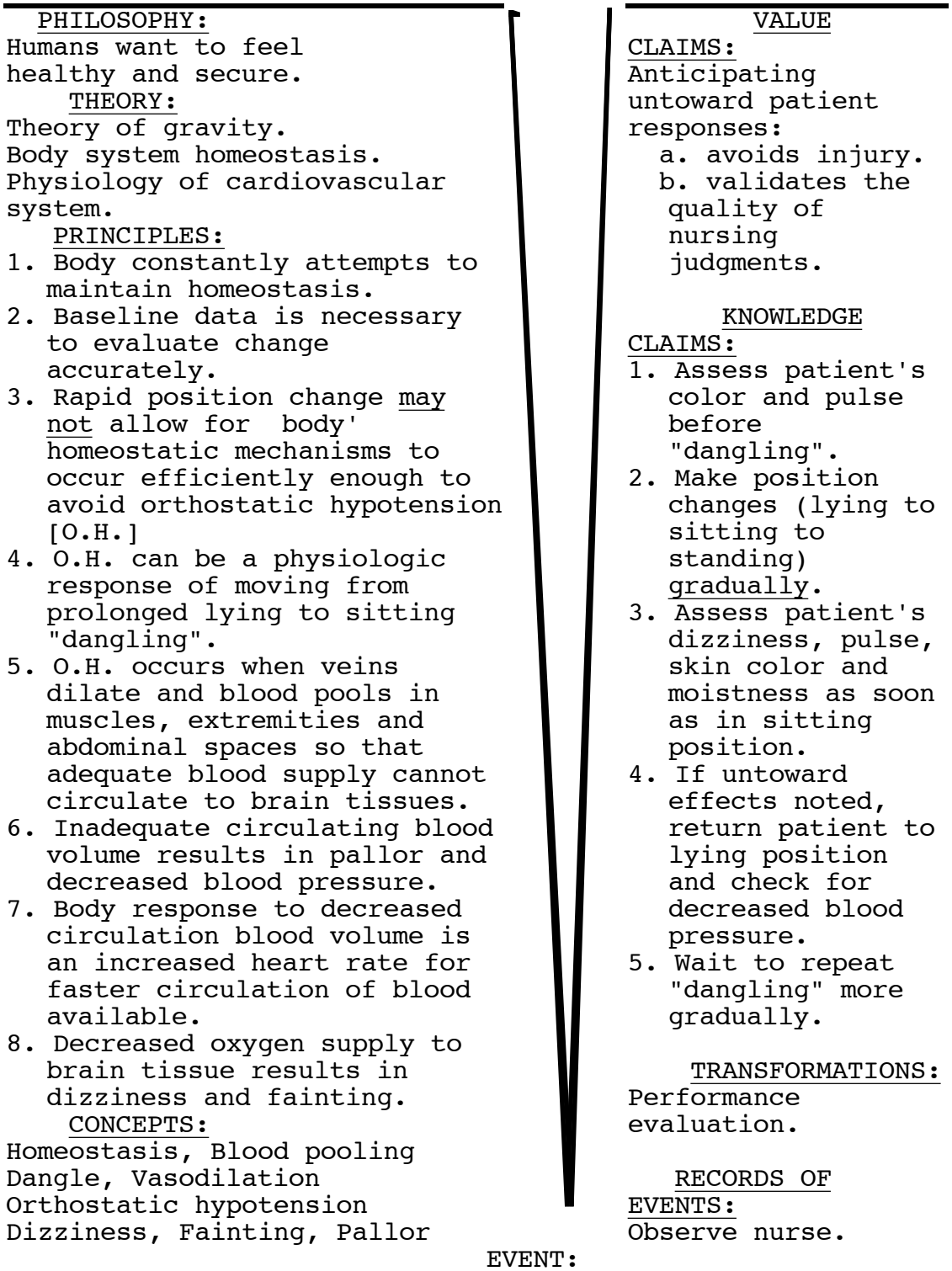
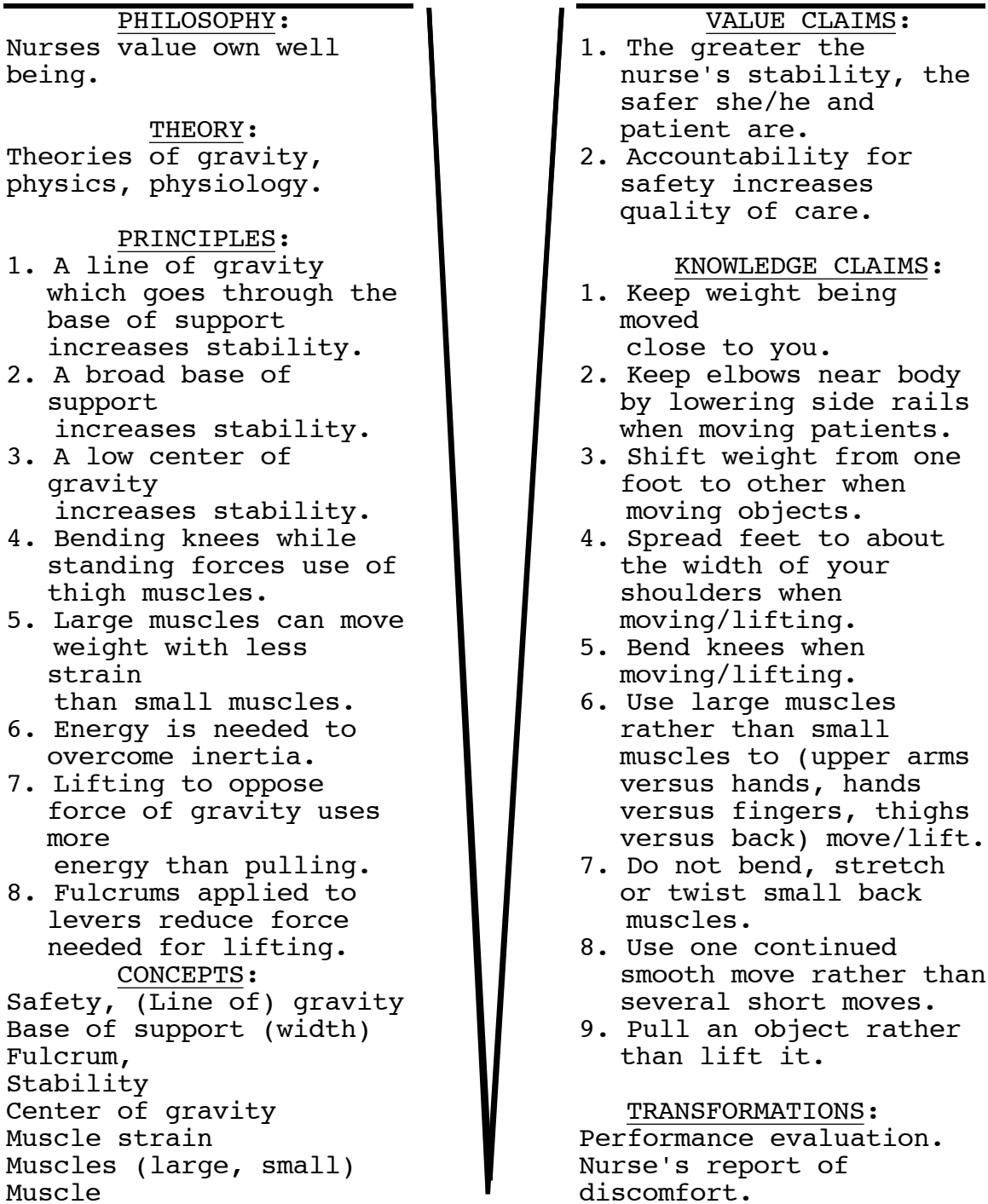
APPENDIX B

