PERFORMANCE EVALUATION STUDENT NAME:_____

CAPNOGRAPHY DATE:_____

INITIAL EVALUATOR: _____ **Initial Evaluation: Pass ____ or Remediate ____**

SECOND EVALUATOR: _____ **Second Evaluation: Pass ____ or Remediate ____**

SCORING SYSTEM:

3 points	Describes and/or performs objectives perfectly without prompting and in appropriate time interval.
2 points	Describes and/or performs objectives satisfactorily without prompting or with minimal assistance/or completes step slower than expected.
1 point	Describes and/or performs objectives with assistance or prompting. Appears unsure of task.
0 point	Unable to perform objective adequately
NA	Objective not appropriate or unnecessary. Some steps may not be done at all clinical agencies.

	0	1	2	3	NA
1. Gather appropriate equipment and supplies a Capnograph b Capnostat & cuvette c Adapter, tubing, filter, drain bottle d Mouthpiece & filter					
2. **Clean hands in patient room and implement standard precautions					
3. Prepare the patient and verify conditions for monitoring a. Patient position b. Oxygen therapy c. Ventilator settings d. Airway patency					
4. Prepare the capnometer following department policy and procedure a. Plug unit in b. Connect all necessary supplies and accessories c. Turn unit on and allow warm up d. After self check, determine if calibration is needed					
5. Apply the capnometer to the patient					
6. Allow the unit to stabilize and evaluate the EtCO2 reading a. Correlate to clinical assessment b. Correlate to an arterial blood gas (PaCO2) c. Determine if deadspace is increased (PaCO2 – PetCO2)					
7. Set alarms and other settings appropriately a High and low EtCO2 b High & low respiratory rate c Correct for high FIO2 and/or Nitrous Oxide use d Apply CO2 correction factor e All other parameters available					

	0	1	2	3	NA
8. Document results properly a. Date, military time, b. Site of monitoring (ET, Nasal) c. PetCO2 d. Heart rate & rhythm e. Resp. rate & pattern. f. Skin color, temp & moisture g. Signature & credentials					
9. Demonstrate the ability to correlate the PetCO2 results to an arterial blood gas or TcPCO2 reading					
10. Maintains equipment as necessary: a. Side stream: Check lines, drain bottles and filters b. Main stream: cleans cuvette as needed c. Printer: Paper & ink					
11. Processes equipment after use: a. Discards disposable equipment b. Wipes down monitor according to manufacturer instructions					
12. Knowledge/Comprehension Level (Can the student answer all oral review questions?)					

Students must pass all critical steps with a score of 2 or 3 *Revised 12/2012*

ORAL REVIEW QUESTIONS

1. Explain the principle and theory of operation.
   Capnography comprises the continuous analysis and recording of carbon dioxide concentrations [CO_2] in respiratory gases. The device measures carbon dioxide levels by emitting two infrared light beams, one which passes through a reference chamber; the other passes through the sample chamber where carbon dioxide absorbs the infrared radiation.

2. List the main things that could cause a change in the PetCO_2 tracing.
   a. **Change in metabolic rate (amount of carbon dioxide being produced)**
   b. **Change in pulmonary perfusion**
   c. **Change in ventilation**
   d. **Other gases in the system with absorption spectra similar to carbon dioxide (nitrous oxide)**
   e. **Equipment malfuction**

3. Give clinical examples of when continuous capnography may be needed.
   a. **Used as an apnea monitor for all forms of apnea (central & obstructive).**
   b. **Monitoring severity of pulmonary disease and evaluating response to therapy.**
   c. **Use to determine that tracheal rather than esophageal intubation has taken place.**
   d. **Continued monitoring of the integrity of the ventilatory circuit, including the artificial airway.**
   e. **Evaluation of the efficiency of mechanical ventilatory support by determination of the difference between the arterial partial pressure for CO_2 ($PaCO_2$) and the $PetCO_2$.**
   f. **Monitoring adequacy of pulmonary, systemic, and coronary blood flow.**

g. **Use as a tool to screen for pulmonary embolism.**
h. **Monitoring inspired CO_2 when CO_2 gas is being therapeutically administered**

4. Name the two most common forms of capnometer, their advantages and disadvantages.
    a. **Mainstream**
        i. **Advantages**
            1. **Sensor is at the patient's airway**
            2. **Fast response (crisp waveform)**
            3. **Short lag time (real-time readings)**
            4. **No sample flow to reduce tidal volume**
        ii. **Disadvantages**
            1. **Secretions and humidity can block sensor window**
            2. **Sensor requires heating to prevent condensation**
            3. **Requires frequent calibration**
            4. **Bulky sensor at patient airway**
            5. **Does not measure N_2O**
            6. **Difficult to use with non-intubated patients**
            7. **Reusable adapters require cleaning and sterilization**
    b. **Sidestream**
        i. **Advantages**
            1. **No bulky sensor or heaters at airway**
            2. **Ability to measure N_2O**
            3. **Disposable sample line**
            4. **Ability to use with non-intubated patients.**
        ii. **Disadvantages**
            1. **Secretions block sample tubing**
            2. **Trap required to remove water from the sample**
            3. **Frequent calibration required**
            4. **Slow response to CO_2 changes**
            5. **Lag time between CO_2 change and measurement**
            6. **Sample flow may decrease tidal volume**

5. Explain what the normal value is for ($PaCO_2$ – $PetCO_2$) and what an elevated value indicates.
In healthy individuals, the end-tidal carbon dioxide level is 2 to 6 mm Hg (1 – 5 mmHg) less than the arterial carbon dioxide level. The difference between $PetCO_2$ and $PaCO_2$ increases as dead-space volume increases

6. Explain what the following changes in $PetCO_2$ could be caused from.
    a. A slowly increasing $PetCO_2$
        1. **Hypoventilation**
        2. **Increase in CO_2 production (fever)**
    b. A rapidly increasing $PetCO_2$
        1. **Sudden increase in cardiac output**
        2. **Sudden release of tourniquet**
        3. **Injection of Sodium Bicarbonate**
    c. An increasing baseline on the capnograph tracing
        1. **Rebreathing of carbon dioxide due to faulty exhalation valve or excessive deadspace in ventilator circuit**
    d. A slowly decreasing $PetCO_2$
        1. **Hyperventilation**
        2. **Decrease in oxygen consumption**
        3. **Decrease in pulmonary perfusion**

e. A rapidly decreasing $PetCO_2$
    1. **Sudden hyperventilation**
    2. **Sudden decrease in cardiac output**
    3. **Massive pulmonary embolism**
    4. **Air embolism**
    5. **Disconnection from ventilator**
    6. **Obstruction of endotracheal tube**
    7. **Leakage in circuit**

f. A $PetCO_2$ that rapidly drops to zero
    1. **Sudden decrease in cardiac output**
    2. **Massive pulmonary embolism**
    3. **Air embolism**
    4. **Disconnection from ventilator**
    5. **Obstruction of endotracheal tube**

g. An abnormal rounding of the $PetCO_2$ tracing
    1. **Partial gas flow (airway) obstruction**

7. Describe the maintenance involved in continuous $PetCO_2$ monitoring.
   Routine calibration and infection control procedures as outlined by the manufacturer.