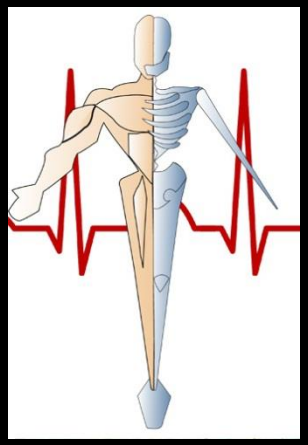
Three Phase CEUs Presents:

Topics in Radiography Volume IV ©

"Mastery Test"

by

John Fleming, M.Ed.,RT(R)(MR)(CT)



Please scroll down to proceed.

Forward:

The premise behind the creation of this tutorial is to provide imaging professionals with access to high quality yet affordable continuing education.

Our courses qualify as Category A (technical) points for the following: all ARRT recognized imaging modalities, ARRT-CQR, FDOH-Bureau of Radiation Control, NMTCB, and RCIS.

According to the ARRT, a current license as a general radiographer with the FDOH is required to qualify to complete this course. *This rule does not apply to either the NMTCB or RCIS credentials.*

Please scroll down to proceed.

Payment Methods:

1. Venmo: @John-Fleming-Three-Phase-CEUs (press to copy & paste)
2. Cash App: $ThreePhaseCEUs (press to copy & paste)
3. Zelle: (727) 744-7946
4. Apple Pay: (727) 744-7946
5. PayPal: (727) 744-7946
6. Check: please make your check payable to, “Three Phase CEUs” and return it along with your answer sheet to the address below.

Three Phase CEUs
c/o John Fleming
80 Bay Woods Drive
Safety Harbor, FL 34695

Text John Fleming at (727) 744-7946 for our current prices.

Please scroll down to proceed.

Mastery Test Instructions:

Please place an "X" over the correct response on your answer sheet. Feel free to write your answer down on a blank piece of paper if you do not have access to a printer. That is just as good.

After you complete your answer sheet, just snap a picture of it with your cell phone and text it to John Fleming at (727) 744-7946. The picture does not need to be perfect, only legible.

We will return your certificate of completion to you via e-mail after we receive your payment and completed answer sheet.

Thanks for your support and be sure to reach out via text message if you encounter any snags.

Please scroll down to proceed.

Question #1:

Which of the following terms refers to infections that patients acquire while admitted to a health-care facility and generally develop 48 hours or later after admission?

a. nosocomial
b. diaphoresis
c. incontinent
d. foot drop

Question #1: Review

General Patient Care Terminology:

- Nosocomial Infection

  These are infections are infections patients acquire while admitted to a health-care facility and generally develop 48 hours or later after admission.

- Diaphoresis

  This is the medical definition of excessive sweating due to an underlying health condition or a medication.

- Incontinent

  This is the inability to control urination or defecation.

- Foot Drop

  This is a drooping of the foot from weakness or paralysis of anterior leg muscles.

Question #2:

Which of the follow is a one-celled organism that consists of a single strand of DNA and RNA but with no organelles?

a. fungus
b. virus
c. bacteria
d. protozoa

Question #2: Review

Types of Microbes:

- Bacteria

  These are one-celled organisms that consist of a single strand of DNA and RNA with no organelles.

  Some can form spores which is a protective coat that insulates when unfavorable conditions are present.

  Examples: TB, lung abscess, bacterial pneumonia, E-coli, MRSA
- Fungi

  Fungi include the following: mushrooms, yeasts, and molds.
- Protozoa

  These are complex, one–celled organisms.
  They are able to survive without a host.
- Virus

  They the smallest known infectious agent and are visible with electron microscope.

Question #3:

In reference to conflict resolution, what percentage of patients will be willing to return to a health care setting if a problem that occurs during their stay is resolved immediately?

a. 5
b. 37
c. 74
d. 95

Question #3: Review

Patients as Customers or Clients:

- 95% will do business with us again if the problem is resolved on the spot.
- 74% of unsatisfied customers will do business with us again if they were listened to fairly.

Question #4:

Which of the following terms refers to treatment that is accepted by medical experts as a proper treatment for a certain type of disease and that is widely used by healthcare professionals?

a. standard of care
b. malpractice
c. litigation
d. deposition

Question #4: Review

Medicolegal Terminology:

- Standard of Care

  Treatment that is accepted by medical experts as a proper treatment for a certain type of disease and that is widely used by healthcare professionals.