FOCUS QUESTION for week #3:
How can a nurse begin mobilizing a patient safety?



FOCUS QUESTION for weeks #1 [plus 3,5]:
How can the nurse maintain
his/her own safety while working?



THEORY

PHILOSOPHY:
Nurses value own well being.

THEORY:
Theories of gravity, physics, physiology.

PRINCIPLES:
1. A line of gravity which goes through the base of support increases stability.
2. A broad base of support increases stability.
3. A low center of gravity increases stability.
4. Bending knees while standing forces use of thigh muscles.
5. Large muscles can move weight with less strain than small muscles.
6. Energy is needed to overcome inertia.
7. Lifting to oppose force of gravity uses more energy than pulling.
8. Fulcrums applied to levers reduce force needed for lifting.

CONCEPTS:
Safety, (Line of) gravity
Base of support (width)
Fulcrum,
Stability
Center of gravity
Muscle strain
Muscles (large, small)
Muscle
Energy
Inertia

PRACTICE

VALUE CLAIMS:
1. The greater the nurse's stability, the safer she/he and patient are.
2. Accountability for safety increases quality of care.

KNOWLEDGE CLAIMS:
1. Keep weight being moved close to you.
2. Keep elbows near body by lowering side rails when moving patients.
3. Shift weight from one foot to other when moving objects.
4. Spread feet to about the width of your shoulders when moving/lifting.
5. Bend knees when moving/lifting.
6. Use large muscles rather than small muscles to (upper arms versus hands, hands versus fingers, thighs versus back) move/lift.
7. Do not bend, stretch or twist small back muscles.
8. Use one continued smooth move rather than several short moves.
9. Pull an object rather than lift it.

TRANSFORMATIONS:
Performance evaluation.
Nurse's report of discomfort.

RECORD OF EVENT:
Observe nurse working.

EVENT:
Nurse uses own body when working.

