MICHIGAN DEPARTMENT OF COMMUNITY HEALTH
BUREAU OF HEALTH POLICY, PLANNING & ACCESS
EMS & TRAUMA SERVICES SECTION
201 TOWNSEND STREET
LANSING, MI 48913

REQUIREMENTS:

SPECIALIST EDUCATION PROGRAM

INITIAL

and

REFRESHER

Specialist programs must be based on this criteria and approved by the Michigan Department of Community Health. Individuals completing non-approved programs shall be ineligible for licensure.

J-328
6/85, Revised 7/91, 7/95, 9/06, 3/07 Authority: Act 368, P.A. 1978 as amended

PREFACE

I. Application for Education Program Approval

Education programs must be formally approved by the Michigan Department of Community Health (MDCH) prior to initiation of a course. Each education program must have a sponsor, as defined in the administrative rules.

The education program sponsor, in conjunction with the physician director and/or the Instructor-Coordinator, shall be responsible for the following:

A. Curriculum development, including clinical coordination.

B. Ensure that clinical contracts are current and on file, and that quality assurance measures are in place, including patient confidentiality.

C. Evaluation and selection of instructors.

D. Student evaluation (for basic literacy and math skills, at a minimum) for admission into the program.

E. Clear and detailed requirements for one to meet in order to complete the program successfully. These are to include grievance policies, P.A. 179 of 1990, rules and regulations, and the instructional objectives.

F. Maintain and assure the availability of adequate and functioning equipment, including training aids, classrooms, and a resource library.

G. Ensure that practical examinations maintain an adequate student to instructor ratio, to allow for close observation of student activities, and are in compliance with the task analyses, which is part of this document.

H. Periodically review student performance, and assist students, as appropriate.

I. Maintain student performance records, for a minimum of 5 years. At a minimum, performance records must include terminal event evaluation tools.

J. Provide MDPH, within 30 calendar days of the completion of a course (classroom and clinical sections), the names of students who have successfully completed the education program course.

K. Assuring student competency of knowledge and skills at the EMT level.

L. Issue each graduate proof of successful course completion.

General Provisions

Each education program course shall:

A. Utilize clearly stated behavioral objectives and performance criteria for the didactic, practical, and clinical activities.

B. Provide clinical training in a hospital and a limited advanced, or advanced life support agency. Each clinical site shall be capable of meeting the clinical educational objectives developed by the Instructor-Coordinator.

Students who complete an unapproved program course will not be eligible for licensure.

An education program approval shall remain in effect unless otherwise denied or revoked by the department as prescribed in the administrative rules. If a program sponsor does not offer a course for three consecutive years, the sponsor will have to submit an initial application for program approval.

Course Approval Requirements

The application for Approval to Conduct an Education Program (J-135), must be completed with the assistance of an Emergency Medical Services Instructor-Coordinator (EMS I-C). Required documentation must be included and submitted to the appropriate Regional Coordinator at least sixty (60) days prior to the first class session. Following review, the Regional Coordinator will resolve with the program sponsor (it's designee) any issues which may arise concerning the application. Programs meeting established criteria are submitted to MDPH by the Regional Coordinator for approval action.

The Education Program Sponsor (or it's designee) will be formally notified by the department, or it's designee, of approval or disapproval. Program approval affords the sponsor authorization to conduct an education program at that level, and approval to conduct the first course.

Once a course has been approved, the EMS I-C is responsible to provide each student with, or make available for their review and study, the following information:

A. A copy of the MDPH course approval
B. Specialist program objectives
C. A copy of the current EMS legislation; P.A. 179 of 1990 and administrative rules
D. The requirements which must be achieved to successfully complete the course shall be in writing, and provided to each student.

The education program sponsor is responsible for notifying the Regional Coordinator of any modifications to their program schedule on the Addendum for Approval to Conduct an Education Program (J-135A). As Regional Coordinators conduct periodic on-site visits to evaluate courses, any changes to an approved education program must be reported.

Subsequent Course(s) Requirements

An education program sponsor may provide subsequent courses at any time following initial approval, by submitting an Addendum for Approval to Conduct an Education Program (J-135A). This form is to be completed with assistance of an I-C and submitted with a ***revised course schedule*** and a listing of the ***current clinical contracts*** to the appropriate Regional Coordinator at least thirty (30) days prior to the first class session. Programs which continue to meet minimum criteria shall be submitted to MDPH by the Regional Coordinator for approval action.

II. Program Admission Prerequisites

The minimum requirements for admission to a Specialist course is successful completion of an Emergency Medical Technician (EMT) course. However, individuals wishing to participate in the Specialist examination for licensure must provide proof of current or past Michigan licensure at the EMT level. Education program sponsors are expected to establish written admission policies and have them available for prospective students.

All eligible candidates for licensure must be at least 18 years of age, at the time of application to MDPH.

III. Program Staff

Emergency Medical Services Instructor-Coordinator (EMS I-C)

The I-C for the program must be licensed by MDPH and possess dual licensure as a Specialist or Paramedic. The I-C is the liaison between the class, instructional staff, program sponsor, physician director and MDPH or it's designee. In concert with the education program sponsor, the I-C is responsible for completing the application(s) for program approval and providing any supportive documentation required by the department.

Physician Director

Each education program must have a physician director (PD), who possesses current licensure in accordance with department rules. Responsibilities of the PD include provision of medical expertise and assurance that current standards of emergency care are being presented in each course. Further responsibilities are outlined in the administrative rules.

Instructors

Course instructors are to be selected by the I-C and PD. Each instructor shall possess expertise and background in the topic area(s) which they address. Instructors are to be provided with the appropriate lesson outline and objectives in advance of the presentation, and are to be thoroughly versed on the content and limitations of the topic they are to present. The Instructor-Coordinator and program sponsor are responsible to assure all program requirements are met.

IV. Licensure Examination

Students who successfully complete an approved course are eligible to participate in the examination for licensure, provided that they are in compliance with the current statute and administrative rules.

Following course completion, the I-C must submit to the department a list of the names of the students who successfully completed the course. This information must be submitted on the Notification of Students Completing an Education Program Course form (J-122). This form must be signed by the I-C. I-Cs may expedite the licensure process by including with this form, completed student examination/licensure applications, the appropriate supportive documentation outlined in the application, and the respective fees. Those students who wish to submit their application directly to the department must include a copy of their course completion certificate along with the aforementioned documents.

Only those students whose completed examination/licensure applications have been received and approved by the department on or before the first working day of the month that they wish to take the examination will be scheduled for examination during that month. Each I-C shall contact the appropriate Regional Coordinator to arrange for the licensure examination. Approximately two weeks prior to the examination, the Regional Coordinator will contact, by mail, each applicant with the examination date, time and place, unless specific arrangements have been made between the I-C and the Regional Coordinator.

Questions regarding these requirements should be directed to your Regional Coordinator.

V. Course Length and Organization

The initial course must comprise a minimum of 100 clock hours. This includes didactic presentations, practical demonstrations, skills practice and clinical experience. The sequence in which lessons are presented is left to the discretion of the I-C. It is expected, however, that Topic 1 (Introduction, Roles/Responsibilities of the Specialist, Medical/Legal Considerations, EMS Systems Operations) will be presented first. **The student is responsible for all information in the current EMT Objectives.**

VI. Lesson Outlines and Objective Format

The information included, in conjunction with the EMT objectives, is required in order to meet the established educational objectives for a Specialist education program. I-Cs and other instructors shall use this minimum required material in their education programs, as the licensure examination is based on these objectives.

Note: The enclosed material is a supplement to the EMT Lesson Outline and Objectives and should not be used without them.

Text

The choice of text and/or handout material is left to the discretion of the program sponsor and I-C.

To allow flexibility in choosing a preferred text, program objectives were developed to ensure consistent minimum education standards, in conjunction with the educational objectives for the EMT, and are to serve as the foundation for course development. The following have been utilized in the development of the educational objectives:

Cardiopulmonary Resuscitation:	American Heart Association American Red Cross
Pediatrics:	Pediatric Emergency Management Curriculum- MDPH/EMS-C Project
Trauma:	Basic Trauma Life Support/Advanced - Brady
	Pre-Hospital Trauma Life Support - Mosby

Other Specialist Topics:

Advanced Emergency Care for Paramedic Practice - Lippincott

Emergency Care in the Streets Fourth Edition - Little, Brown

Paramedic Emergency Care Second Edition - Brady

Mosby's Paramedic Textbook - Mosby

Task Analysis:

The skills that the Specialist will minimally be able to perform are broken down into an abbreviated task analysis format for the instructor and student. The instructor may modify the format as needed for practice and testing purposes. The skills are identified in this manner instead of a psychomotor objective format. **The student is responsible for all EMT skills as well as specific advanced level skills. The specific advanced level skills (from the Paramedic Objectives) are included in this curriculum for convenience in duplication of this document.**

VII. Curriculum Format

The Specialist Objectives include specific topic areas that are a review of the EMT level topics or are new material from the Paramedic curriculum. The instructor is responsible to identify for the student that all patients should have consideration for vascular access, fluid volume management and advanced airway management, as appropriate. Objectives, specific for Specialist level practice, have not been written for all topic areas to illustrate that point.

Topic Format

See Example Page Following

#1 Title:
Each topic is titled listing the major subjects included in the topic. The first page of each topic includes the publishing date. As topics are updated, a new date for the topic will be posted in the upper right corner. The page numbers at the bottom of each page include the topic number and page number within the topic.

#2 Opening Statement:
Each topic has an opening statement that is similar. This statement identifies the expected performance of the student. Multiple performance verbs are used since the student will have their performance evaluated at many different learning levels.

#3 Related Information:
Each topic identifies what related topic areas and task analysis should be referenced when covering that topic.

#4 Definitions:
New terms are defined at the beginning of the topic. The exception is when a term is defined within an objective statement, if it is more appropriate within the flow of the outlined material.

#5 Outline and Objectives:
The topic is outlined with subject headings identified by **bold print.** Most often the topic heading is followed by objective statements. These objectives are numbered by the topic number followed by the objective number.

#6 Outline Only
When a outlined subject heading is given with no objective statements following, it indicates the objective information is covered in the EMT Lesson Outlines and Objectives, or elsewhere in the Specialist document.

EXAMPLE TOPIC PAGE ONE

#1 Specialist **6: FLUIDS AND ELECTROLYTES,IV THERAPY, SHOCK**

#2 LESSON OUTLINE AND PERFORMANCE OBJECTIVES:

According to Specialist lecture presentations, assigned readings, practical lab and clinical assignments, the student will be able to state, describe, choose, demonstrate, analyze, prescribe, evaluate, etc., the following, including information addressed in:

#3 EMT Objectives:	**IV Maintenance, Shock**
	Anatomy and Physiology
	Patient Assessment
EMT Task Analysis:	**PASG: Application/ Inflation**
Paramedic Task Analysis:	**Airway Management, Oxygen Therapy, Ventilation**
	Drug and Fluid Volume Calculations
	Peripheral Intravenous Lines

#4 Definitions:

To meet the objectives of this part, each student must be able to define and understand related terminology. The student is responsible for all EMT terminology in related sections. The following terms are not intended to be all-inclusive.

1. Anion: An ion with a negative charge.

2. Cation: An ion with a positive charge.

OUTLINE AND OBJECTIVES

#5 I. Fluids and Electrolytes

A. Water Distribution

6.1 The two (2) compartments of total body water (TBW) are:

a. Intracellular fluid

b. Extracellular fluid

#6 B. Movement of Water, Solutes

1. Osmosis

2. Diffusion

EMT - SPECIALIST EDUCATION PROGRAM
INITITAL COURSE CONTENT AREAS

TOPIC	**RECOMMENDED COURSE HOURS**
INTRODUCTION, ROLES/RESPONSIBILITIES OF THE SPECIALIST, MEDICAL/LEGAL CONSIDERATIONS, EMS SYSTEMS OPERATIONS	**2 hours**
TELEMETRY/ COMMUNICATIONS	**2 hours**
PATIENT ASSESSMENT TRIAGE	**10 hours**
RESPIRATORY EMERGENCIES, CHEST INJURIES ACID-BASE BALANCE AIRWAY MANAGEMENT, OXYGEN THERAPY	**24 hours**
FLUIDS AND ELECTROLYTES, IV THERAPY, SHOCK	**20 hours**
INTRODUCTION TO PHARMACOLOGY CARDIOVASCULAR SYSTEM	**2 hours** **2 hours**
CENTRAL NERVOUS SYSTEM OTHER TRAUMATIC INJURIES: BLEEDING & SOFT TISSUE INJURIES, MUSCULOSKELETAL INJURIES, FACIAL INJURIES, ABDOMINAL INJURIES, BURNS	**2 hours**
ACUTE ABDOMEN DIABETES	**2 hours**
COMMUNICABLE DISEASES BEHAVIORAL EMERGENCIES POISONS, SUBSTANCE ABUSE	0 0 0
THE GERIATRIC PATIENT	**1 hour**

OBSTETRICAL/ GYNECOLOGICAL EMERGENCIES	0
PEDIATRICS	**2 hours**
ENVIRONMENTAL EMERGENCIES	**1 hours**
HAZARDOUS MATERIALS	0
STRESS MANAGEMENT IN EMS	0

MINIMUM RECOMMENDED CLASSROOM HOURS =	**70**
MINIMUM REQUIRED CLINICAL HOURS =	**30**

NOTE: Many topics overlap and hours may be distributed over various lecture and practical sessions. Time for comprehensive final student evaluation is not included in total required program hours. It is mandatory to evaluate student performance throughout the course, including comprehensive final didactic and practical examinations.