- Malpractice

  Improper or unethical conduct or unreasonable lack of skill by a holder of a professional or official position.

- Litigation

  This is the process of taking legal action.

- Deposition

  Refers to oral questioning under oath.

Question #5:

According to the NCRP, the Bucky slot cover must contain _____ mm of Pb or its equivalent.

a. 0.1
b. 0.25
c. 0.5
d. 1.0

Question #5: Review

Designing for Radiation Protection:

- The Bucky slot cover must contain 0.25 mm of Pb or its equivalent.
- Protective gloves must contain 0.25 mm of Pb or its equivalent.
- Fluoroscopy protective drapes must contain 0.25 mm of Pb or its equivalent.
- The source-to-skin distance for stationary fluoroscopy units must be at least 15” or 38 cm.
- The source-to-skin distance for mobile fluoroscopy (c-arm) units must be at least 12” or 30 cm.
- If operating above 70 kVp, each tube must possess at least 2.5 mm of total aluminum filtration.
- The exposure switch on a mobile imaging system must allow the radiographer to stand at least 6’ or 2 m from the source during the exposure.

Question #6:

A sterile pack is considered unsterile if the expiration date is either not visible or has been removed.

a. true
b. false

Question #6: Review

Opening a Sterile Pack:

- To begin with, check the expiration date.

  If there is no date, the pack is considered unsterile.
- Place the pack on a clean table with the sealed end toward you.
- Remove and discard the tape.
- Open the first corner away from you.
- Next, open flaps 2, 3, and 4.
- Within these flaps, the pack is sterile.
- Observe indicator tape.

Question #7:

Which of the following dosimeters uses metal filters with varying atomic numbers to determine occupational dose to ionizing radiation?

a. photographic emulsion (film badge)
b. thermoluminescence dosimeter (TLD)
c. optically stimulated luminescence (OSL)
d. gas filled detector

Question #7: Review

Types of Dosimeters:

- Photographic emulsion is the earliest known dosimeter, and it was first used in the 1940s.
- A piece of film is sandwiched between three sets of metal filters each containing a different atomic number.
- As the film is exposed to x-rays, it will acquire a density.
- As the x-ray exposure increases, the density of the film will increase proportionally.
- The metal filters serve a means to determine the strength (penetrating ability) of the x-ray exposure.
- If the filter with the highest atomic number has a density beneath it, then the radiographer was exposed to a higher kVp x-ray.
- This means that the radiographer received a deep dose as opposed to just a shallow or skin dose.

Question #8:

Which of the following is the medical definition of excessive sweating due to an underlying health condition or a medication?

a. nosocomial infection
b. diaphoresis
c. incontinent
d. foot drop

Question #8: Review

General Patient Care Terminology:

- Nosocomial Infection

  These are infections are infections patients acquire while admitted to a health-care facility and generally develop 48 hours or later after admission.

- Diaphoresis

  This is the medical definition of excessive sweating due to an underlying health condition or a medication.

- Incontinent

  This is the inability to control urination or defecation.

- Foot Drop

  This is a drooping of the foot from weakness or paralysis of anterior leg muscles.

Question #9:

The patient condition that is characterized by low levels of oxygen in their arterial blood is referred to as which of the following?

a. hypoxia
b. hypoxemia
c. hypercapnia
d. oxygen saturation

Question #9: Review

Oxygen Therapy Terminology:

- Hypoxia

  This is low levels of oxygen in body tissues.

  It causes confusion, restlessness, difficulty in breathing, rapid heart rate, and bluish skin.

- Hypoxemia

  This is a below-normal level of oxygen in arterial blood.

  This will likely lead to shortness of breath.

- Hypercapnia

  This is an increase in arterial blood carbon dioxide levels.

- Oxygen Saturation

  This is the amount of oxygen that is bound to the hemoglobin.

Question #10:

Which of the following refers to the number of naturally occurring spontaneous mutations that occur per generation?

a. mutagens
b. spontaneous mutations
c. mutation frequency
d. doubling dose

Question #10: Review

Genetically Significant Dose (GSD):

- The doubling dose is that dose of ionizing radiation that is required to double the mutation frequency.

  The doubling dose is thought to be between 50 and 250 rad in humans.

  This wide range of values is due to the fact that there are some individuals that are naturally more radioresistant or radiosensitive than others.

- Mutagens are any agent that may cause some type of a mutation.