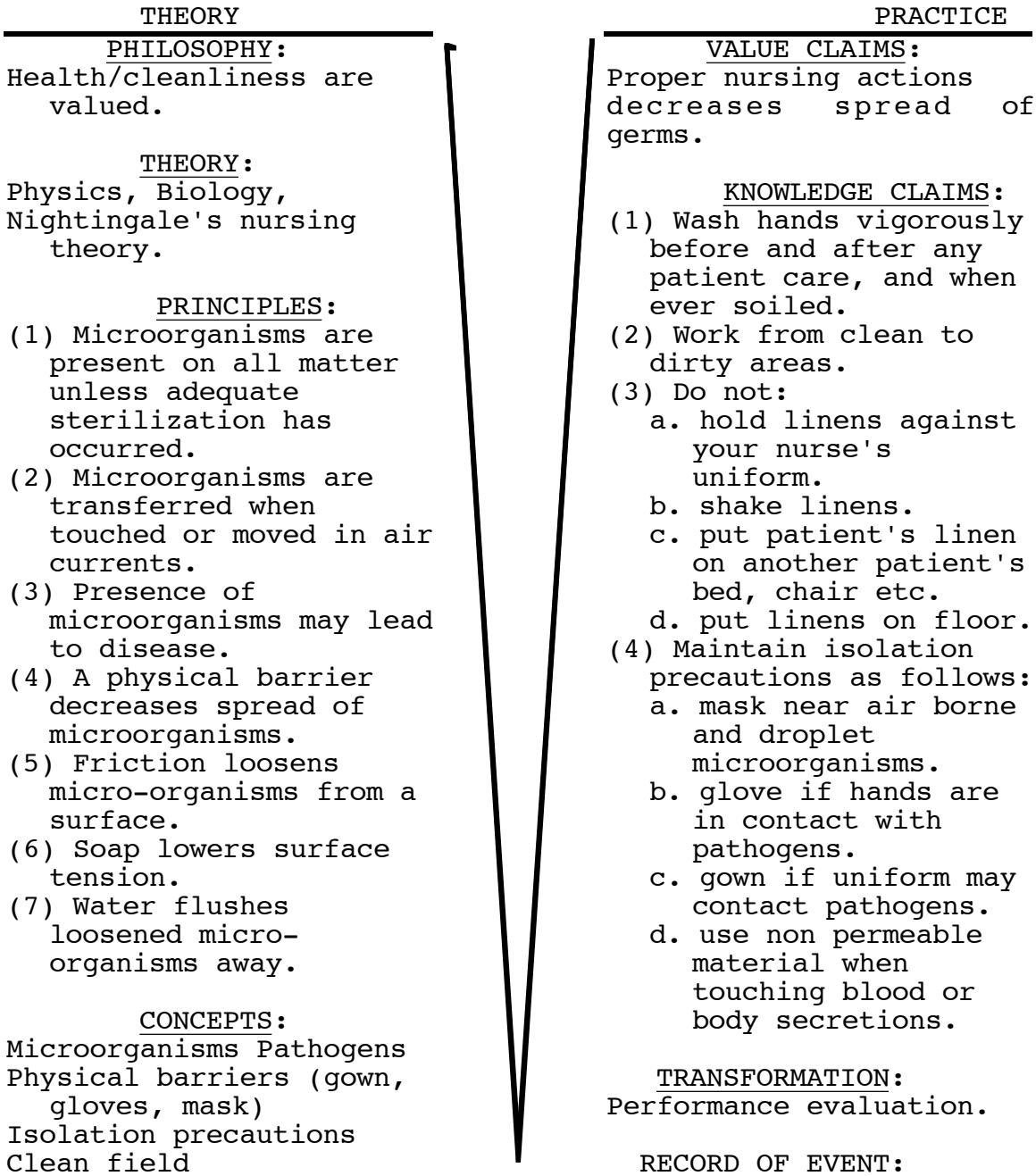
FOCUS QUESTION for week 2 [plus 8]:
How does the nurse
maintain sterile technique?

THEORY	PRACTICE
PHILOSOPHY: Healthy state is valued. THEORY: Physics, Biology, Nightingale's nursing theory. PRINCIPLES: (1) A sterile object or field is free of all micro-organisms and spores. (2) Unobserved sterile fields cannot be assumed to remain sterile. (3) Gravity causes microorganisms to fall on a sterile field when a non sterile object is held over it. (4) Microorganisms migrate from area to area by direct contact, air currents or gravity. (5) Microorganisms from mouth or nose spread into air with coughing, sneezing or talking. (6) Microorganisms do not move easily from one side of a dry surface to another; rather they travel slowly along the surface. (7) When a sterile field becomes wet, capillary action draws microorganisms from non sterile to sterile surface. CONCEPTS: sterile field, sterile indicators sterile technique/asepsis contamination, sterilization capillary action, air currents microorganisms; spores migration, gravity	VALUE CLAIMS: Proper nursing actions prevent infections and their spread. KNOWLEDGE CLAIMS: (1) Check packages labeled sterile for expiration indicators, tears and wetness. (2) Face sterile field. (3) Keep sterile field no lower than waist or table height. (4) Do not reach (or hold unsterile objects) over sterile field. (5) Do not touch sterile objects or fields with non sterile/ contaminated objects. (6) Do not talk, cough or sneeze over sterile field. (7) Assume one inch border around sterile field is contaminated. (8) Discard a sterile field which is wet. TRANSFORMATION: Performance evaluation. RECORD OF EVENT: Observe nurse using surgical asepsis.

EVENT:
Nurse uses surgical asepsis.

FOCUS QUESTION for week #2:

How does the nurse maintain a clean environment?