All Specialist programs must have the minimum required 70 classroom hours and 30 additional clinical hours. The minimum total required program hours, to receive course approval, are 100 hours.

At least 30 of the 70 classroom hours is to be used for introduction and practice of skills.

EMT - SPECIALIST EDUCATION PROGRAM
REFRESHER COURSE CONTENT AREAS

TOPIC	REQUIRED COURSE HOURS Minimum	Minimum practical
PREPARATORY	**5 hours**	
Introduction to Emergency Medical Care		
Roles/Responsibilities of the EMT-Specialist		
Fluids and Electrolytes		
IV Therapy		
Introduction to Pharmacology		
Communicable Diseases		
Stress Management in EMS		
AIRWAY	**9 hours**	**2 hours**
Airway. Oxygenation, Ventilation		
EDTLA		
Endotracheal Intubation		
PATIENT ASSESSMENT	**4 hours**	**2 hours**
Patient Assessment		
Communications		
Documentation		
MEDICAL	**10 hours**	**2 hours**
Respiratory Emergencies		
Cardiovascular Emergencies		
Diabetic Emergencies		
Allergic Reactions		
Poisoning/Overdose Emergencies		
Environmental Emergencies		
Behavioral Emergencies		
Abdominal Illness		
CNS Illness		
Obstretics		
TRAUMA	**8 hours**	**2 hours**
Bleeding and Shock		
Soft Tissue Injuries		
Musculoskeletal Care		
Injuries to the Head and Spine		
Burns		

SPECIAL CONSIDERATIONS	**4 hours**	**1 hour**
Geriatrics		
Pediatrics		
OPERATIONS	**2 hours**	
EMS Systems Operations		
Triage		
Hazardous Materials		

Required Minimum	42
Required Practical Hours	9
Total Required Clinical Hours	0

The refresher course must include a minimum of 9 practical hours in the appropriate categories. These hours are inclusive of, not in addition to, the minimum required category hours.

CLINICAL OBJECTIVES

At a minimum, the Specialist student shall complete 30 hours of clinical experience. The clinical experience shall include the Emergency Department (minimum 8 hours) and Limited Advanced or Advanced Life Support Vehicle (minimum 8 hours) rotations. Although other clinical areas, such as Operating Room, Intensive Care Unit, Phlebotomy Team, Intravenous Team, Geriatrics, Pediatrics, Labor and Delivery, Psychiatric Unit,and Respiratory Therapy are desirable and strongly encouraged, they may not be practical in some medical facilities.

The Instructor-Coordinator should develop a list of clinical objectives to be demonstrated, observed or discussed by the Specialist student during this portion of the program. These objectives should be specific to the clinical area. Minimum objectives for clinical rotations in the Emergency Department and Limited Advanced or Advanced Life Support Unit are listed below. **These are a supplement to the clinical objectives in the EMT curriculum.**

Upon completion of the clinical section of the education program, the Specialist student will have demonstrated, observed, or discussed:

1. The appropriate method for maintaining a patent airway, including esophageal obturation, endotracheal intubation and esophageal double lumen airway.

2. The proper technique for starting an IV, maintaining patency and rate, and discontinuing the IV, while maintaining sterile technique.

Specialist

1: INTRODUCTION
ROLES/RESPONSIBILITIES OF THE SPECIALIST
MEDICAL/LEGAL CONSIDERATIONS
EMS SYSTEMS OPERATIONS

LESSON OUTLINE AND PERFORMANCE OBJECTIVES:

According to Specialist lecture presentations, assigned readings, practical lab and clinical assignments, the student will be able to state, describe, choose, demonstrate, analyze, prescribe, evaluate, etc., the following, including information addressed in:

EMT Objectives:	**Introduction**
	Roles/Responsibilities of the EMT
	Medical Legal Considerations
	EMS Systems Operations

OUTLINE AND OBJECTIVES

I. Introduction and Orientation

- **A. Course Administration**
  - **1. Course Format**
  - **2. Policies and Procedures**
  - **3. Student Requirements**
  - **4. MDPH Performance Objectives**

II. Roles and Responsibilities

- **A. Roles**
- **B. Responsibilities**

III. Medical/Legal Considerations

- **B. Legal/Documentation Considerations**
- **C. Current Michigan Statutes that Apply to EMS**
- **D. Michigan Continuing Education Requirements for Relicensure**

IV. EMS Systems Operations

A. Components

B. Systems Operation Under Medical Control Authority

Specialist **2: TELEMETRY/COMMUNICATIONS**

LESSON OUTLINE AND PERFORMANCE OBJECTIVES:

According to Specialist lecture presentations, assigned readings, practical lab and clinical assignments, the student will be able to state, describe, choose, demonstrate, analyze, prescribe, evaluate, etc., the following, including information addressed in:

EMT Objectives: Communications

OUTLINE AND OBJECTIVES

I. Communications

A. Medcom

B. Documentation

C. Interpersonal Communication

1. Patient (Psychological and Emotional Support)

2. Family and Friends (Psychological and Emotional Support)

3. Other Medical Personnel

Specialist **3: PATIENT ASSESSMENT**

LESSON OUTLINE AND PERFORMANCE OBJECTIVES:

According to Specialist lecture presentations, assigned readings, practical lab and clinical assignments, the student will be able to state, describe, choose, demonstrate, analyze, prescribe, evaluate, etc., the following, including information addressed in:

EMT Objectives:	**Anatomy and Physiology** **Patient Assessment**
EMT Task Analysis:	**All Assessment Skills** **Patient Management-Trauma Scenario** **Patient Management-Medical Scenario**
Specialist Objectives:	**Fluids, IV Therapy, Shock** **Respiratory Emergencies**
Paramedic Task Analysis:	**Airway Management, Oxygen Therapy, Ventilation** **Drug and Fluid Volume Calculations** **Intraosseous Infusion** **IV Discontinuation** **Peripheral Intravenous Lines**

OUTLINE AND OBJECTIVES

I. Patient Assessment

A. Review Dispatch Information

B. Overview the Scene

1. Hazards/Safety

2. Mechanism of Injury

3. Patient Information

4. Additional Resources

C. Identify Yourself and Team

D. Perform Prioritized Patient Assessment

E. Determine/Acknowledge Primary Complaint

1. Transport Priority Decisions Made

F. Complete Assessment is Finished, Repeated as Necessary

1. Examination Skills/Specialized Assessment Areas

a. Enhancing Communication Skills

1) Patient Interviewing Skills

2) Past Medical History

3) History of Present Illness/Injury

4) Communicating to Other Health Professionals

b. Inspection-Visual

1) Head, Facial, Neck Areas

2) Chest and Abdominal/Pelvic Area

c. Palpation

1) Chest/Abdominal Area

2) Skin

d. Auscultation

1) Chest/Neck Area

e. Percussion

f. Olfaction (Smell)

2. Types of Physical Exams

a. Trauma Patient Assessment

1) Primary Assessment

2) Secondary Assessment

3) Continuous Re-evaluation

4) Serial Vital Signs

b. Medical Patient Assessment

1) Communication/Interviewing Skills

2) Complete Primary and Secondary Assessments

3) Serial Vital Signs

3. Diagnostic Signs to Evaluate During Assessment

a. Airway

b. Breathing

c. Circulation

d. Neurological Exam

e. Glucose Determination

3.1 Blood glucose evaluation should occur on patients with risk of hypoglycemia or unexplained altered mental status.

f. Pulse Oximetry

3.2 Pulse oximetry is helpful to determine oxygen saturation levels in patients who may have respiratory or cardiovascular compromise, or anyone who may be at risk of hypoxia.

3.3 Pulse oximetry may not be accurate for patients with decreased peripheral perfusion, CO toxicity, hypothermia, cyanide poisoning or methyl alcohol poisoning.

g. Peak Expiratory Flow Rate

3.4 Peak Expiratory Flow Rates (PEFR) may be measured during evaluation of patients in respiratory distress, especially before and after medication management.

4. Additional Physical Exam Information

II. Documentation of Patient Assessment

III. Additional Information for Trauma Assessment and General Management

A. Mechanism of Injury

B. Priority Needs of the Trauma Patient

Specialist **4: TRIAGE**

LESSON OUTLINE AND PERFORMANCE OBJECTIVES:

According to Specialist lecture presentations, assigned readings, practical lab and clinical assignments, the student will be able to state, describe, choose, demonstrate, analyze, prescribe, evaluate, etc., the following, including information addressed in:

EMT Objectives: **Patient Assessment**
Triage

OUTLINE AND OBJECTIVES

I. Introduction

A. Definitions

II. Incident Command Structure

III. General Principles of Triage

IV. Priorities of Care

V. General Principles of Management

Specialist

5: RESPIRATORY EMERGENCIES
CHEST INJURIES
ACID-BASE BALANCE
AIRWAY MANAGEMENT, OXYGEN THERAPY

LESSON OUTLINE AND PERFORMANCE OBJECTIVES:

According to Specialist lecture presentations, assigned readings, practical lab and clinical assignments, the student will be able to state, describe, choose, demonstrate, analyze, prescribe, evaluate, etc., the following, including information addressed in:

EMT Objectives:	**Anatomy and Physiology** **Patient Assessment** **Respiratory Emergencies, Chest Injuries** **Airway Management, Oxygen Therapy**
EMT Task Analysis:	**Airway Management, Oxygen Therapy, Ventilation**
Specialist Objectives:	**Fluids, IV Therapy, Shock**
Paramedic Task Analysis:	**Airway Management, Oxygen Therapy, Ventilation** **Drug and Fluid Volume Calculations** **Intraosseous Infusion** **IV Discontinuation** **Peripheral Intravenous Lines**

Definitions:

To meet the objectives of this part, each student must be able to define and understand related terminology. The student is responsible for all EMT terminology in related sections. The following are not intended to be all-inclusive.

1. Acidosis: Increased hydrogen ion concentration with resulting pH less than 7.35.

2. Alkalosis: Decreased hydrogen ion concentration with resulting pH greater than 7.45.

3. Arterial Blood Gases: The measurement of the oxygen, carbon dioxide, pH, and bicarbonate in arterial blood samples.

4. Buffer: A chemical system set up in the body to respond to changes in the hydrogen ion concentration to maintain a normal pH.

5. Dead Air Space: The amount of gas remaining in the upper air passages, where it is unavailable for gas exchange.

6. Metabolic Acidosis: An increase of acid produced by the body (i.e., diabetic ketoacidosis), resulting in a decrease in pH.

7. Metabolic Alkalosis: An excess of base in the body (may be caused by ingestion or injection of large amounts of sodium bicarbonate), resulting in an increase in pH.

8. pH: Term used to express the hydrogen ion concentration of a fluid.

9. Respiratory Acidosis: Retention of carbon dioxide and an increase in carbonic acid, resulting in decreased pH.

10. Respiratory Alkalosis: Excessive elimination of carbon dioxide, resulting in increased pH.

OUTLINE AND OBJECTIVES

I. Anatomy and Physiology

A. Anatomy and Physiology of the Respiratory Tract

1. The Upper Airway

2. The Lower Airway

3. Anatomical Components of the Lungs

B. Mechanism of Respiration

C. Mechanism of Ventilation

D. Factors that Influence Levels of Oxygen and Carbon Dioxide

1. Oxygen and Carbon Dioxide Levels

5.1 Oxygen and carbon dioxide levels are determined by measuring the partial pressure of those gases.

2. Diffusion

5.2 Diffusion is the movement of gases from high partial pressure to low partial pressure.

3. Oxygen Concentration in the Blood

5.3 Oxygen diffuses into the blood plasma, where it combines with hemoglobin. 97% of oxygen is carried by hemoglobin, 3% is dissolved in plasma.