  Examples include but are not limited to viruses, drugs, and exposure to ionizing radiation.

- Spontaneous mutations are naturally occurring changes to DNA that result in mutations.
- The mutation frequency is the number of naturally occurring spontaneous mutations that occur per generation.

Question #11:

Which of the following terms refers to when the patient is able to walk and is not bedridden?

a. ambulatory
b. atrophy
c. decubitus ulcer
d. enteric

Question #11: Review

General Patient Care Terminology:

- Ambulatory

  The patient is able to walk and is not bedridden.

- Atrophy

  This refers to a decrease in size of a muscle, tissue or organ.

- Defecation

  This is the evacuation of fecal matter from rectum.

- Decubitus Ulcer

  This ulcer is commonly referred to as a bed sore or pressure sore.

- Enteric

  This pertains to the intestines.

Question #12:

Which of the following medications is an antihistamine that can be used to treat allergies, insomnia, and symptoms of the common cold?

a. diphenhydramine
b. atropine
c. dilantin
d. lasix

Question #12: Review

Common Types of Medications:

- Benadryl or Diphenhydramine

  This is an antihistamine and sedative mainly used to treat allergies, insomnia, and symptoms of the common cold.

  It is also less commonly used for tremor in parkinsonism, and nausea.

  Benadryl is a bronchodilator.

- Atropine

  Is used to increase the heartrate to combat bradycardia.

- Dilantin

  This medication is administered to prevent seizures.

- Heparin/Aspirin/Coumadin

  These medications are blood thinners that prolong clotting and help to prevent thrombus formation.

Question #13:

Which of the following refers to the process of listening to the sounds of your heart, lungs, arteries, and abdomen?

a. Korotkoff's Sounds
b. auscultation
c. systole
d. vasodilation

Question #13: Review

Vital Signs Terminology:

- Systole

  This is the contraction phase of heart.

  This is a measurement of the integrity of the left ventricle of the heart.

- Diastole

  This is the relaxation phase of the heart.

  The left ventricle relaxes and fills with oxygenated blood from the lungs.

- Auscultation

  This is the process of listening to the sounds of your heart, lungs, arteries, and abdomen.

- Korotkoff's Sounds

  These are sounds that a healthcare worker listens for with a stethoscope while taking a blood pressure.

Question #14:

The NCRP sets the annual whole body dose limit for occupationally exposed individuals to no more than _____ rem/year.

a. 0.5
b. 5
c. 15
d. 50

Question #14: Review

Dose Limits Set by the NCRP:

- The following is a partial list of dose limits set by the NCRP for both occupationally exposed individuals and for the general public:

  The annual whole body dose limits for occupationally exposed personnel is as follows:

  - Entire Body: 5 rem/year or 50 mSv/year
  - Lens of the Eye: 15 rem/year or 150 mSv/year
  - All other individual organs (liver, hands, skin etc.) of the body: 50 rem/year or 500 mSv/year

  Pregnant radiographers and students must keep their dose limits below the following:

  - 0.05 rem/month or 0.5 mSv/month
  - 0.5 rem/year or 5 mSv/year

Question #15:

Which of the following refers to improper or unethical conduct or unreasonable lack of skill by a holder of a professional or official position?

a. standard of care
b. malpractice
c. litigation
d. deposition

Question #15: Review

Medicolegal Terminology:

- Standard of Care

  Treatment that is accepted by medical experts as a proper treatment for a certain type of disease and that is widely used by healthcare professionals.

- Malpractice

  Improper or unethical conduct or unreasonable lack of skill by a holder of a professional or official position.

- Litigation

  This is the process of taking legal action.

- Deposition

  Refers to oral questioning under oath.

Question #16:

Which of the following types of shock can be caused by a hypersensitivity to antigens that can lead to an allergic reaction?

a. hypovolemic
b. cardiogenic
c. anaphylactic
d. septic

Question #16: Review

Types of Shock:

- Hypovolemic Shock

  This an emergency condition that is often associated with some type of trauma and loss of blood volume.

- Cardiogenic Shock

  This may occur when the heart fails to supply blood to vital organs.

- Anaphylactic Shock

  This type of shock can be caused by a hypersensitivity to antigens that can lead to an allergic reaction.

- Septic Shock

  This is a life-threatening condition that happens when your blood pressure drops to a dangerously low level after an infection.