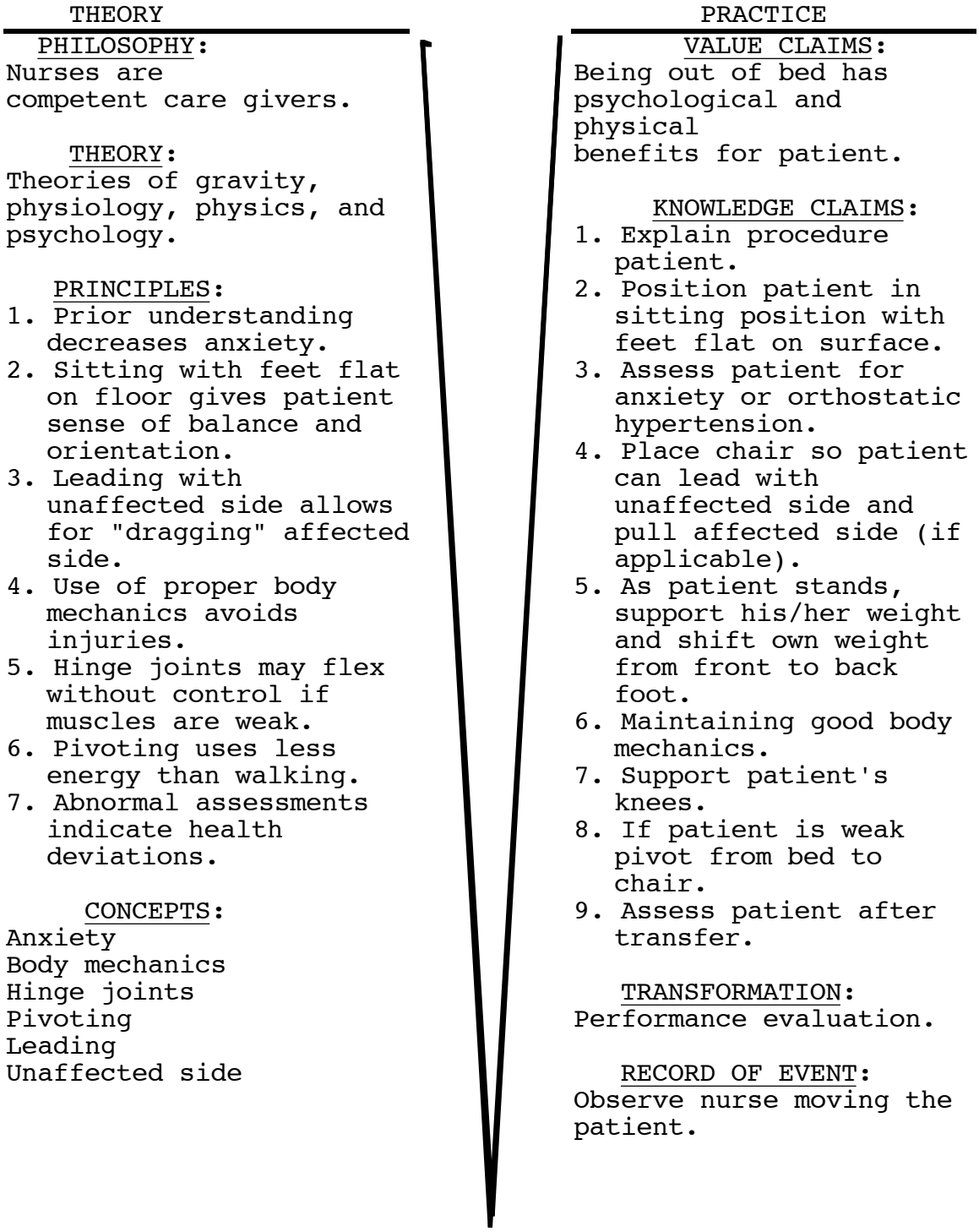


EVENT:

Nurse uses medical asepsis.

FOCUS QUESTION for week #3:

How does nurse safely transfer patient from bed to chair?