5.4 Carbon monoxide may displace oxygen on hemoglobin.

5.5 Oxygen derangements may be corrected by:

a. Increasing ventilation
b. Administering supplemental oxygen
c. Intermittent positive pressure ventilation
d. Correcting underlying cause

4. Carbon Dioxide Concentration in the Blood

5.6 Carbon dioxide is transported mainly as bicarbonate.

5.7 Factors that effect carbon dioxide concentrations in the blood include:

a. Increased carbon dioxide production
b. Decreased carbon dioxide elimination

5.8 Carbon dioxide derangements may be corrected by:

a. Increasing/decreasing ventilation
b. Correcting underlying cause

E. Regulation of Respiration

F. Modified Forms of Respiration

G. Measures of Respiratory Function

H. Acid-Base Balance

5.9 Normal body pH is 7.35 - 7.45.

1. Acid-Base Regulators

5.10 Three (3) principle acid-base regulators are:

a. Buffer system: the most rapidly acting (fraction of a second) acid-base regulator. It acts as a "chemical sponge", "soaking up" hydrogen ions, when present in excess, and releasing them when the concentration is deficient.
b. Respiratory system: slower than the buffer system (one to three minutes). An increase in levels of carbon dioxide or hydrogen ions stimulates the respiratory center in the brain to increase the rate and depth of respirations. This increases the rate of carbon dioxide exhaled, and less carbonic acid is formed. As carbon dioxide and hydrogen

concentrations decrease, stimulus to the respiratory center is decreased and depth of respirations return to normal.

c. Renal system: the slowest mechanism (hours to days) in long term regulation of acid-base balance. The kidneys excrete and/or retain hydrogen and bicarbonate ions.

5.11 The bicarbonate buffer system is the most important buffer system in the body.

5.12 The carbonate-carbonic acid equilibrium is $CO_2+H_2O\leftrightarrow H_2CO_3\leftrightarrow H+HCO_3$.

2. Respiratory Acidosis

5.13 Increased CO_2 with resulting decreased pH stimulates the respiratory center to increase the rate and depth of breathing.

5.14 When the respiratory system fails to compensate, the mechanism for correcting respiratory acidosis is the kidneys, by conserving bicarbonate and excreting more hydrogen ions.

5.15 The management of respiratory acidosis is to assist in ventilating the patient with a bag valve mask, or other positive pressure device, to increase the inspiratory volume, and eliminate more carbon dioxide via the lungs.

5.16 A common cause of respiratory acidosis is respiratory depression, which is secondary to:

a. Drug effect causing hypoventilation
b. Traumatic injury
c. Respiratory disease

3. Respiratory Alkalosis

5.17 When the respiratory system fails to compensate, the mechanism for correcting respiratory alkalosis is the kidneys, by excreting more bicarbonate and retaining hydrogen ions.

5.18 The management of respiratory alkalosis is to assist the patient in retaining carbon dioxide, such as having them slow their breathing to a normal rate.

5.19 A common cause of respiratory alkalosis is hyperventilation syndrome.

4. Metabolic Acidosis

5.20 The compensatory mechanism for correcting metabolic acidosis is through the lungs, where rate and depth of respirations increase, to expel more carbon dioxide.

5.21 The compensatory mechanism for correcting metabolic acidosis, over the long term lies with the kidneys excreting more hydrogen ions.

5.22 Common causes of metabolic acidosis are:
   a. Diabetic ketoacidosis
   b. Lactic acid production during hypoxic states

5. Metabolic Alkalosis

5.23 The management of metabolic alkalosis is correcting the underlying cause, such as restoring adequate circulation and ventilation.

5.24 The compensatory mechanism for correcting metabolic alkalosis is via the lungs, in an attempt to retain carbon dioxide. The kidneys retain hydrogen ions.

5.25 A common cause of metabolic alkalosis is over-ingestion of products containing sodium bicarbonate, such as antacids.

II. Respiratory Assessment

A. Airway Assessment

B. Assessment of Breathing

III. Respiratory Problems

A. Trauma

1. Airway Obstruction

a. Pathophysiology

b. Signs and Symptoms

c. Management

5.26 In the unconscious patient with a foreign body obstruction, use BLS methods to relieve obstruction. If the obstruction remains after one cycle, directly visualize the airway with the laryngoscope. If the foreign body can be seen, remove with Magill forceps.

5.27 Management of the choking victim in the late stages of asphyxiation, after BLS and airway visualization has been attempted, cricothyrotomy is performed by ALS personnel.

2. Laryngeal Spasm or Laryngeal Edema

a. Pathophysiology

b. Signs and Symptoms

c. Management

5.28 Management of acute laryngeal spasm or laryngeal edema includes:

a. BLS management
b. Considering early endotracheal intubation before airway becomes obstructed. Consider using a smaller than normal ET tube to achieve placement.
c. Starting IV of crystalloid

3. Aspiration

a. Pathophysiology

b. Signs and Symptoms

c. Management

5.29 Management of the patient with possible aspiration includes:

a. BLS management
b. Establishing and maintaining advanced airway as needed
c. Starting IV of crystalloid

4. Rib Fracture

a. Signs and Symptoms

b. Management

5.30 Management of the patient with suspected rib fractures includes:

a. BLS management
b. Starting IV of crystalloid

5. Flail Chest

a. Pathophysiology

b. Signs and Symptoms

c. Management

5.31 Management of the patient with a flail chest includes:

a. BLS management
b. Establishing and maintaining advanced airway as indicated

c. Auscultating breath sounds, monitoring chest rise and fall, neck vein distention, and trachea location
d. Starting IV of crystalloid

6. Closed Pneumothorax

a. Pathophysiology

b. Signs and Symptoms

c. Management

5.32 Management of the patient with a closed pneumothorax includes:
a. BLS management
b. Repeating auscultation of breath sounds
c. Establishing and maintaining advanced airway as indicated
d. Starting IV of crystalloid

7. Open Pneumothorax

a. Pathophysiology

b. Signs and Symptoms

c. Management

5.33 Management of the patient with an open pneumothorax includes:
a. BLS management
b. Establishing and maintaining advanced airway as indicated
c. Repeating auscultation of breath sounds
d. Starting IV of crystalloid

8. Tension Pneumothorax

a. Pathophysiology

b. Signs and Symptoms

c. Management

5.34 Management of the patient with a tension pneumothorax includes:

a. BLS management
b. Establishing and maintaining advanced airway as indicated
c. Repeated auscultation of breath sounds before and after treatment
d. Chest decompression would need to be performed by ALS personnel
e. Starting IV of crystalloid

9. Hemothorax

a. Pathophysiology

b. Signs and Symptoms

c. Management

5.35 Management of the patient with a hemothorax includes:
a. BLS management
b. Establishing and maintaining advanced airway as indicated
c. Repeating auscultation of breath sounds
d. Starting IV of crystalloid

10. Traumatic Asphyxia

a. Pathophysiology

b. Signs and Symptoms

c. Management

5.36 Management of the patient with traumatic asphyxia includes:
a. BLS management
b. Establishing and maintaining advanced airway as indicated
c. Determining if chest decompression would need to be performed by ALS personnel
d. Starting IV of crystalloid

11. Myocardial Contusion

a. Pathophysiology

b. Signs and Symptoms

c. Management

5.37 Management of the patient with myocardial contusion includes:

a. BLS management
b. Establishing and maintaining advanced airway as indicated
c. Starting IV of crystalloid

12. Pericardial Tamponade

a. Pathophysiology

b. Signs and Symptoms

5.38 Signs and symptoms of pericardial tamponade may include:

a. Thready, tachycardic pulse
b. Hypotension with narrow pulse pressure
c. Neck vein distention
d. Muffled heart tones
e. Diminished QRS amplitude
f. Pale, cool skin
g. Chest discomfort

c. Management

5.39 Management of the patient with pericardial tamponade includes:

a. BLS management
b. Establishing and maintaining advanced airway as indicated
c. Starting IV crystalloid
d. Immediate transport

B. Medical

1. Asthma

a. Pathophysiology

b. Signs and Symptoms

c. Management

5.40 Management of the patient with asthma includes:

a. BLS management
b. Starting IV of crystalloid

c. Observing patient for progression into status asthmaticus
d. Be prepared to establish and maintain an advanced airway as indicated

d. Status Asthmaticus

1) Signs and Symptoms

5.41 Patients with continued asthma, unrelieved by medication administration, are usually dehydrated and require fluid administration.

2) Management

5.42 Management for a patient in status asthmaticus is the same as for the patient experiencing as asthma attack but the sense of urgent rapid transport is greater. Consider intubation as appropriate.

2. Chronic Bronchitis

a. Pathophysiology

b. Signs and Symptoms

c. Management

5.43 Management of the patient with chronic bronchitis includes:
a. BLS management
b. Starting IV of crystalloid
c. Establishing and maintaining advanced airway as indicated

3. Emphysema

a. Pathophysiology

b. Signs and Symptoms

c. Management

5.44 Management of the patient with emphysema includes:
a. BLS management
b. Starting IV of crystalloid
c. Establishing and maintaining advanced airway as indicated

4. Pneumonia

a. Pathophysiology

b. Signs and Symptoms

c. Management

5.45 Management of the patient with pneumonia includes:

a. BLS management
b. Starting IV of crystalloid
c. Establishing and maintaining advanced airway was indicated

5. Pulmonary Embolism

a. Pathophysiology

b. Signs and Symptoms

c. Management

5.46 Management of the patient with a pulmonary embolism includes:

a. BLS management
b. Establishing and maintaining advanced airway as indicated
c. Starting IV of crystalloid

6. Anaphylaxis

a. Pathophysiology

b. Signs and Symptoms

c. Management

5.47 Management of the patient in anaphylaxis includes:

a. BLS management

b. Establishing and maintaining an advanced airway as indicated
c. Starting IV of crystalloid

7. Hyperventilation Syndrome

a. Pathophysiology

b. Signs and Symptoms

c. Management

IV. Basic Airway Management and Oxygen Therapy

A. Basic Airway Management

1. Manual Airway Maneuvers

2. Basic Airway Adjuncts

3. Suctioning

4. Airway Obstruction Removal

B. Oxygen Administration Devices

C. Ventilation Devices and Procedures

V. Advanced Airway Management

A. Esophageal Obturator Airway/Esophageal Gastric Tube Airway

5.48 Advantages of EOA and EGTA insertion are:

a. The EOA/EGTA have a distal cuff which helps reduce gastric reflux into the airway.
b. The procedure does not require direct visualization for placement.

5.49 Use of the EOA/EGTA is contraindicated in patients:

a. With a gag reflex
b. Under 16 years of age
c. Under 5 feet tall or over 6'7" tall
d. With known esophageal or liver disease or alcoholism
e. Who have ingested caustic substances

5.50 Successful use of the EOA/EGTA is dependent upon proper positioning of the patient's head and jaw prior to insertion of the tube, and during ventilation. The head should be in the neutral or flexed position and the jaw should be lifted.

5.51 The EOA/EGTA should be inserted with the mask and tube assembled so the cuff will stop at the appropriate depth.

5.52 Once in place, absent breath sounds and absence of chest rise and fall during ventilation would indicate that the tube has been misplaced in the trachea.

5.53 Cuff inflation should be completed after breath sounds have been evaluated. The cuff should be inflated with 30-35cc of air to obtain a seal.

5.54 Effective management of the EOA/EGTA in an unconscious patient includes:

a. Maintaining placement until an endotracheal tube is in place
b. Maintaining a good facial seal with the mask

5.55 The EOA/EGTA is removed considering the following factors:

a. The patient's level of consciousness is adequate to maintain his/her own airway, or an endotracheal tube is in place.
b. A suction unit should be available and prepared prior to removal.
c. Ventilation equipment is prepared and supplemental oxygen is available.
d. The patient is positioned on his/her side, unless contraindicated.
e. The cuff has been completely deflated, and the tube gently removed.

B. Esophageal-Tracheal Airways

5.56 The Esophageal-Tracheal Double Lumen Airway (ETDLA) (Combitube) is recognized as a substitute for the EOA/EGTA in Michigan.