Question #17:

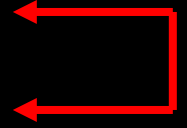
Which of the following interactions in matter will occur in Radiation Therapy while using meV?

a. coherent scattering
b. photoelectric interaction
c. compton interaction
d. photodisintegration

Question #17: Review

- Types of X-ray Interactions in Matter:

1. Coherent Scattering
2. Photoelectric Interactions
3. Compton Interactions
4. Pair Production
5. Photodisintegration



These two are employed in Radiation Therapy and use meV.

Question #18:

Which of the following terms refers to a decrease in size of a muscle, tissue, or organ?

a. ambulatory
b. atrophy
c. defecation
d. enteric

Question #18: Review

General Patient Care Terminology:

- Ambulatory

  The patient is able to walk and is not bedridden.

- Atrophy

  This refers to a decrease in size of a muscle, tissue, or organ.

- Defecation

  This is the evacuation of fecal matter from rectum.

- Decubitus Ulcer

  This ulcer is commonly referred to as a bed sore or pressure sore.

- Enteric

  This pertains to the intestines.

Question #19:

Which of the following refers to the amount of oxygen that is bound to hemoglobin?

a. oxygen tension
b. PO_2
c. PCO_2
d. oxygen saturation

Question #19: Review

Oxygen Therapy Terminology:

- Oxygen Tension or Partial Pressure (PaO_2)

  This is the amount of oxygen dissolved in arterial blood plasma.

- PO_2

  This is the amount of oxygen in the blood and is referred to as oxyhemoglobin.

- PCO_2

  This is the amount of carbon dioxide in the blood and is referred to as carbamino-hemoglobin.

- Oxygen Saturation

  This is the amount of oxygen that is bound to the hemoglobin.

Question #20:

Which of the following gas filled radiation detectors is used in CT scanners and gamma cameras in Nuclear Medicine?

a. ionization chamber
b. Geiger-Muller counter
c. dose area product (DAP) meter
d. scintillation detector

Question #20: Review

Gas Filled Detectors:

- A gas filled detector is a very broad category of detectors that all possess the same characteristic: they are filled with a gas.
- These detectors have a positively charged central electrode that is passed through a gas filled chamber.
- As radiation ionizes the gas, the liberated electrons are attracted to the positive electrode, amplified & then finally measured.
  The measurement is then displayed on a gauge.
- Most Common Types of Gas Filled Detectors are:

1. Pocket Ionization Chamber
2. Ionization or Ion Chamber
3. Geiger-Muller (GM) Counter
4. Dose Area Product (DAP) Meter
5. Scintillation Detector (Really in a class by itself because it is used exclusively in CT scanners and gamma cameras for Nuclear Medicine.

Question #21:

According to the NCRP, protective gloves must contain ____ mm of Pb or its equivalent.

a. 0.1
b. 0.25
c. 0.5
d. 1.0

Question #21: Review

Designing for Radiation Protection:

- The Bucky slot cover must contain 0.25 mm of Pb or its equivalent.
- Protective gloves must contain 0.25 mm of Pb or its equivalent.
- Fluoroscopy protective drapes must contain 0.25 mm of Pb or its equivalent.
- The source-to-skin distance for stationary fluoroscopy units must be at least 15” or 38 cm.
- The source-to-skin distance for mobile fluoroscopy (c-arm) units must be at least 12” or 30 cm.
- If operating above 70 kVp, each tube must possess at least 2.5 mm of total aluminum filtration.
- The exposure switch on a mobile imaging system must allow the radiographer to stand at least 6’ or 2 m from the source during the exposure.

Question #22:

Which of the following is not one of the three interactions that occurs at the anode during an exposure?

a. infrared radiation
b. characteristic x-ray production
c. bremsstrahlung x-ray production
d. photoelectric effect

Question #22: Review

- Below are the three interactions that occur at the anode:
  - Infrared Radiation
  - Characteristic X-ray Production
  - Bremsstrahlung X-ray Production

Question #23:

Which of the following terms refers to the inability to control urination or defecation?

a. nosocomial infection
b. diaphoresis
c. incontinent
d. foot drop

Question #23: Review

General Patient Care Terminology:

- Nosocomial Infection

  These are infections are infections patients acquire while admitted to a health-care facility and generally develop 48 hours or later after admission.

- Diaphoresis

  This is the medical definition of excessive sweating due to an underlying health condition or a medication.

- Incontinent

  This is the inability to control urination or defecation.