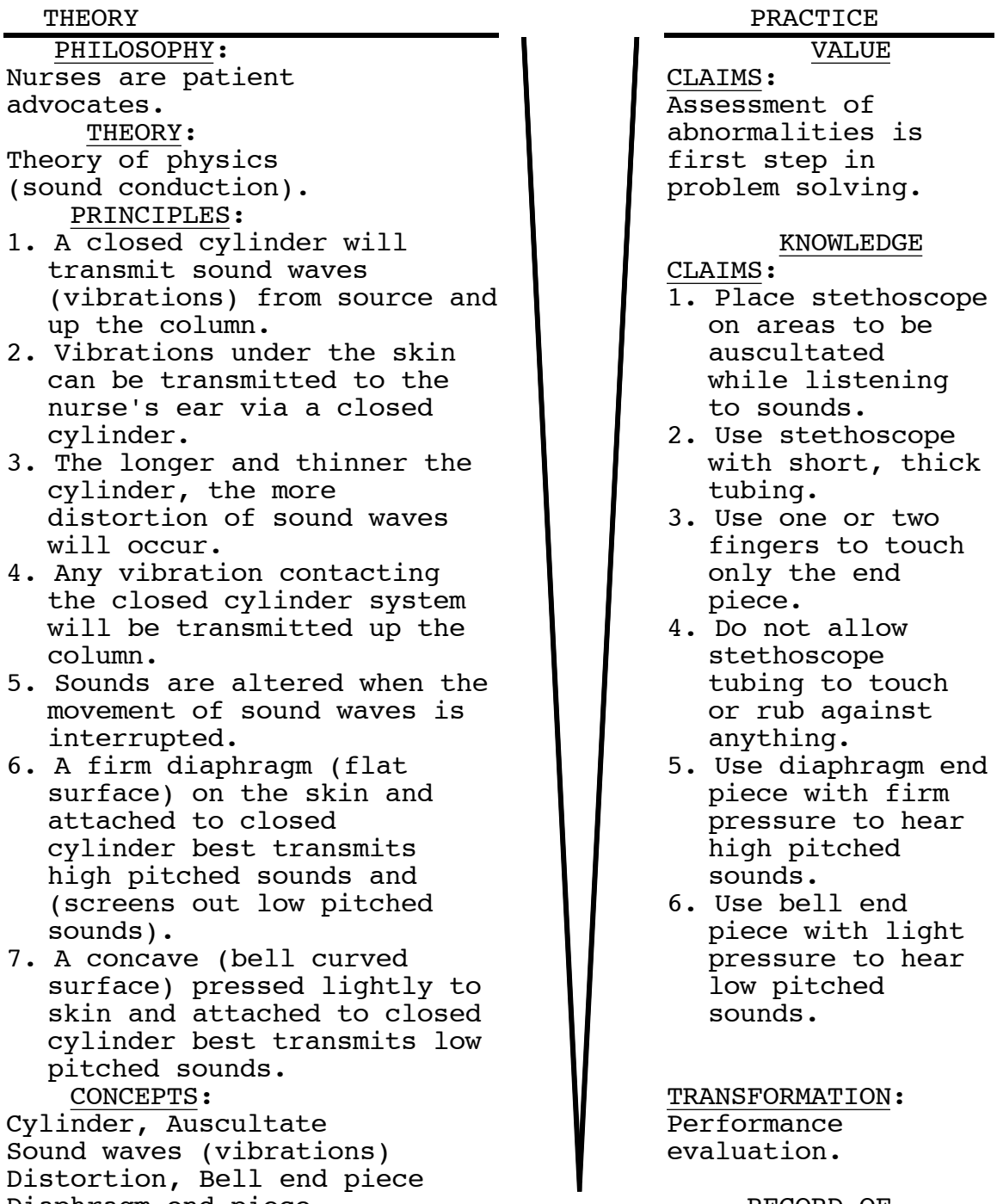
FOCUS QUESTION for week #5:
How does the nurse assess the patient's skin during the bath?

THEORY:	PRACTICE:
PHILOSOPHY: Nurses are patient advocates. THEORY: Human anatomy and physiology, Nightingale's theory. PRINCIPLES: 1. Pressure between bony prominences and external sources decreases blood supply to skin and underlying tissue. 2. Decreased blood supply to skin and underlying tissue [ischemia] leads to cell and tissue death [necrosis]. 3. Moist skin is more likely to macerate than dry skin. 4. Chapped, overly dry skin is likely to crack. 5. Lesions which break skin integrity produce pathways for microorganisms to enter the body. 6. Texture of skin may be related to amount of moisture within skin and underlying tissue. 7. Abnormal accumulation of body fluid in interstitial spaces [edema] may result from inadequate venous circulation [return of blood to heart]. 8. Heart pumping against gravity increases likelihood of edema in extremities positioned below heart [dependent edema]. CONCEPTS: Bony prominence, Ischemia Necrosis, Asymmetric, Edema Supple, Tenting, Turgor Lesion, Pressure, Macerate Protocol, Dependent Edema	VALUE CLAIM: Assessment and intervention of health problems avoid further problems. KNOWLEDGE CLAIMS: 1. Assess skin for progression of ischemis and necrosis. a. red [as capillaries try to compensate for pressure in specific area by dilating] b. then pale [decreased blood supply from pressure] c. black [rotted tissue] 2. Reposition immobile patient intermittently at least every two hours. 3. Use pillows, rolls and special mattresses to support body parts and avoid pressure. 4. Assess skin turgor, contour and moistness. 5. Keep skin clean, dry, supple and separated from other skin surfaces. 6. Document open lesions and follow established protocols for treatment. 7. Assess for abnormal and asymmetric swelling. 8. Elevate extremities of immobilized patient to/or above heart level to help avoid dependent edema. TRANSFORMATIONS: Performance evaluation. RECORD OF EVENT: Observe nurse bathing patient.

EVENT: Nurse assesses patient's skin.

FOCUS QUESTION for week #6 [plus 7,8]

How can the nurse auscultate the patient?



FOCUS QUESTION for week #4 [plus 5,6,7,8,13,14,15]

How does the nurse palpate the patient?