5.57 Indications for placement of Esophageal-Tracheal Airways are the same as for the EOA/EGTA.

5.58 Contraindications for placement of Esophageal-Tracheal Airways are the same as for the EOA/EGTA.

5.59 The cuffs of the Esophageal-Tracheal Airways seal the pharynx or the esophagus, allowing ventilations to enter the larynx indirectly or directly (dependent on device), eliminating the need for a face mask seal.

C. Endotracheal Intubation

1. General Considerations

5.60 Indications for endotracheal intubation include:

a. All critical patients who are unable to maintain their own airway
b. Patients who are unresponsive with absent gag reflex
c. When there is risk of aspiration, as in the unconscious and/or altered mental status patient
d. When the potential for laryngeal swelling is evident
e. The dyspneic patient that needs ventilatory assistance due to respiratory fatigue and ventilatory failure
f. The need for direct tracheal suctioning
g. The need for positive pressure ventilation

5.61 Causes of potentially difficult endotracheal intubations include patients with:

a. Prominent upper incisors
b. Underbite (most small children)
c. A large tongue (most small children)
d. A narrow mouth

e. Excess secretions in the oropharynx
f. A large "bull" neck
g. Arthritic changes or fusion of the cervical spine
h. Dentures
i. Laryngeal edema

5.62 It is essential that baseline breath sounds be obtained prior to intubation.

5.63 Hyperventilation of the apneic patient prior to each intubation attempt is important.

5.64 Optimal head positioning for endotracheal intubation is a neutral or sniffing position. The neck should not be hyperextended.

5.65 Rough technique may increase the risk of laryngospasm.

5.66 Intubation of a patient with copious gastric reflux should be completed with the use of Sellick's maneuver (cricoid pressure) to stem flow.

5.67 Suctioning of the patient prior to intubation is best accomplished under direct laryngoscopy with a pharyngeal suction tip.

5.68 Tube size in the average adult patient is 8.0mm I.D. Keep one size smaller and larger readily accessible.

5.69 The laryngoscope blade is available in two primary styles, with each style requiring a specific technique for use.

a. Each blade works by sweeping the tongue to the left into the cheek area.
b. The curved blade's tip is inserted into the vallecula, with lifting movement of the tongue, which indirectly lifts the adjacent epiglottis to expose the vocal cords.
c. The tip of the straight blade is inserted under the epiglottis, and the entire blade is used to lift the tongue and epiglottis for visualization.
d. Blade insertion should be slow and gradual, with recognition of each descending landmark.

5.70 Manipulation of the blade with a prying or levering motion may result in damage to the teeth or soft tissues.

5.71 Use of Sellick's maneuver may be beneficial in intubation.

5.72 Indications for the use of a stylet include:

a. Orotracheal intubations
b. In the trauma victim, to allow orotracheal and digital intubation with minimal movement of cervical soft tissue.
c. Anticipated difficult intubations

5.73 Proper technique for the use of a stylet includes:

a. Recessing the tip of the stylet within the end of the endotracheal tube, which will prevent the laceration of laryngeal structures.
b. Insertion within the tube, and bending the distal third to a hockey stick configuration (45 degree angle).

5.74 The endotracheal tube should be inserted under conditions that are as sterile as possible.

5.75 The cuff should be inflated as soon as the tube is inserted, to enhance breath sounds and seal the airway against aspiration.

5.76 The cuff of the ET tube should only be inflated until a seal is achieved (no blow-by heard). Excessive cuff pressure can occur when a specific number of cc's are used as a guide for inflation.

5.77 Excessive cuff pressure may result in mucosal necrosis, esophageal or tracheal damage.

5.78 Correct tube positioning is noted when there:

a. Are equal breath sounds bilaterally
b. Is an absence of gastric sounds with ventilation
c. Is fogging of the tube with exhalation
d. Is full movement of the chest with ventilation
e. Is direct visualization of the tube passing through the vocal cords (orotracheal route)

5.79 If tube placement cannot be confirmed, it should be assumed that it is incorrectly placed, BLS ventilations resumed, and alternative airway adjuncts considered.

5.80 Tube placement may be monitored by non-invasive respiratory monitoring devices if available.

5.81 Tube depth should be noted utilizing the centimeter marker. This must be monitored for shifting during treatment and transport.

5.82 Each intubation attempt for an apneic patient should take no longer than 30 seconds, with appropriate oxygenation between each attempt.

5.83 For the breathing patient, the intubation technique should not be rushed. Rough technique will increase the chance of laryngospasm.

5.84 Proper technique for the removal of the endotracheal tube (extubation) includes:

a. The patient's level of consciousness is adequate to maintain his/her own airway (orotracheal).
b. A suction unit is prepared and available.
c. Ventilation equipment is prepared.
d. Intubation equipment is ready in the event that re-intubation is necessary.
e. The patient is positioned on his/her side, unless contraindicated.
f. The cuff is fully deflated, and the tube gently removed.
g. Supplemental oxygen is applied after removal.

2. General Considerations for Orotracheal Intubation

5.85 Orotracheal intubation is accomplished under direct visualization of the tube passing between the vocal cords (ideal depth is halfway between the vocal cords and carina).

5.86 Holding the tube vertically will result in loss of view. It is preferable to hold it on its side and insert from the right corner of the mouth.

5.87 A bite block should be inserted to prevent biting of the tube, and subsequent asphyxiation.

3. General Considerations for Nasotracheal Intubation

5.88 Indications for nasotracheal intubation include patients:

a. With suspected spinal injury
b. With severe trauma to the mouth and lower jaw that would complicate use of a laryngoscope
c. With head injury or severe, prolonged seizures, in which the teeth and jaw are clenched shut and the mouth cannot be opened
d. Who are conscious, or have altered level of consciousness and hypoventilating severely, and need positive pressure ventilation or tracheal suctioning

5.89 Placement of a nasotracheal tube requires that the patient is breathing. This allows for listening to breath sounds at the end of the tube as it is advanced into the larynx.

5.90 Proper technique for the insertion of an endotracheal tube through the nasotracheal route includes:

a. Choosing an endotracheal tube one size smaller than one chosen for orotracheal intubation in the same patient to facilitate passage through the nasopharynx

b. Lubricating the tube with a water soluble lubricant to prevent injury to the nasal mucosa
c. Listening for breath sounds at the end of the tube
d. Inserting the tube during inspiration
e. Tube placement is confirmed as with other insertion procedures.

4. General Considerations for Digital Intubation

5.91 Indications for digital intubation include:

a. Patients who may be unable to be placed in a supine position
b. Patients who may be inaccessible for standard intubation techniques
c. Patients at risk for cervical spine injury
d. Patients who have facial injuries that distort anatomy

5.92 Digital intubation is accomplished by:

a. Placement of a stylet within the tube and the tube formed in a hockey stick configuration
b. Lubricating the tube with a water soluble lubricant

c. Using the index and middle finger of one hand to walk down the midline of the tongue while pulling anterior, which will lift the epiglottis within reach of the fingers
d. Placing the tube anterior to the palpating fingers and advancing distally through the vocal cords
e. Tube placement is confirmed as with other insertion procedures.

5. Pediatric Orotracheal Intubation

5.93 Indications for orotracheal intubation in the pediatric patient are the same as those for the adult.

5.94 The most appropriate size endotracheal tube for an infant/child is determined using the formula "16 plus age (in years) divided by 4". An alternate approach, although not as accurate, is to measure the diameter of the small finger or the nares. Tubes one-half size larger and smaller should also be available to prepare for individual differences.

5.95 A straight blade should be used for infants. (Due to the relatively large size of the epiglottis of the infant, a curved blade cannot lift the tongue sufficiently to raise the epiglottis and expose the glottic opening).

5.96 For the child in respiratory arrest due to epiglottitis, intubation should not be attempted initially. Frequently, the child is in respiratory arrest due to respiratory muscle fatigue secondary to high airway resistance, not due to total obstruction. Ventilation with the BVM will frequently work and should be the initial approach. Intubation in this situation is extremely difficult and should be performed with guidance from medical control.

5.97 A stylet is important when intubating infants and small children, due to their anatomy. The tongue is relatively larger and the glottic opening is approximately two cervical vertebrae higher than the adult. Both of these differences cause the ET tube to require a greater bend to reach the glottic opening.

5.98 For children up to approximately age 8, an uncuffed ET should be used. The ET will seal at the cricoid level, the narrowest point of the airway, due to the elasticity of the child's airway and the circular shape of the cricoid cartilage.

5.99 When intubating an infant/small child, the tube should be inserted only until the glottic marker on the tube approximates the vocal cords, to avoid right mainstem intubation.

5.100 Nasotracheal intubation should be avoided in children in the prehospital setting due to the high probability of adenoid trauma and consequent bleeding into the airway.

5.101 During intubation of the neonate, the heart rate should be monitored by an assistant to detect bradycardia due to vagal stimulation.

5.102 Breath sounds of the intubated infant should be auscultated in the axillary area, in order to provide maximum separation of the lung fields and accentuate unequal breath sounds caused by right mainstem placement.

Specialist

6: FLUIDS AND ELECTROLYTES
IV THERAPY
SHOCK

LESSON OUTLINE AND PERFORMANCE OBJECTIVES:

According to Specialist lecture presentations, assigned readings, practical lab and clinical assignments, the student will be able to state, describe, choose, demonstrate, analyze, prescribe, evaluate, etc., the following, including information addressed in:

EMT Objectives:	**IV Maintenance, Shock**
	Anatomy and Physiology
	Patient Assessment
EMT Task Analysis:	**PASG: Application/ Inflation**
	PASG: Deflation
	All Assessment Skills
Paramedic Task Analysis:	**Airway Management, Oxygen Therapy, Ventilation**
	Drug and Fluid Volume Calculations
	Intraosseous Infusion
	IV Discontinuation
	Peripheral Intravenous Lines

Definitions:

To meet the objectives of this part, each student must be able to define and understand related terminology. The student is responsible for all EMT terminology in related sections. The following terms are not intended to be all-inclusive.

1. ABO System: A system of blood typing based on the presence of proteins on the surface of the red blood cells.

2. Anion: An ion with a negative charge.

3. Cation: An ion with a positive charge.

4. Colloid Solution: A solution containing large osmotically active molecules such as proteins.

5. Crystalloid Solution: A solution which does not contain protein or other large molecules.

6. Fick Principle: The amount of oxygen delivered to each cell is directly related to oxygen exchange in the lungs, the circulation of oxygen to the cells, and the presence of red blood cells.

7. Fluid Challenge: A large amount of solution infused rapidly to rule out hypovolemia.

8. Hematocrit: The percentage of the blood consisting of the red blood cells (normal is 45 percent).

9. Hemoglobin: An iron-containing compound, found within the red blood cell, that is responsible for the transport and delivery of oxygen to the body cells. The normal amount of hemoglobin is 15 grams/100 ml of blood.

10. Hemolytic Reaction: An adverse response to receiving blood or blood products. Also referred to as transfusion reaction.

11. Hypertonic: A solution having a concentration of solute molecules higher than that within the cells.

12. Hypotonic: A solution having a concentration of solute molecules lower than that inside the cells.

13. Ion: An atom or group of atoms possessing a positive or negative charge.

14. Isotonic: A solution having concentration of solute molecules equivalent to that inside a cell, or the same concentration of solutes on either side of a semipermeable membrane.

15. Nonelectrolyte: A molecule (group of atoms) with no electric charge.

16. Osmosis: Movement of solvent (water) through a semipermeable membrane from a solution of lower concentration to a solution of higher concentration, thereby equalizing the concentration of solute on the two sides of the membrane.

17. Peripheral Vascular Resistance: The resistance to blood flow due to the peripheral blood vessels. This pressure must be overcome for the heart to pump blood effectively.

18. Pyrogenic

Reaction: An adverse response to receiving foreign protein, causing fever (most common in intravenous infusions).

19. Semipermeable Membrane: A membrane that allows some molecules in a solution to pass through, but not others.

20. Tonicity: The number of particles present per unit volume.

21. Total Body Water (TBW): The amount of water in the body, approximately 60% of total body weight.

OUTLINE AND OBJECTIVES

I. Fluids and Electrolytes

A. Water Distribution

6.1 The two (2) compartments of total body water (TBW) are:
- a. Intracellular fluid.
- b. Extracellular fluid

6.2 Two (2) types of extracellular fluid are:
- a. Interstitial fluid
- b. Intravascular fluid (plasma)

B. Role of Electrolytes

1. Principle Cations

6.3 Four (4) principle cations and their functions are:
- a. Sodium (Na^{+}) - most prevalent of the extracellular cations. It regulates the distribution of water throughout the body.
- b. Potassium (K^{+}) - chief cation of the intracellular fluid. Has a critical role in mediating electrical impulses in nerves and muscles, including that of the heart.
- c. Calcium (Ca^{++}) - necessary for bone development, blood clotting, neuromuscular activity and muscle contraction.
- d. Magnesium (Mg^{++}) - is important as a coenzyme for metabolism of proteins and carbohydrates.