- Foot Drop

  This is a drooping of the foot from weakness or paralysis of anterior leg muscles.

Question #24:

Hypertension is characterized by having a systolic pressure of greater than ____ mm of Hg.

a. 60
b. 80
c. 120
d. 140

Question #24: Review

Vital Signs Terminology:

- Vasodilation

  The widening of blood vessels as a result of the relation of the blood vessel's muscular walls.

- Vasoconstriction

  The narrowing of blood vessels by small muscles in their walls.

- Hypotension

  This can be caused by loss of blood, anemia, shock i.e., burns, trauma, vomiting, diarrhea, heart exhaustion.

  The threshold is less than 90 mm Hg for a systolic pressure and less than 60 mm Hg for a diastolic pressure.

- Hypertension

  This is caused by a constriction of blood vessels, stress, medication, obesity, and smoking.

  The threshold is greater than 140 mm Hg for a systolic pressure and greater than 90 mm Hg for a diastolic pressure.

Question #25:

According to the guidelines for proper body mechanics, it is acceptable to twist your torso while pulling a patient onto a radiographic table.

a. true
b. false

Question #25: Review

Basic Body Mechanics:

- The general rule-of-thumb is to pull a patient and push a load.
- How to Lift a Load :

    1) Bend at your knees.
    2) Keep your back straight.
    3) Keep a wide base of support.
    4) Use arm, leg, and stomach muscles.
    5) Avoid twisting while pulling a patient.
    6) Always push a load i.e., portable and stretchers.

Question #26:

The type of infection control characterized by eliminating microbes but not their spores by using soap, water, friction, and various chemicals is called:

a. microbial dilution.
b. surgical asepsis.
c. sterilization.
d. medical asepsis.

Question #26: Review

Techniques of Infection Control:

- Microbial Dilution

  This is the process of destroying and removing microbes or microbes & their spores.

- Medical Asepsis

  This is eliminating microbes but not their spores by using soap, water, friction, and various chemicals.

  Disinfection is the process of altering the environment available for microbes to thrive.

  Antisepsis/Antiseptic is a process that inhibits bacterial growth.

Question #27:

Which of the following organizations mandates that non-sterile gloves must be worn whenever you may come in contact with a patient's body fluids?

a. ARRT
b. JRCERT
c. OSHA
d. ASRT

Question #27: Review

OSHA Guidelines:

- Personal Protective Equipment or PPE

  Non-sterile Gloves

  - They are to be worn whenever you may contact body fluids.
  - They are cheap and disposable.
  - This is a good example of medical asepsis.

    Dispose immediately following their use.

    Next, complete a 30 second scrub.

Question #28:

This term pertains to the intestines:

a. atrophy.
b. defecation.
c. decubitus ulcer.
d. enteric.

Question #28: Review

General Patient Care Terminology:

- Ambulatory

  The patient is able to walk and is not bedridden.

- Atrophy

  This refers to a decrease in size of a muscle, tissue or organ.

- Defecation

  This is the evacuation of fecal matter from rectum.

- Decubitus Ulcer

  This ulcer is commonly referred to as a bed sore or pressure sore.

- Enteric

  This pertains to the intestines.

Question #29:

Which of the following is emitted when outer shell electrons fill a vacancy in the inner shell of an atom, releasing x-rays in a pattern that is distinctive to each element?

a. infrared radiation
b. characteristic x-ray production
c. bremsstrahlung x-ray production
d. coherent scatter production

Question #29: Review

Characteristic X-ray Production:

- Characteristic x-rays are emitted when outer shell electrons fill a vacancy in the inner shell of an atom, releasing x-rays in a pattern that is "characteristic" to each element.
- Below is a list of steps and interactions that occur during the formation of characteristic x-rays:

  A projectile or incident electron that is released from the filament ionizes a tungsten K shell electron at the target.

  - This liberated electron from the tungsten atom is now referred to as a free electron.

  An unstable hole has now been created within that shell and the tungsten atom now has a positive overall charge.

  The mission of the tungsten atom is to regain a neutral charge.

  In response, an outer shell electron may fall into the slot once held by the vacated or ionized tungsten electron.

  As this occurs, the tungsten atom will release electromagnetic energy in the form of a K-characteristic x-ray.

  The x-ray energy is equal to the difference in the shell binding energies involved according to the formula below:

  Characteristic X-ray Energy = E1 - E2

Question #30:

The narrowing or constriction of blood vessels by small muscles in their walls is referred to as:

a. dyspnea.
b. vasoconstriction.
c. vasodilation.
d. diastole.