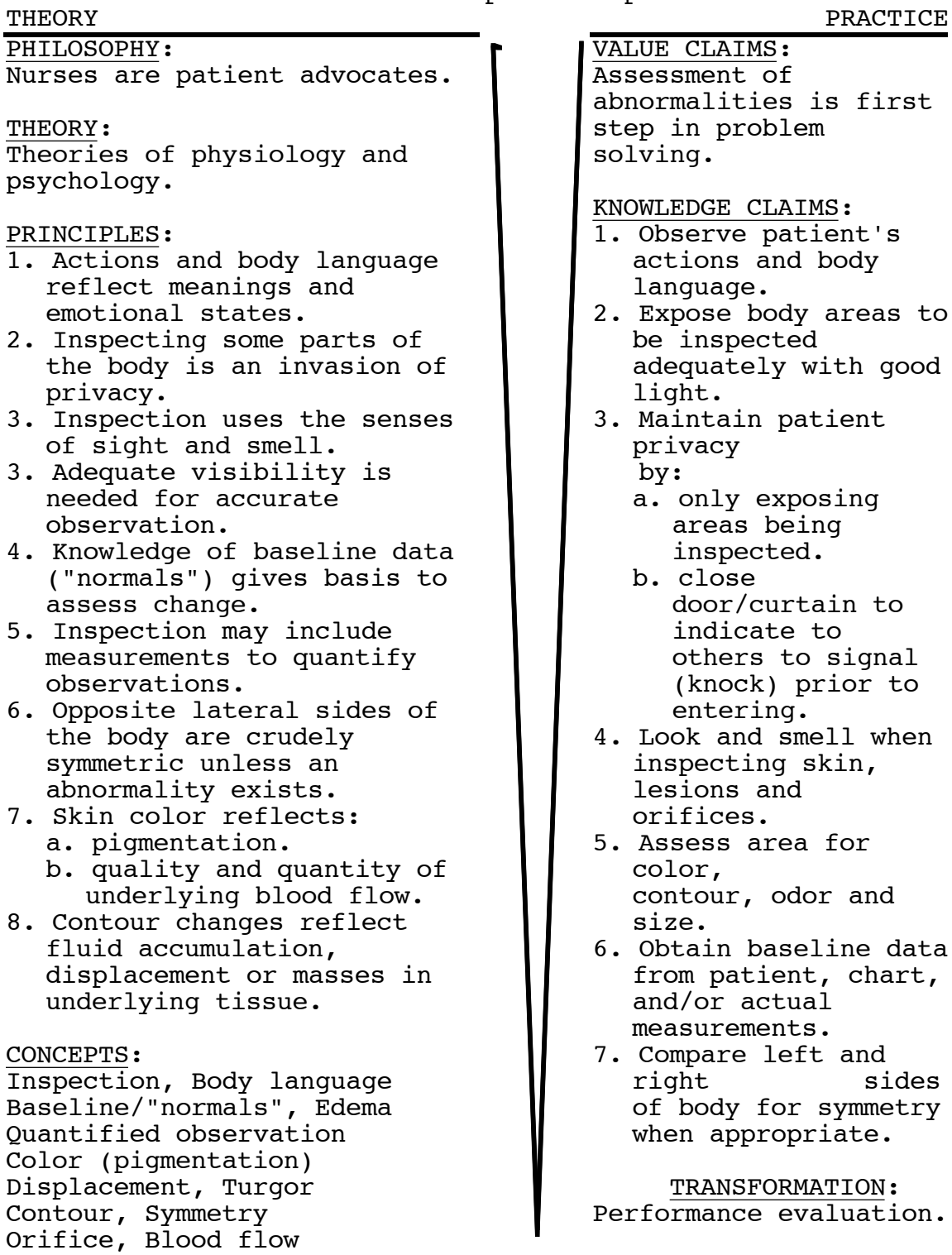
THEORY	PRACTICE
PHILOSOPHY: Nurses are patient advocates. THEORY: Theories of physiology, earth science, psychology. PRINCIPLES: 1. Touching patient is a physical invasion of his/her space. 2. Palpation uses the sense of touch through hands and fingers: a. finger pads are especially sensitive due to numerous nerve endings. b. palmer surfaces and finger pads are sensitive to discriminating textures, consistencies and size. c. ulnar surfaces are especially sensitive to vibrations. d. dorsal surfaces are especially sensitive to crude temperatures. 3. Palpations provide touch sensitivity for varying depths: a. light: < than .5 inch (1cm) b. deep: < than 2 inches (4cm) 4. Deep palpation may illicit pain or movement of tissue/ fluid with subsequent patient fear. 5. Touch sensitivity is decreased during application of deep pressure. 6. Skin temperature reflects amount of blood under skin, metabolism and exposure. CONCEPTS: Space invasion, Vibrations Palpation (light/deep) Sensitivity, Finger pads Palmer surface, Ulnar surface Dorsal surface, Temperature Texture, Masses	VALUE CLAIM: Assessment of abnormalities is first step in problem solving. KNOWLEDGE CLAIM: 1. Introduce self and explain plans before touching patient. 2. Use gentle warm hands with short fingernails. 3. Use palmer surface and finger pads to feel for masses, texture, moisture, consistency. 4. Use ulnar surface when feeling vibrations. 5. Use dorsal surface to assess crude temperatures. 6. Do light palpation before deep palpation. 7. Palpate tender areas last. 8. Use non dominant hand to apply pressure over relaxed dominant hand for deep palpation. TRANSFORMATION: Performance evaluation. RECORD OF EVENT: Observe nurse.