6.4 Patients using diuretic medications may lose potassium and develop a potassium deficiency called hypokalemia.

6.5 Patients with renal disease may retain potassium, and develop a high potassium level called hyperkalemia.

6.6 Low or high potassium levels may cause cardiac dysrhythmias.

6.7 A low calcium level may cause muscle tissue to spasm. This may also cause seizures and weak heart muscle contraction.

6.8 Magnesium plays a similar role to calcium in controlling neuromuscular response. A deficiency may cause spasm and muscle weakness.

2. Principle Anions

6.9 Two (2) principle anions and their functions are:

a. Chloride (Cl^-) - found in the extracellular fluid, which participates indirectly in regulating the body's acid-base balance.

b. Bicarbonate (HCO_3^-) - chief buffer of the body, which maintains acid-base balance.

C. Movement of Water, Solutes

1. Osmosis

2. Diffusion

3. Tonicity

a. Isotonic

b. Hypotonic

c. Hypertonic

D. Disorders of Hydration

1. Dehydration

6.10 Dehydration is the abnormal loss of fluid which also effects loss of electrolytes from the body.

a. Causes

6.11 Possible causes of dehydration are:

a. Vomiting
b. Diarrhea
c. Increased urination, such as in diabetes
d. Increased respiration
e. Diaphoresis
f. Third space losses (burns, peripheral edema, wounds, bowel obstruction)
g. Fever
h. Hot environment

i. Plasma losses

b. Signs and Symptoms

c. Management

6.12 Management of the patient with dehydration includes:

a. BLS Management
b. Starting IV of crystalloid, administering fluid bolus of 200 - 400 ml titrated until improvement in symptoms (20ml/kg in peds)

2. Overhydration

a. Causes

6.13 Overhydration occurs when the body is unable to eliminate water and salts as needed. This can occur with congestive heart failure, liver or renal failure. This can also occur from over-infusion of intravenous fluids.

b. Signs and Symptoms

6.14 Possible signs and symptoms of overhydration are:

a. Pulmonary edema
b. Dyspnea, rales
c. Jugular vein distention
d. Hypertension
e. Peripheral edema

c. Management

6.15 Management of the overhydrated patient includes:

a. BLS management (as in CHF patient)
b. Starting IV of crystalloid
c. Fowler's position may possibly improve respiratory effort

II. IV Therapy

A. Blood and Blood Components

1. Functions

2. Major Blood Components

3. Blood Preparations, Derivatives and Substitutes

6.16 The optimum fluid for volume replacement is whole blood.

B. IV Fluids and Equipment

1. Types of Fluids

a. Colloids

6.17 A colloid is a solution with high molecular weight. These solutions are used as volume expanders and are rarely used prehospital.

b. Crystalloids - Prehospital Solutions

6.18 An isotonic solution has the same concentration as the fluid compartment it is being compared to. Examples of isotonic solutions are Normal Saline and Lactated Ringer's.

6.19 A hypotonic solution has a concentration of solutes less than that found within the cell. The water in this solution will move into the cells. An example of a hypotonic solution is 5% Dextrose in Water.

6.20 A hypertonic solution has a concentration of solutes greater than that found in the compartment it is being compared to. This solution will draw water from the cells into the vascular space. An example of a hypertonic solution is 50% Dextrose.

2. Specific Indications for Use

6.21 The prehospital choice for volume fluid replacement is an isotonic crystalloid solution, such as Ringer's Lactate or Normal Saline.

3. Contraindications for Specific Use

6.22 Glucose solutions are not used as rapid volume expanders because glucose, when metabolized, converts the solution into free water.

4. Maintenance of Solutions and Equipment

6.23 Solutions must be stored in a clean, dry place at a temperature as close to normal body temperature as possible, in accordance with state pharmacy regulations.

5. Additional Equipment

a. Administration Sets

6.24 Types of intravenous administration sets are:

a. Macro drip - which deliver 10 - 20 gtt/ml
b. Micro drip (or mini drip) - which deliver 60 gtt/ml
c. Blood infusion sets

d. Volume control sets (Buretrol, Volutrol) may be used for pediatrics or administration of medication which deliver 60 gtt/ml

b. Needles and Catheters

6.25 When replacing fluid volume in the adult, the intravenous catheter should be a large gauge, generally a 14 or 16 gauge catheter.

6.26 When using an intravenous line to keep a vein open for possible drug administration, generally a 18 or 20 gauge catheter is sufficient, for an adult.

6. Factors Effecting Flow and Patency of IV

6.27 Factors that influence IV flow, other than size of the IV catheter, are:

a. Length and diameter of administration set tubing
b. The height of the IV bag
c. The pressure applied to the IV bag
d. Patient positioning

C. Venous Cannulation

1. Peripheral IV Insertion

a. Indications

6.28 Three (3) indications for IV cannulation in the field are:

a. Drug administration
b. Replacement of fluid
c. Obtaining specimens of venous blood for laboratory determinations

b. Advantages/Disadvantages of Peripheral IV

6.29 Advantages of peripheral IV therapy are:

a. The technique is easy to master
b. Catheterization of a peripheral vein does not interfere with continuing ventilation and chest compression during CPR

6.30 Disadvantages of peripheral IV therapy are:

a. It may be difficult or impossible to establish an access from a peripheral vein
b. There can be significant delay in the drug reaching the heart
c. Peak drug levels are lower

d. Hypertonic or irritating solutions should not be administered via this route
e. The incidence of phlebitis increases

c. Types of Catheters

6.31 Types of catheters used in the prehospital setting are:
a. The catheter-over-the-needle
b. The catheter-through-the-needle
c. Butterfly needles

d. Insertion Sites

6.32 Common areas for IV cannulation in the field are:
a. The dorsum of the hand
b. The ventral forearm
c. The antecubital fossa
d. The external jugular vein

6.33 The antecubital fossa should be the first choice in cardiac arrest.

6.34 The long saphenous veins are commonly used when IV cannulation occurs in the legs.

e. Complications

1) Local

6.35 Local complications of IV therapy are:
a. Hematoma
b. Thrombophlebitis
c. Cellulitis
d. Infiltration
e. Inadvertent arterial puncture

6.36 Signs and symptoms of local infiltration are:
a. Edema at the venipuncture site
b. Significant slowing or stopping of the IV infusion
c. No blood return in the IV tubing
d. Pain

6.37 The correct first step in managing local IV infiltration is to discontinue the IV.

6.38 Signs and symptoms of arterial puncture are:
a. Pain
b. Immediate return of bright red blood into the IV tubing

6.39 The correct management for arterial puncture during an IV attempt is immediate withdrawal of the needle

and the application of direct pressure to the puncture site for at least five (5) minutes.

2) Systemic

6.40 Systemic complications of IV therapy are:

a. Fluid overload, pulmonary edema, third spacing
b. Sepsis
c. Pulmonary thromboembolism
d. Air embolism
e. Catheter fragment embolism
f. Increased intracranial pressure, secondary to head injury
g. Hemodilution
h. Decreased core temperature
i. Fluid leaking
j. Pyrogenic reaction (rare with crystalloids)

6.41 The management for pyrogenic reaction is immediate cessation of the IV infusion.

6.42 When using a catheter-over-the-needle type IV catheter, once it has been withdrawn, the needle should never be pushed back into the catheter as this may cause catheter shear.

6.43 When using a catheter-through-the-needle type IV catheter, the catheter should never be pulled back through the needle as this may cause catheter shear.

f. Evaluation/Maintenance of Patency

g. Calculation of Infusion Rates

6.44 Rate of fluid replacement is dependent on monitoring of the patient's:

a. Pulse
b. Skin condition (temperature, color, moisture)
c. Capillary refill
d. LOC
e. Blood pressure

2. Central IV Lines

a. Indications

6.45 Central IV line placement is performed when peripheral insertion is not available or when fluids/medications must be administered into the central circulation. They are also used

for insertion of monitoring devices. Central lines are rarely established in the prehospital setting.

b. Insertion Sites

6.46 Central line cannulation may be performed under the authority of local medical control. The common locations of central IV sites are:

a. Femoral vein
b. Internal jugular vein
c. Subclavian vein

c. Complications

6.47 Complications of central line cannulation may include:

a. Hematoma
b. Pneumothorax
c. Hemothorax
d. Air embolism
e. Infiltration of fluid into the pleural or mediastinal space

D. Intraosseous Infusions

1. Indications

6.48 The intraosseous (IO) route is used in the pediatric patient (most commonly under the five years of age) when peripheral access has not been successful.

6.49 The IO route can be used for all the common emergency medications as well as for fluid resuscitation involving shock.

2. Contraindications

6.50 Contraindications for the IO route include:

a. Fracture of the extremity
b. Infiltration of the IV fluid at the site
c. Burned tissue
d. Previous IO insertion site
e. Infection, cellulitis

3. Complications

6.51 Complications of the IO route include:

a. Sepsis
b. Osteomyelitis
c. Bone marrow damage
d. Fat embolism

4. Equipment

6.52 A bone marrow type needle and a syringe will be needed along with the standard IV set up for an intraosseous infusion. Bone marrow needles specially developed for intraosseous infusions are short and easily stabilized for use in the prehospital setting.

5. Locations for Insertion

6.53 A common site for IO insertion is the proximal tibia. The distal femur and distal tibia may also be used.

III. Pathophysiology/Management of Shock

A. Review Anatomy and Physiology

1. Circulatory System

2. Innervation of Circulatory System

B. Defintions of Shock

1. Physiology of Aerobic Metabolism

6.54 Inadequate cellular oxygenation produces anaerobic metabolism.

6.55 Anaerobic metabolism occurs in shock states.

6.56 Normal aerobic metabolism is maintained by RBC oxygenation, and can only occur if:

a. The alveoli are adequately oxygenated. This is dependent on:
   1) Open airway
   2) Adequate ventilation
   3) Normal oxygen levels in environment (FiO_2)

b. Oxygen is transported across the alveolar/capillary wall. This is dependent on:
   1) Presence of oxygen in alveolus
   2) Conditions of alveolar wall
   3) Presence of RBC to on load oxygen
   4) No edema to block passage of oxygen
   5) Patient temperature; if patient is hypothermic, oxygen is less readily released from hemoglobin to the patient's tissues

2. Shock Defined As Inadequate Tissue Perfusion

6.57 Peripheral tissue oxygenation is dependent on:

a. Adequate number of RBC's

b. Adequate tissue perfusion

c. Adequate off-loading of oxygen

6.58 The components of adequate perfusion are:

a. Pumping heart, with adequate:
   1) Strength of contractions
   2) Rate of contractions
   3) Preload (blood volume available to the atrium)

b. Fluid in the system
   1) Preload must be adequate
   2) Consistent fluid volume

c. Container
   1) Amount of fluid in system has to fit container size
   2) Heart chambers and blood vessels must maintain their size to ensure efficient pressure and perfusion
   3) Afterload (or resistance to pumping throughout the system).

d. Oxygen
   1) Oxygen must be present on the hemoglobin molecule or anaerobic metabolism occurs.

C. Stages of Shock

1. Compensated Shock

6.59 In compensated shock, the body's defense mechanisms attempt to preserve blood pressure and blood flow to major organs. Baroreceptors stimulate sympathetic nervous system to secrete norepinephrine and epinephrine, and the following occur:

a. Precapillary sphincters close, blood is shunted to larger vessels
b. Increased heart rate and strength of contractions
c. Increased respiratory function. Bronchodilation. This will continue until the problem is solved or shock progresses to being decompensated.

2. Decompensated Shock

6.60 In decompensated shock:

a. Precapillary sphincters open, blood pressure falls
b. Cardiac output falls
c. Blood sludges in tissue beds, blood flow stagnates
d. Red cells stack (rouleaux)

3. Irreversible Shock

6.61 In irreversible shock:

a. Cell death begins
b. Vital organs falter

c. Patient may be resuscitated but will usually die later (ARDS, renal and hepatic failure, sepsis)

D. Assessment of Shock

6.62 Assessment of the potential shock patient includes:

a. BLS assessment
b. Continued re-assessment with serial vital signs
c. Monitoring EKG

1. Signs and Symptoms

E. Specific Types of Shock

1. Hypovolemic

a. Pathophysiology

b. Signs and Symptoms

c. Management

6.63 The management of the hypovolemic shock patient may include:

a. BLS management
b. Establishing and maintaining an advanced airway as indicated, with strict C-spine immobilization of the trauma patient
c. While enroute, starting two large bore IV's with crystalloid running wide-open, titrated to patient condition. Do not delay transport to start IV therapy.