Question #30: Review

Vital Signs Terminology:

- Systole

  This is the contraction phase of heart.

  This is a measurement of the integrity of the left ventricle of the heart.

- Diastole

  This is the relaxation phase of the heart.

  The left ventricle relaxes and fills with oxygenated blood from the lungs.

- Dyspnea

  Difficulty in breathing caused by shortness of breath.

- Apnea

  This is the lack of breathing.

- Vasodilation

  The widening of blood vessels as a result of the relation of the blood vessel's muscular walls.

- Vasoconstriction

  The narrowing or constriction of blood vessels by small muscles in their walls.

Question #31:

Which of the following dosimeters uses heat to release light from lithium fluoride (LiF) crystals that have been exposed to ionizing radiation?

a. photographic emulsion (film badge)
b. thermoluminescence dosimeter (TLD)
c. optically stimulated luminescence (OSL)
d. gas filled detector

Question #31: Review

Thermoluminescence Dosimeters (TLD):

- A TLD contains lithium fluoride (LiF) crystals that can take many forms.
- LiF crystals store energy when they are exposed to ionizing radiation.
- After they are sent back to the manufacturer, the LiF crystals are heated during processing.
- As the LiF crystals are heated, they emit a light that is proportional to the amount radiation exposure that they received.
- This light is directed towards a PM tube which then generates an electric signal.

  Remember, a photomultiplier tube always produces electrons (electric signal) when it is exposed to light.

- A TLD can be worn up to three months between readings.
- The primary disadvantage of a TLD is that it does not provide an immediate reading.
- Advantages of a TLD:

  They are reusable and not affected by heat and humidity.

  A TLD can measure doses as low as 0.05 mGy which makes them twice as sensitive as a film badge.

Question #32:

During the process of infection, which of the following stages is characterized by the appearance of early signs and symptoms of the disease?

a. latent stage
b. prodromal stage
c. active stage
d. convalescence stage

Question #32: Review

The Process of Infection:

1. Incubation or Latent Stage
   - The disease cannot be detected.
   - This is a dormant period.
2. Prodromal Stage
   - Early signs and symptoms of the disease appear.
3. Active/Full Stage
   - This is when the disease peaks.
4. Convalescence
   - This is a period of recovery or remission.
   - It is possible to re-enter the latent stage.

Question #33:

Which of the following types of shock is a life-threatening condition that happens when your blood pressure drops to a dangerously low level after an infection?

a. hypovolemic
b. cardiogenic
c. anaphylactic
d. septic

Question #33: Review

Types of Shock:

- Hypovolemic Shock

  This an emergency condition that is often associated with some type of trauma and loss of blood volume.

- Cardiogenic Shock

  This may occur when the heart fails to supply blood to vital organs.

- Anaphylactic Shock

  This type of shock can be caused by a hypersensitivity to antigens that can lead to an allergic reaction.

- Septic Shock

  This is a life-threatening condition that happens when your blood pressure drops to a dangerously low level after an infection.

Question #34:

Which of the following refers to the process of taking legal action?

a. standard of care
b. malpractice
c. litigation
d. deposition

Question #34: Review

Medicolegal Terminology:

- Standard of Care

  Treatment that is accepted by medical experts as a proper treatment for a certain type of disease and that is widely used by healthcare professionals.

- Malpractice

  Improper or unethical conduct or unreasonable lack of skill by a holder of a professional or official position.

- Litigation

  This is the process of taking legal action.

- Deposition

  Refers to oral questioning under oath.

Question #35:

Which of the following refers to any agent that may cause some type of mutation?

a. mutagens
b. spontaneous mutations
c. mutation frequency
d. doubling dose

Question #35: Review

Genetically Significant Dose (GSD):

- The doubling dose is that dose of ionizing radiation that is required to double the mutation frequency.

  The doubling dose is thought to be between 50 and 250 rad in humans.

  This wide range of values is due to the fact that there are some individuals that are naturally more radioresistant or radiosensitive than others.

- Mutagens are any agent that may cause some type of a mutation.

  Examples include but are not limited to viruses, drugs, and exposure to ionizing radiation.

- Spontaneous mutations are naturally occurring changes to DNA that result in mutations.
- The mutation frequency is the number of naturally occurring spontaneous mutations that occur per generation.