EVENT:

Nurse palpates parts of patient.

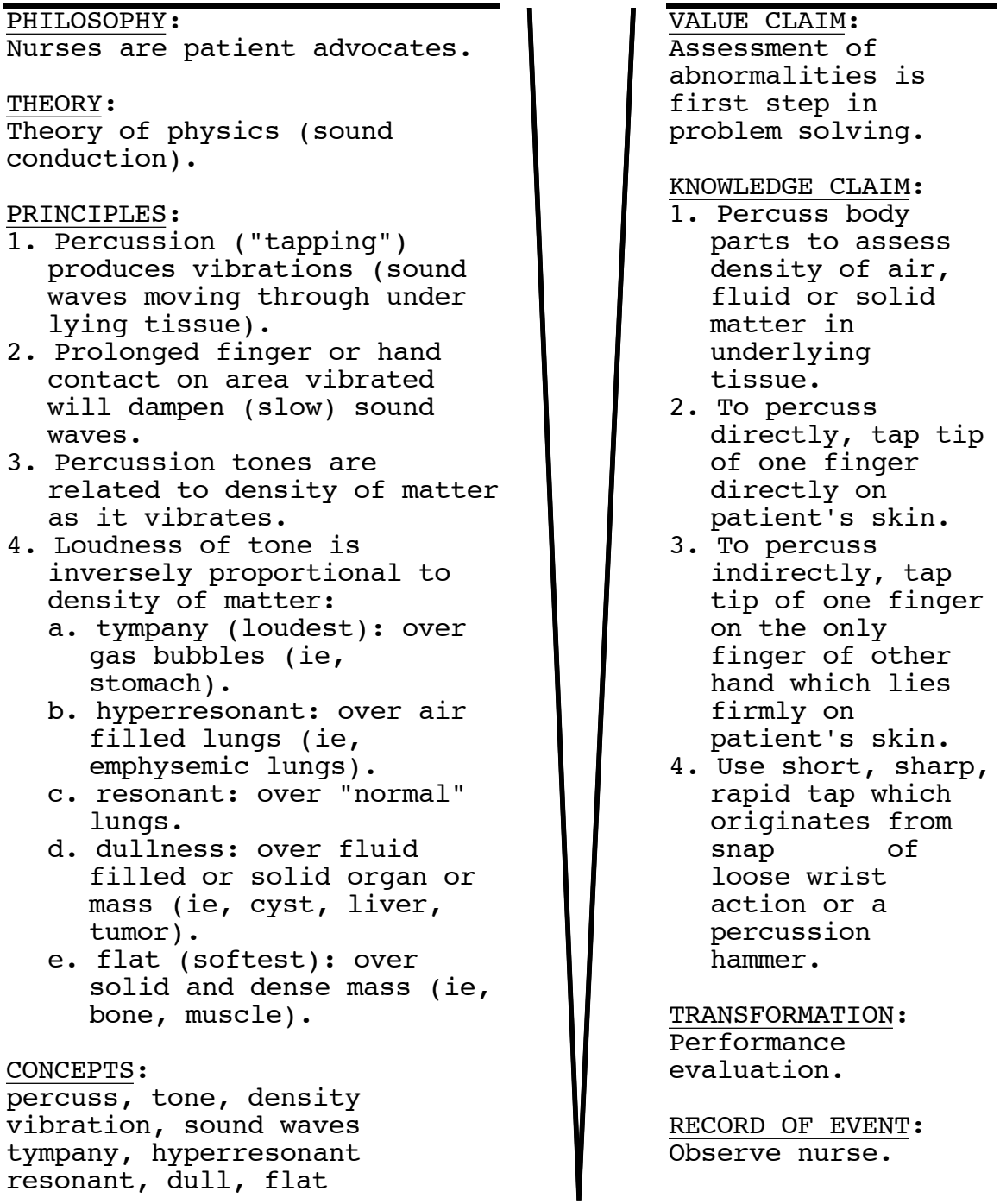
FOCUS QUESTION for week 4 [plus 5,6,7,8,13,14,15]

How does the nurse inspect the patient?