2. Cardiogenic

a. Pathophysiology

6.64 The pathophysiology of cardiogenic shock is:

a. Pump failure; severe left ventricular failure (AMI, CHF)
b. Coronary artery perfusion is decreased, worsening the situation
c. Compensatory mechanisms worsen the situation
d. Patient may be normovolemic or hypovolemic

b. Signs and Symptoms

6.65 Possible signs and symptoms of cardiogenic shock are:

a. Signs and symptoms of AMI, CHF
b. Hypotension

c. Altered LOC
d. Rapid, thready pulse
e. Other serious dysrhythmias may appear, including profound bradycardia. It is difficult to know if rhythm is causing hypotension or shock causing dysrhythmia.
f. Skin is cool, clammy, poor color (cyanosis, pallor, ashen)
g. Rapid, shallow breathing

c. Management

6.66 Management of the cardiogenic shock patient may include:
a. BLS management
b. Establishing and maintaining an advanced airway as indicated
c. Starting IV of crystalloid
d. Considering administration of a fluid bolus

6.67 The rationale for performing a fluid challenge in a possible cardiogenic shock patient is to rule out the possibility of hypovolemia. A fluid challenge is accomplished by administering an IV bolus of crystalloid (normal saline) very rapidly and then reassessing patient condition (including VS, LOC and breath sounds).
a. If a patient improves with rapid volume infusion, the IV should be continued at a faster than keep open rate, (possibly 100 - 150 ml per hour).
b. If a patient's condition deteriorates following rapid volume infusion, the infusion should be slowed to a TKO rate.

3. Neurogenic

a. Pathophysiology

b. Signs and Symptoms

c. Management

6.68 Management of the neurogenic shock patient may include:
a. BLS management
b. Establishing and maintaining an advanced airway as indicated, with C-spine stabilization in the trauma patient
c. Starting IV's of crystalloid running wide open, titrated to patient's condition

4. Anaphylactic

a. Pathophysiology

6.69 The pathophysiological effects of anaphylaxis are:

a. Systemic vasodilation
b. Increased vascular permeability
c. Dysrhythmias
d. Bronchoconstriction
e. Possible laryngospasm
f. Widespread swelling possibly due to interstitial edema

b. Signs and Symptoms

c. Management

6.70 Management of the patient in anaphylactic shock includes:

a. BLS management
b. Establishing and maintaining strict airway management, considering early endotracheal intubation
c. Placing a constricting band of venous flow proximal to any injection site
d. Starting IVs of crystalloid running wide open, titrated to patient condition

5. Septic Shock

6.71 Septic shock is the physiological response to bacterial infection causing severe vasodilation, potential third spacing of fluid, and pooling of blood in the periphery. The integrity of the cell membrane is altered allowing for leakage of fluids and nutrients.

6.72 Management of septic shock is focused on maintaining circulating blood volume.

6. Respiratory Shock

7. Metabolic Shock

6.73 Metabolic shock is caused by a metabolic derangement, such as diabetic ketoacidosis. Management is focused on eliminating the acidosis.

8. Psychogenic Shock

F. Pneumatic Anti-Shock Garment (PASG)

1. Introduction

2. Purpose/Advantages

3. **Indications for Application**

4. **Contraindications for Use of PASG**

5. **Precautions or Alterations in Use of PASG**

6. **Indications for Inflation**

7. **Deflation of PASG**

LESSON OUTLINE AND PERFORMANCE OBJECTIVES:

According to Specialist lecture presentations, assigned readings, practical lab and clinical assignments, the student will be able to state, describe, choose, demonstrate, analyze, prescribe, evaluate, etc., the following, including information addressed in:

Specialist Objectives:	**Fluids and Electrolytes, IV Therapy, Shock** **Respiratory Emergencies**
Paramedic Task Analysis:	**Airway Management, Oxygen Therapy, Ventilation** **Drug and Fluid Volume Calculations** **Intraosseous Infusion** **IV Discontinuation** **Peripheral Intravenous Lines**

Definitions:

To meet the objectives of this part, each student must be able to define and understand related terminology. The following terms are not intended to be all-inclusive.

1. Apothecary System: A system of weights and measures used widely in early medicine.
2. Contraindication: A condition which precludes the use of a drug.
3. Indication: The condition for which a drug is recommended.
4. Local Effect: Drug exerts an effect only in the area in which it is administered.
5. Metric System: A system of weights and measures widely used in science and medicine. It is based on a unit of 10.
6. Precaution: Identifies type of patient or condition that warrants closer observation for side effects with specific medication administration.
7. Routes of Administration: The route by which a drug is administered.
8. Side Effect: Predictable, expected secondary reaction, often not desirable.

9. Systemic Effect: Drug is distributed and absorbed throughout the bloodstream by one or more body systems.

OUTLINE AND OBJECTIVES

I. Introduction

A. Drug Sources

7.1 The four (4) sources of drug derivatives are:
- a. Animal
- b. Vegetable
- c. Mineral
- d. Synthetic

B. Drug Names

7.2 The four (4) names given to a drug are:
- a. Official name
- b. Chemical name
- c. Generic name

II. Routes of Administration

7.3 Routes of drug administration are:

a. Buccal: Administration of a drug between the teeth and mucous membrane of the cheek.

b. Endotracheal (ET): Administration of a drug into the endotracheal tube to be absorbed through the respiratory circulation.

c. Inhalation: Administration of aerosolized drugs into the lungs to be absorbed through the respiratory circulation.

d. Intravenous (IV): Administration of a drug directly into the venous bloodstream (usually by way of an established IV line).

e. Intramuscular (IM): Administration of a drug directly into muscle tissue where it is then absorbed into the bloodstream.

f. Intraosseous (IO): Administration of a drug into the bone marrow.

g. Oral: Administration of a drug by mouth (the patient swallows the drug) where it is absorbed in the intestinal tract.

h. Rectal: Administration of a drug into the rectum where it is absorbed by mucous membrane.

i. Subcutaneous (SC, SQ): Administration of a drug into the loose connective tissue located just beneath the skin.

j. Sublingual (SL): Administration of a drug under the tongue where it is absorbed by mucous membrane.

k. Topical: Administration of a drug by placing on the skin.

7.4 Routes of administration from fastest to slowest absorption rates are:
a. IV, IO (direct circulatory administration)
b. ET, Inhalation
c. SL, Rectal, Buccal
d. IM
e. SQ
f. Oral

III. Metric System

A. Review of Decimal System

B. Metric Units

7.5 Metric units of measurements and their abbreviations are:
a. Kilogram - kg (1,000 gm)
b. Gram - gm or g
c. Milligram - mg (1/1000 gm)
d. Microgram - ìg or mcg (1/1000 mg)
e. Liter - l or L (1,000 ml)
f. Milliliter - ml

C. Metric Conversions

7.6 Milligrams are converted to grams by moving the decimal point three (3) decimal places to the left. Example: 500 milligrams equals 0.50 grams.
a. There are 1,000 micrograms in 1 milligram
b. There are 1,000 milligrams in 1 gram
c. There are 1,000 grams in 1 kilogram

7.7 Milliliters are converted to liters by moving the decimal point three (3) places to the left. Example: 500 milliliters equals 0.50 liters.
a. There are 1,000 milliliters in a liter
b. There are 1,000 cubic centimeters in a liter
c. Milliliters (ml) and cubic centimeters (cc) are equivalent

Specialist **8: CARDIOVASCULAR DISEASE**

LESSON OUTLINE AND PERFORMANCE OBJECTIVES:

According to Specialist lecture presentations, assigned readings, practical lab and clinical assignments, the student will be able to state, describe, choose, demonstrate, analyze, prescribe, evaluate, etc., the following, including information addressed in:

EMT Objectives:	**Anatomy and Physiology**
	Patient Assessment
	Cardiovascular Disease, CPR, AED
EMT Task Analysis:	**All Assessment Skills**
	BLS Skills
	AED
	Patient Management: Cardiac Arrest
	Patient Management: Medical Scenario
Specialist Objectives:	**Fluids and Electrolytes, IV Therapy, Shock**
	Respiratory Emergencies
Paramedic Task Analysis:	**Airway Management, Oxygen Therapy, Ventilation**
	Drug and Fluid Volume Calculations
	Intraosseous Infusion
	IV Discontinuation
	Peripheral Intravenous Lines

OUTLINE AND OBJECTIVES

I. Cardiovascular Anatomy and Physiology

A. The Systemic Circulation

B. The Pulmonary Circulation

C. The Heart

1. Coronary Circulation

2. Pump Structure

3. Hemodynamic Influences

4. Innervation

VI. Cardiovascular Conditions

A. Coronary Artery Disease

1. Definitions

2. Predisposing Factors

B. Angina Pectoris

1. Pathophysiology

2. Signs and Symptoms

C. Myocardial Infarction

1. Pathophysiology

2. Signs and Symptoms

3. Management

D. Congestive Heart Failure

1. Pathophysiology

2. Signs and Symptoms

E. Cardiogenic Shock (See Fluids, Shock)

Specialist **9: CENTRAL NERVOUS SYSTEM**

LESSON OUTLINE AND PERFORMANCE OBJECTIVES:

According to Specialist lecture presentations, assigned readings, practical lab and clinical assignments, the student will be able to state, describe, choose, demonstrate, analyze, prescribe, evaluate, etc., the following, including information addressed in:

EMT Objectives:	**Central Nervous System**
EMT Task Analysis:	**Spinal Immobilization Skills** **Assessment Skills** **Airway Management, Oxygen Therapy, Ventilation**
Specialist Objectives:	**Fluids and Electrolytes, IV Therapy, Shock** **Respiratory Emergencies**
Paramedic Task Analysis:	**Airway Management, Oxygen Therapy, Ventilation** **Drug and Fluid Volume Calculations** **Intraosseous Infusion** **IV Discontinuation** **Peripheral Intravenous Lines**

OUTLINE AND OBJECTIVES

I. Anatomy and Physiology of Nervous System

A. Central Nervous System (CNS)

1. Brain

a. Cerebrum

b. Cerebellum

c. Brain Stem

d. Meninges, Cerebrospinal Fluid, Ventricles

e. Blood Supply

2. Spinal Cord

B. Peripheral Nervous System

1. Anatomical Divisions

2. Functional Divisions

a. Somatic Nervous System

b. Autonomic Nervous System

1) Sympathetic Nervous System

2) Parasympathetic Nervous System

3. Nervous Transmission Within the CNS

II. Assessment of CNS Injury or Illness

A. Special Considerations in a Neurological Assessment

III. Central Nervous System Trauma

A. Scalp Injury

B. Skull Fracture

C. Brain Injury

1. Cerebral Concussion

2. Cerebral Contusion/Closed Head Injury

3. Intracranial Hematoma/Bleed

a. Signs and Symptoms

4. Intracranial Pressure

5. Management of the Head Injured Patient

D. Spinal Injuries

1. Common Mechanisms of Injury

2. Types of Spinal Injury

3. Complications

4. Assessment

5. Management

IV. Central Nervous System Medical Conditions

A. Coma of Unknown Origin

1. Definition, Complications of Coma

2. Commonly Encountered Causes of Coma

3. Assessment of Coma

4. Management

B. Seizure Disorders

1. Possible Causes

2. Types of Seizures

3. Phases of a Generalized Seizure

4. Assessment

5. Management

C. Cerebrovascular Accident

1. Definitions

2. Predisposing Risk Factors

3. Causes of Interrupted Blood Flow

4. Signs and Symptoms

5. Management of CVA

D. Meningitis

1. Pathophysiology

2. Signs and Symptoms

3. Management

Specialist

10: OTHER TRAUMATIC INJURIES: BLEEDING & SOFT TISSUE INJURIES MUSCULOSKELETAL INJURIES FACIAL INJURIES ABDOMINAL INJURIES, BURNS

LESSON OUTLINE AND PERFORMANCE OBJECTIVES:

According to Specialist lecture presentations, assigned readings, practical lab and clinical assignments, the student will be able to state, describe, choose, demonstrate, analyze, prescribe, evaluate, etc., the following, including information addressed in:

EMT Objectives:	**Patient Assessment** **Other Traumatic Injuries** **Shock**
EMT Task Analysis:	**Bleeding Control, Soft Tissue Injuries** **All Spinal Immobilization Skills** **Airway Management, Oxygen Therapy, Ventilation** **PASG** **Patient Management: Trauma Scenario**
Specialist Objectives:	**Fluids and Electrolytes, IV Therapy, Shock** **Respiratory Emergencies**
Paramedic Task Analysis:	**Airway Management, Oxygen Therapy, Ventilation** **Drug and Fluid Volume Calculations** **Intraosseous Infusion** **IV Discontinuation** **Peripheral Intravenous Lines**

OUTLINE AND OBJECTIVES

I. Bleeding

A. Assessment of Bleeding

B. Signs and Symptoms of Bleeding

C. Basic Management of External Bleeding

D. Basic Management of Internal Bleeding

II. Soft Tissue Injury

A. Types of Soft Tissue Injury

- **B. Assessment of Soft Tissue Injury**
- **C. Management of Bleeding and Soft Tissue Injury**

III. Musculoskeletal Injuries

- **A. Assessment of Musculoskeletal Injuries**
- **B. Causes of Musculoskeletal Injuries**
- **C. Types of Injuries**
- **D. Management of Musculoskeletal Injuries**
- **E. Complications of Musculoskeletal Injuries**

IV. Face, Neck (Soft Tissue), Ear and Eye Injuries

- **A. Concerns**
- **B. Signs and Symptoms**
- **C. Management**

V. Abdominal Injuries

- **A. Types of Injuries**
- **B. Signs and Symptoms**
- **C. Management**

VI. Burns

- **A. Assessment of Burn Injury**
- **B. Classification of Burns**
- **C. General Management**
- **D. Chemical Burns**
- **E. Electrical Injury**

LESSON OUTLINE AND PERFORMANCE OBJECTIVES:

According to Specialist lecture presentations, assigned readings, practical lab and clinical assignments, the student will be able to state, describe, choose, demonstrate, analyze, prescribe, evaluate, etc., the following, including information addressed in:

EMT Objectives:	**Patient Assessment** **Abdominal Injury, Abdominal Illness** **Shock**
EMT Task Analysis:	**All Assessment Skills**
Specialist Objectives:	**IV Fluids, Shock** **Respiratory Emergencies**
Paramedic Task Analysis:	**Airway Management, Oxygen Therapy, Ventilation** **Drug and Fluid Volume Calculations** **Intraosseous Infusion** **IV Discontinuation** **Peripheral Intravenous Lines**

OUTLINE AND OBJECTIVES

I. Acute Abdomen

A. Review Anatomy and Physiology

B. Types/Causes of Abdominal Illness

C. Assessment

1. Special Considerations in Assessment

D. Complications of Abdominal Illness

E. Management

LESSON OUTLINE AND PERFORMANCE OBJECTIVES:

According to Specialist lecture presentations, assigned readings, practical lab and clinical assignments, the student will be able to state, describe, choose, demonstrate, analyze, prescribe, evaluate, etc., the following, including information addressed in:

EMT Objectives:	**Patient Assessment**
	Diabetes
EMT Task Analysis:	**Patient Management-Medical Scenario**
Specialist Objectives:	**Fluids, IV Therapy, Shock**
	Respiratory Emergencies
Paramedic Task Analysis:	**Airway Management, Oxygen Therapy, Ventilation**
	Drug and Fluid Volume Calculations
	Intraosseous Infusion
	IV Discontinuation
	Peripheral Intravenous Lines

OUTLINE AND OBJECTIVES

I. Anatomy and Physiology

A. Glucose Metabolism

II. Types of Diabetes

A. Insulin Dependent Diabetes Mellitus (IDDM, Type I)

B. Non-Insulin Dependent Diabetes Mellitus (NIDDM, Type II)

III. Clinical Conditions Related to Diabetes

A. Other Disease Processes Related to Diabetes

B. Hyperglycemia Leading To Ketoacidosis

C. Hypoglycemia Leading To Insulin Shock

IV. Hyperglycemia (Diabetic Ketoacidosis)

A. Pathophysiology

B. Assessment

C. Signs and Symptoms

D. Management

V. Hypoglycemia (Insulin Shock)

A. Pathophysiology

B. Assessment

C. Signs and Symptoms

D. Management

VI. Hyperosmolar Hyperglycemic Non-Ketotic Coma (HHNK)

A. Pathophysiology

B. Precipitating Factors

C. Signs and Symptoms

D. Management

LESSON OUTLINE AND PERFORMANCE OBJECTIVES:

According to Specialist lecture presentations, assigned readings, practical lab and clinical assignments, the student will be able to state, describe, choose, demonstrate, analyze, prescribe, evaluate, etc., the following, including information addressed in:

EMT Objectives:	**Anatomy and Physiology**
	Patient Assessment
	The Geriatric Patient
EMT Task Analysis:	**All Assessment Skills**
Specialist Objectives:	**Fluids, IV Therapy, Shock**
	Respiratory Emergencies
Paramedic Task Analysis:	**Airway Management, Oxygen Therapy, Ventilation**
	Drug and Fluid Volume Calculations
	Intraosseous Infusion
	IV Discontinuation
	Peripheral Intravenous Lines

OUTLINE AND OBJECTIVE

I. Introduction

II. Anatomy and Physiologic Differences in the Geriatric Patient

- **A. Cardiovascular**
- **B. Respiratory**
- **C. Digestive System**
- **D. Nervous System**
  - **1. Sensory Changes**
- **E. Musculoskeletal System**
- **F. Integumentary System**
- **G. Psycho/Social Changes**

III. Geriatric Assessment Considerations

- **A. Communication**

B. History Taking

C. Physical Exam

IV. Special Considerations in Caring for the Geriatric Patient

A. Trauma

B. Medical Emergencies

1. Cardiovascular

2. Respiratory

3. Abdominal Illness

4. Neurologic Problems

a. Delirium and Dementia

5. Environmental

6. Metabolic

C. Abuse/Neglect

D. Depression

LESSON OUTLINE AND PERFORMANCE OBJECTIVES:

According to Specialist lecture presentations, assigned readings, practical lab and clinical assignments, the student will be able to state, describe, choose, demonstrate, analyze, prescribe, evaluate, etc., the following, including information addressed in:

EMT Objectives:	**Patient Assessment** **Pediatrics** **Respiratory Emergencies** **Airway Management, Oxygen Therapy, Ventilation**
EMT Task Analysis:	**All Assessment Skills** **Patient Management: Trauma Scenario** **Patient Management: Medical Scenario** **Airway Management, Oxygen Therapy, Ventilation** **All Spinal Immobilization Skills**
Specialist Objectives:	**Respiratory Emergencies** **IV Fluids, Shock**
Paramedic Task Analysis:	**Airway Management, Oxygen Therapy, Ventilation** **Drug and Fluid Volume Calculations** **Intraosseous Infusion** **IV Discontinuation** **Peripheral Intravenous Lines**

OUTLINE AND OBJECTIVES

I. Anatomical and Physiological Differences

II. General Assessment of Children

- **A. Goals**
- **B. General Approach to Children**
- **C. Components of Physical Exam**

III. Respiratory Emergencies

- **A. General Airway Management, Oxygenation**
- **B. Airway Compromise**

1. Foreign Body Obstruction

C. Bronchiolitis

1. Pathophysiology
2. Signs and Symptoms
3. Management

D. Asthma

1. Pathophysiology
2. Signs and Symptoms
3. Management

E. Laryngo-tracheal-bronchitis (LTB) (Croup)

1. Pathophysiology
2. Signs and Symptoms
3. Management

F. Epiglottitis

1. Pathophysiology
2. Signs and Symptoms
3. Management

IV. Medical Emergencies

A. Dehydration

1. Pathophysiology
2. Signs and Symptoms
3. Management

B. Sepsis

1. Pathophysiology
2. Signs and Symptoms
3. Management

C. Meningitis

1. Pathophysiology
2. Signs and Symptoms
3. Management

D. Seizures

1. Pathophysiology
2. Signs and Symptoms
3. Management

E. Reye's Syndrome

1. Pathophysiology
2. Signs and Symptoms
3. Management

F. Sudden Infant Death Syndrome

1. General Information
2. Current Theories
3. Assessment Factors
4. Management

G. Hypothermia

V. Trauma Emergencies

A. Head Injury

1. Mechanism of Injury

2. Signs and Symptoms

3. Management

B. Other Traumatic Injuries

1. Chest Injury

2. Abdominal Injury

3. Spinal Injury

a. Spinal Immobilization

C. Bleeding/Shock

1. Pathophysiology

2. Special Considerations

3. Signs and Symptoms

4. Management

a. Special Considerations for Fluid Volume Replacement

D. General Trauma Management

VI. Child Abuse

A. Assessment Factors

B. Management of the Suspected Child Abuse Situation

VII. Pediatric Transport Considerations

VIII. Neonatal Resuscitation
(See Obstetrics, Newborn Resuscitation)

Specialist **19: ENVIRONMENTAL EMERGENCIES**

LESSON OUTLINE AND PERFORMANCE OBJECTIVES:

According to Specialist lecture presentations, assigned readings, practical lab and clinical assignments, the student will be able to state, describe, choose, demonstrate, analyze, prescribe, evaluate, etc., the following, including information addressed in:

EMT Objectives:	**Patient Assessment** **Environmental Emergencies**
EMT Task Analysis:	**All Assessment Skills** **Patient Management-Trauma Scenario** **Patient Management-Medical Scenario** **Airway Management, Oxygen Therapy** **All Spinal Immobilization Skills**
Specialist Objectives:	**Fluids, IV Therapy, Shock** **Respiratory Emergencies**
Paramedic Task Analysis:	**Airway Management, Oxygen Therapy, Ventilation** **Drug and Fluid Volume Calculations** **Intraosseous Infusion** **IV Discontinuation** **Peripheral Intravenous Lines**

OUTLINE AND OBJECTIVES

I. Heat Exposure (Hyperthermia)

A. Emergency Conditions

B. Normal Regulatory Mechanisms

C. Heat Cramps

1. Pathophysiology/Signs and Symptoms

2. Management

D. Heat Exhaustion

1. Pathophysiology

2. Signs and Symptoms

3. Management

E. Heat Stroke

1. Pathophysiology
2. Signs and Symptoms
3. Management

II. Emergencies Due to Cold

A. Normal Compensatory Mechanisms

B. Hypothermia

1. Pathophysiology
2. Signs and Symptoms
3. Management

C. Frostbite

1. Pathophysiology
2. Signs and Symptoms
3. Management

III. Water Related Emergencies

A. Water Rescue

B. Drowning/Near-Drowning/Submersion

1. Incidence
2. Pathophysiology
3. Management

C. Diving Injuries

1. Pathophysiology
2. Signs and Symptoms

3. Management

4. Special Considerations

IV. Radiation Injury

A. Responder Responsibilities

B. Pathophysiology

C. Signs and Symptoms

D. Management

SPECIALIST SKILLS TASK ANALYSIS

PARAMEDIC TASK ANALYSIS:

Airway Management/Oxygen Therapy/Ventilation Skills:

TA-1 Endotracheal Intubation
TA-3 Endotracheal Extubation
TA-4 Esophageal Obturator Airway Insertion
TA-5 Esophageal Obturator Airway Removal
TA-6 Esophageal Tracheal Double Lumen Airway Insertion
TA-7 Esophageal Tracheal Double Lumen Airway Removal
TA-8 Tracheal Suctioning

Fluid and Medication Administration:

TA-9 Fluid Volume Calculation
TA-10 Intraosseous Infusion
TA-11 IV Discontinuation
TA-12 IV Peripheral Line

PARAMEDIC
PRACTICAL EVALUATION FORM

	Airway Management: Endotracheal Intubation	Weight	Score 0,1,2
1.	Knows indication for procedure: any patient at risk to losing their airway due to unconsciousness, airway or respiratory compromise.		
2.	Uses universal precautions throughout procedure.		
3.	Able to choose correct blade and properly attach to handle.		
4.	Checks that light works and is secure in blade.		
5.	Checks tube and cuff for patency, inserts stylet as indicated.		
6.	Prepares tape, ties, bite-block equipment, etc.		
7.	Has stethoscope and suction prepared for use.		
8.	Patient is hyperventilated with supplemental O_2.		
9.	Head is placed in appropriate position for route of intubation that will be used (oral, nasal, spine immobilized).		
10.	For oral route: holds laryngoscope in left hand, moves blade from right to left in mouth for tongue displacement.		
11.	Inserts tube into airway without traumatizing soft tissue or prying of teeth.		
12.	Passes tube through cords during visualization (oral attempt).		
13.	Manually immobilizes the tube until secured later.		
14.	Inflates cuff with enough air to seal properly.		
15.	Auscultates chest bilaterally.		
16.	Listens for gastric sounds.		
17.	Re-positions tube if breath sounds are unequal, (or removes if no ventilation occurs, or gastric air is heard).		
18.	Utilizes End Tidal CO_2 detector, or Esophageal Aspiration Device to confirm and monitor tube placement.		
19.	Inserts oropharyngeal airway or bite-block and secures.		
20.	Adequately secures ET with tape or ties to prevent extubation.		
21.	Knows complications of procedure are: hypoxia, bradycardia, esophageal intubation, trauma to teeth, soft tissue and right bronchus intubation.		
Passing Score=	Total Possible Score=	Total=	

Endotracheal Intubation continued:

Comments:

_____ PASS _____ FAIL EVALUATOR'S SIGNATURE_____

Evaluation Key: 0=Did not accomplish and/or did harm to patient.
1=Completed procedure but was not totally effective.
2=Accomplished task, meeting minimum objective.