Question #36:

What percentage of employees are terminated because of poor work performance?

a. 5
b. 15
c. 50
d. 85

Question #36: Review

Elements of Communication:

- 85% of terminated employees are the result of poor communication skills.
- Only 15% occur because of poor work performance.

Question #37:

Which of the following mixes oxygen with room air thus creating an oxygen concentration of less than 35%?

a. nasal cannula
b. face mask
c. ventilator
d. high flow oxygen delivery system

Question #37: Review

Oxygen Administration:

- Low Flow Oxygen Delivery Systems employ the use of:
  - a. Nasal Cannula
    - Oxygen is mixed with room air.
    - The oxygen concentration is less than 35%.
  - b. Face Mask
    - Set at a rate of greater than 5 LPM.
    - This system will flush used air out of the mask.
    - The oxygen concentration is between 35-60%.

Question #38:

According to the NRCP, the exposure switch on a mobile imaging system must allow the radiographer to stand at least ____ feet from the source during the exposure.

a. 2
b. 4
c. 6
d. 12

Question #38: Review

Designing for Radiation Protection:

- The Bucky slot cover must contain 0.25 mm of Pb or its equivalent.
- Protective gloves must contain 0.25 mm of Pb or its equivalent.
- Fluoroscopy protective drapes must contain 0.25 mm of Pb or its equivalent.
- The source-to-skin distance for stationary fluoroscopy units must be at least 15” or 38 cm.
- The source-to-skin distance for mobile fluoroscopy (c-arm) units must be at least 12” or 30 cm.
- If operating above 70 kVp, each tube must possess at least 2.5 mm of total aluminum filtration.
- The exposure switch on a mobile imaging system must allow the radiographer to stand at least 6’ or 2 m from the source during the exposure.

Question #39:

When opening a sterile pack, the first flap must always be opened:

a. towards you.
b. to your right.
c. to your left.
d. away from you.

Question #39: Review

Opening a Sterile Pack:

- To begin with, check the expiration date.
  If there is no date, the pack is considered unsterile.
- Place the pack on a clean table with the sealed end toward you.
- Remove and discard the tape.
- Open the first corner away from you.
- Next, open flaps 2, 3, and 4.
- Within these flaps, the pack is sterile.
- Observe indicator tape.

Question #40:

Which of the following means of microbe transmission occurs by inhaling evaporated droplets containing microbes?

a. airborne
b. fomite
c. vector
d. vehicle

Question #40: Review

Means of Microbe Transmission:

- Direct Contact
- Indirect Contact
    1. Fomites
    2. Droplet Transmission
    3. Vector Transmission
    4. Vehicle Transmission
    5. Airborne Transmission
        - This occurs by inhaling evaporated droplets containing microbes.
        - The microbes are suspended for long periods and may be moved by air currents or dust.

Question #41:

Which of the following stages of the grieving process is characterized by a period of mourning?

a. denial
b. anger
c. depression
d. acceptance

Question #41: Review

Stages of the Grieving Process:

1. Deniel
2. Anger
3. Bargaining
4. Depression

    This is a period of mourning.

    The individual accepts the impending loss.

    They may be silent and unresponsive.

5. Acceptance

Question #42:

Which of the following terms refers to a drooping of the foot from weakness or paralysis of anterior leg muscles?

a. nosocomial infection
b. diaphoresis
c. incontinent
d. foot drop

Question #42: Review

General Patient Care Terminology:

- Nosocomial Infection

  These are infections are infections patients acquire while admitted to a health-care facility and generally develop 48 hours or later after admission.

- Diaphoresis

  This is the medical definition of excessive sweating due to an underlying health condition or a medication.

- Incontinent

  This is the inability to control urination or defecation.

- Foot Drop

  This is a drooping of the foot from weakness or paralysis of anterior leg muscles.

Question #43:

Which of the following interactions happens in the 10 keV range and occurs are a result of the incident x-ray photon interacting with matter and changing direction only?

a. coherent
b. photoelectric
c. compton
d. pair production

Question #43: Review

Coherent Scattering:

- This type of scatter radiation is also referred to as any of the following:
    1. Classical Scattering
    2. Unmodified Scattering
    3. Thompson Scattering
    4. Rayleigh Scattering
- Coherent scattering occurs at the 10 keV range.
- In this interaction the incident photon interacts with matter and changes direction only.
- No ionizations or loss of energy will occur and therefore, the patient does not receive a dose.
- The incident photon from the primary beam is temporarily absorbed by an atom.
- As a result of this interaction, the atom is raised to an excited state but is not ionized.
- The atom will ultimately release this energy in the form of a scattered x-ray that is equal in strength to the original incident x-ray.
- The scattered x-ray is emitted in an isotropic manner from atom and hence the name, “scattered.”