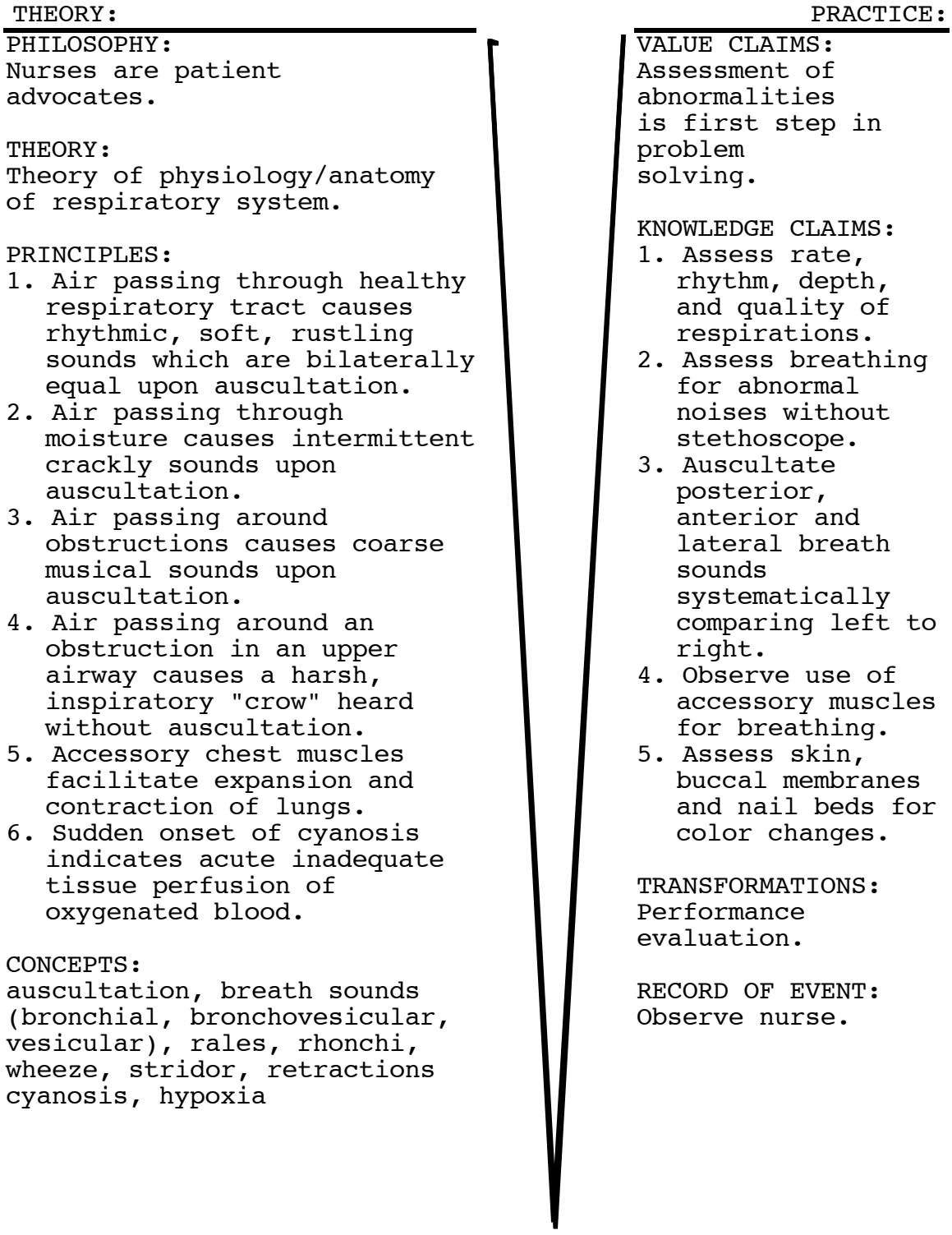
FOCUS QUESTION for week #7 [plus 8]:

How does the nurse percuss his/her patient?



FOCUS QUESTION for week # 7:

How does the nurse assess a patient's respirations?



FOCUS QUESTION for week #6:
How does the nurse assess a patient's blood pressure?THEORY:
PRACTICE:

PHILOSOPHY:
Nurses are patient advocates.
THEORY:
Theory of physiology of cardiovascular system.
PRINCIPLES:
1. Pulses are vibrations of fluid waves as blood is pumped from heart to arteries.
2 a. Systolic pressure reflects maximum pressure exerted on arterial walls as left ventricle contracts [pumps to arteries]
   b. Diastolic pressure reflects pressure of elastic tone in arterial walls when heart is at rest.
3. In a normal cardiovascular system:
   a. level of cardiac output is directly proportional to level of blood pressure
   b. level of blood pressure is directly proportional to level of peripheral vascular resistance, vascular elasticity and vasoconstriction
   c. level of peripheral vascular resistance is inversely proportional to lumen of arteries.
   d. level of blood pressure is directly proportional to blood volume/viscosity
4. Vasomotor center in brainstem exerts control on level of blood pressure.
CONCEPTS:
systolic/diastolic pressure elastic tone, lumen (artery) vasoconstriction, cardiac output, vasomotor center, peripheral vascular resistance, blood viscosity, volume.

VALUE CLAIMS:
Assessment of abnormalities is first step in problem solving.
KNOWLEDGE CLAIMS:
1. Palpate brachial pulse and apply cuff with indicator (arrow) one inch above pulsation.
2. Use cuff which is 20% wider than diameter of arm.
3. Palpate radial artery and inflate cuff 20-30 mm.Hg. above point of pulse disappearance.
4. Read manometer at eye level.
5. Place diaphragm of stethoscope over brachial artery and slowly/smoothly deflate cuff.
6. Note number where:
   a. first consecutive tapping was heard.
   b. abrupt muffling (damping) sound heard.
   c. complete disappearance of sound occurred.
7. Deflate and remove cuff before documenting.
8. Use thigh with popliteal artery if needed (and expect systolic reading to be 10-40 mm.Hg. higher).

TRANSFORMATION:
Performance evaluation.

RECORD OF EVENT:
Observe nurse.

EVENT: Nurse checks patient's blood pressure.