Instructors may choose to establish a degree of importance factor for each step of the task prior to execution of the evaluation.

PARAMEDIC
PRACTICAL EVALUATION FORM

	Airway Management: Endotracheal Tube Extubation	**Weight**	**Score 0,1,2**
1.	Knows indications for extubation: patient is responsive and can maintain airway.		
2.	Uses universal precautions throughout procedure.		
3.	Prepares for sterile suctioning down ET.		
4.	Suctions through tube and oropharynx if needed.		
5.	Turns patient's head to side if possible.		
6.	Deflates cuff before withdrawing tube.		
7.	Removes tube without incident.		
8.	Knows complications of procedure are: hypoxia, aspiration, soft tissue trauma, bradycardia.		
Passing Score=	Total Possible Score=	Total=	

Comments:

_____ PASS _____ FAIL EVALUATOR'S SIGNATURE_____

Evaluation Key:

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Instructors may choose to establish a degree of importance factor for each step of the task prior to execution of the evaluation.

Airway Management: Esophageal Obturator Airway Insertion (EOA, EGTA)		**Weight**	**Score 0,1,2**
1.	Knows indications for use of EOA, EGTA: when endotracheal intubation cannot be obtained in the patient who is unable to maintain own airway.		
2.	Knows contraindications: a. Gag reflex present b. Patient less than 80 lbs., less than 16 years, persons under 5 ft. tall, persons over 6 ft. 7 in. c. History of corrosive ingestion d. History of esophageal disease		
3.	Uses universal precautions throughout procedure.		
4.	Prepares equipment: Checks tube, cuff, mask, suction ready		
5.	Hyperventilates patient with supplemental O_2		
6.	Places patient head in neutral or flexed position, lifts jaw straight up (except in trauma pt).		
7.	Holds tube in other hand with mask attached.		
8.	Inserts tube following curvature of oropharynx into esophagus.		
9.	Adjusts mask to fit securely on face with neck extended, if no trauma suspected. If trauma suspected, modified jaw thrust may be used.		
10.	Ventilates while auscultating chest bilaterally, watches for chest rise. Confirms placement. Can identify tracheal placement.		
11.	Inflates cuff with up to 35cc of air and removes syringe to maintain air in cuff.		
12.	Re-evaluates chest for adequate ventilations.		
13.	Knows complications: aspiration, hypoxia, bradycardia, soft tissue damage, endotracheal intubation.		
Passing Score=	Total Possible Score=	Total=	

Comments:

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PARAMEDIC
PRACTICAL EVALUATION FORM

Airway Management: **Esophageal Obturator Airway Removal**	**Weight**	**Score** **0,1,2**
1. Knows indications for removal of tube: a. Gag reflex present b. Tracheal intubation accomplished		
2. Uses universal precautions throughout procedure.		
3. Suction is prepared for immediate use.		
4. Places patient on his side if possible.		
5. Deflates cuff.		
6. Withdraws tube.		
7. Expects vomiting and immediately begins suctioning oropharynx.		
8. Knows complications: soft tissue trauma, vomiting, aspiration.		
Passing Score= Total Possible Score=	Total=	

Comments:

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PARAMEDIC
PRACTICAL EVALUATION FORM

Airway Management: Esophageal Tracheal Double Lumen Airway (Combitube) Insertion		**Weight**	**Score 0,1,2**
1.	Knows indications for use of ETDLA: when endotracheal intubation cannot be obtained in the patient who is unable to maintain their own airway.		
2.	Knows contraindications: a. Gag reflex present b. Patient less than 16 years, persons under 5 ft. tall, persons over 6 ft. 7 in. c. History of corrosive ingestion d. History of esophageal disease		
3.	Uses universal precautions throughout procedure.		
4.	Prepares equipment: Checks tube, cuff, mask, suction ready.		
5.	Hyperventilates patient with supplemental O_2.		
6.	Places patient head in neutral position, (with manual immobilization throughout procedure for trauma patient). Lifts jaw with one hand.		
7.	Inserts tube following curvature of oropharynx. The tube is advanced gently until the printed ring is aligned with teeth.		
8.	Inflates line 1, blue pilot balloon leading to the pharyngeal cuff, with 100ml of air using the 140ml syringe.		
9.	Inflates line 2, white pilot balloon leading to the distal cuff, with approximately 15ml of air using the 20ml syringe.		
10.	Begins ventilation through the longer blue connecting tube. If auscultation of breath sounds is positive and auscultation of gastric insufflation is negative, continues ventilation.		
11.	If auscultation of breath sounds is negative, and gastric insufflation is positive, immediately begins ventilation through the short clear connecting tube.		
12.	Confirms tracheal ventilation by auscultation of breath sounds and absence of gastric insufflation.		
13.	Removes syringe and monitors that cuffs remain inflated.		
Passing Score=	Total Possible Score=	Total=	

Comments:

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PARAMEDIC
PRACTICAL EVALUATION FORM

Airway Management: Esophageal Tracheal Double Lumen Airway (Combitube) Removal		**Weight**	**Score 0,1,2**
1.	Knows indications for removal of tube: gag reflex present		
2.	Uses universal precautions throughout procedure.		
3.	Suction is prepared for immediate use.		
4.	Places patient on his side if possible.		
5.	Deflates cuffs.		
6.	Withdraws tube.		
7.	Expects vomiting and immediately begins suctioning oropharynx.		
8.	Knows complications: soft tissue trauma, vomiting, aspiration.		
Passing Score=	Total Possible Score=	Total=	

Comments:

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PARAMEDIC
PRACTICAL EVALUATION FORM

Airway Management: Tracheal Suctioning		Weight	Score 0,1,2
1.	States indication for tracheal suctioning: prior to intubation, prior to extubation, to remove foreign materials from airways, or pulmonary edema.		
2.	Recognizes that the patient under-going tracheal suctioning has the potential for cardiac arrhythmia. Places patient on monitor.		
3.	Pre-oxygenates the patient with high concentration oxygen.		
4.	Uses universal precautions throughout procedure.		
5.	Assembles equipment and wears sterile gloves.		
6.	Advances the catheter as far as possible into the trachea (either through the nasal passage or the ET tube) without applying suction to the catheter, using sterile technique.		
7.	Applies intermittent suction while withdrawing the catheter, rotating the catheter as it is being withdrawn. Tracheal suctioning is applied for no more than 10 seconds.		
8.	Recognizes need for additional suctioning and re-oxygenates the patient prior to repeating suction procedure.		
9.	States that when cardiac arrhythmia, bronchospasm or other problems arise during suctioning, suctioning is discontinued immediately and the patient is ventilated with high concentration oxygen.		
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PARAMEDIC
PRACTICAL EVALUATION FORM

Fluid and Medication Administration: Drug/Fluid Calculations	**Weight**	**Score 0,1,2**
INTRAVENOUS VOLUME INFUSION		
1. Student is given a volume order to be infused over a given time period with specified infusion equipment: a. Calculates drops per minute		
Passing Score= Total Possible Score=	Total=	

Comments:

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PARAMEDIC
PRACTICAL EVALUATION FORM

	Fluid and Medication Administration: Intraosseous Infusion	**Weight**	**Score 0,1,2**
1.	States indications for procedure: any pediatric patient in cardiac arrest, or shock, when peripheral venous access cannot be obtained.		
2.	States complications: osteomyelitis, sepsis, fat embolism, marrow destruction, subperiosteal infusion, fracture.		
3.	Uses universal precautions throughout procedure.		
4.	Prepares necessary equipment.		
5.	Selects site: preferred site is proximal tibia, the width of one to two fingers below tibial tuberosity, slightly medial. Alternate site is distal tibia, one finger width proximal to the medial malleolus, at an anteromedial surface.		
6.	Disinfects puncture site.		
7.	At proximal tibia, flexes knee slightly, inserts needle perpendicular to skin, slightly angles to avoid epiphysis. At distal tibia, needle is inserted at 90° angle.		
8.	Advances the needle using consistent downward twisting motion.		
9.	Advances the needle until resistance is decreased and knows that this signifies entering the marrow.		
10.	Removes the stylus and how to confirm placement. (ie; free flowing IV fluid, no swelling at site, etc.)		
11.	Attaches flushed IV set up.		
12.	Secures/stabilizes needle to maintain position.		
Passing Score=	Total Possible Score=	Total =	

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PARAMEDIC
PRACTICAL EVALUATION FORM

Fluid and Medication Administration: IV Discontinuation	**Weight**	**Score 0,1,2**
1. Can state the signs and symptoms of IV infiltration: a. Swelling of tissues b. Blanching of tissues c. IV stops d. IV runs sluggishly		
2. Uses universal precautions throughout procedure.		
3. Clamps the IV tubing shut (off) with fluid adjustment clamp.		
4. Removes the tape securing needle and tubing to skin with minimal movement of catheter.		
5. Presses a dry, sterile gauze or alcohol wipe over injection site.		
6. Removes the catheter in a quick, smooth motion keeping the shaft parallel to the skin.		
7. Applies pressure on injection site until bleeding has stopped.		
8. Inspects the catheter for completeness.		
9. Performs the procedure without tissue trauma to IV site.		
10. Properly disposes of contaminated equipment.		
Passing Score= Total Possible Score=	Total=	

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PARAMEDIC
PRACTICAL EVALUATION FORM

Fluid and Medication Administration: (IV) Intravenous Line Peripheral	**Weight**	**Score 0,1,2**
1. Knows the indications for starting an IV: a. Medication route b. To replace volume c. Prophylactically in suspected impending vascular collapse		
2. Knows proper fluid to use as indicated by patient condition.		
3. Knows complications of venipuncture: a. Infection b. Hematoma c. Air embolism, catheter embolism, thrombus e. Tissue necrosis from infiltration f. Veno-spasm g. Arterial puncture		
4. Assembles equipment: a. Catheter b. Alcohol preps c. Tape strips d. Dressings as needed e. Sharp container if appropriate f. Gloves		
5. Attaches appropriate tubing to bag using proper technique and flushes out air.		
6. Applies constricting band over upper or lower arm.		
7. Palpates for presence of distal pulse.		
8. Inspects arm for veins and palpates to rule out potentially damaged or difficult vessels.		
9. Knows larger veins are to be used for volume replacement.		
10. Knows smaller veins are suitable for medication lines.		
11. Finds a suitable vein.		
12. Uses universal precautions.		
13. Disinfects insertion site.		
14. Anchors vein without contaminating insertion site.		
15. Introduces needle bevel up at 45° or less angle to vein, maintaining sterility of needle, catheter, and site.		

Peripheral IV Continued:

PARAMEDIC
PRACTICAL EVALUATION FORM

	Fluid and Medication Administration: (IV) Intravenous Line Peripheral	**Weight**	**Score 0,1,2**
16.	Keeps vein anchored.		
17.	Watches for flash-back while introducing needle (with catheter).		
18.	Once flash-back is achieved, advances catheter.		
19.	Withdraws needle (and removes constricting band).		
20.	Hooks up tubing maintaining sterility and checks site for infiltration.		
21.	Watches drip chamber for unimpeded flow of solution then adjusts to appropriate rate.		
22.	Applies bandaid, dressing or tape over site and properly secures catheter and tubing to arm.		
23.	Applies hand or arm board if required and wraps loosely enough to prevent constriction.		
24.	Knows when to discontinue: a. Signs of infiltration: swelling, blanching, pain b. IV runs sluggishly or not running		
Passing Score=	Total Possible Score=	Total=	

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