Question #44:

The patient condition that is characterized by a below-normal level of oxygen in arterial blood is referred to as which of the following?

a. hypoxia
b. hypoxemia
c. hypercapnia
d. oxygen saturation

Question #44: Review

Oxygen Therapy Terminology:

- Hypoxia

  This is low levels of oxygen in body tissues.

  It causes confusion, restlessness, difficulty in breathing, rapid heart rate, and bluish skin.

- Hypoxemia

  This is a below-normal level of oxygen in arterial blood.

  This will likely lead to shortness of breath.

- Hypercapnia

  This is an increase in arterial blood carbon dioxide levels.

- Oxygen Saturation

  This is the amount of oxygen that is bound to the hemoglobin.

Question #45:

Which of the following is the smallest know infectious agent and are composed of either DNA or RNA?

a. protozoa
b. fungi
c. bacteria
d. virus

Question #45: Review

Types of Microbes:

- Bacteria

  These are one-celled organisms.

- Fungi

  Fungi include the following: mushrooms, yeasts, and molds.

  They require moisture and darkness to survive.

- Protozoa

  These are complex, one–celled organisms.

  They are able to survive without a host.

- Virus

  They the smallest known infectious agent and are visible with electron microscope.

  A virus is composed of either DNA or RNA.

  They must also live in host cell.

  They do not always respond to antimicrobial medications.

  Examples: HIV, hepatitis, rabies, and viral pneumonia.

Question #46:

According to the NCRP, fluoroscopy protective drapes must contain ____ mm of Pb or its equivalent.

a. 0.1
b. 0.25
c. 0.5
d. 1.0

Question #46: Review

Designing for Radiation Protection:

- The Bucky slot cover must contain 0.25 mm of Pb or its equivalent.
- Protective gloves must contain 0.25 mm of Pb or its equivalent.
- Fluoroscopy protective drapes must contain 0.25 mm of Pb or its equivalent.
- The source-to-skin distance for stationary fluoroscopy units must be at least 15” or 38 cm.
- The source-to-skin distance for mobile fluoroscopy (c-arm) units must be at least 12” or 30 cm.
- If operating above 70 kVp, each tube must possess at least 2.5 mm of total aluminum filtration.
- The exposure switch on a mobile imaging system must allow the radiographer to stand at least 6’ or 2 m from the source during the exposure.

Question #47:

Droplets containing microbes can travel a distance of _____ feet.

a. 1 to 2
b. 3 to 5
c. 7 to 9
d. 11 to 12

Question #47: Review

Means of Microbe Transmission:

- Indirect Contact
    1. Fomites
    2. Droplet Transmission

        Occurs when the infected person coughs, sneezes or talks.

        Droplets can contact mucous membranes such as the eyes, nose, etc.

        Droplets do not remain in air & only travel 3-5'.
    3. Vector Transmission
    4. Vehicle Transmission
    5. Airborne Transmission

Question #48:

Difficulty in breathing caused by shortness of breath is referred to as:

a. diastole.
b. vosodilation.
c. apnea.
d. dyspnea.

Question #48: Review

Vital Signs Terminology:

- Systole

  This is the contraction phase of heart.

  This is a measurement of the integrity of the left ventricle of the heart.

- Diastole

  This is the relaxation phase of the heart.

  The left ventricle relaxes and fills with oxygenated blood from the lungs.

- Dyspnea

  Difficulty in breathing caused by shortness of breath.

- Apnea

  This is the lack of breathing.

- Vasodilation

  The widening of blood vessels as a result of the relation of the blood vessel's muscular walls.

- Vasoconstriction

  The narrowing of blood vessels by small muscles in their walls.

Question #49:

What percentage of communication consists of body language?

a. 7
b. 43
c. 50
d. 87

Question #49: Review

Elements of Communication:

- People gather 87% of their lifetime information by sight alone.
  - 7% by hearing
  - 3.5% by smell
  - 1.5% by touch
  - 1% by taste
- Communication consists of:
  - 50% body language
  - 43% voice inflection
  - 7% of what is actually spoken

Question #50:

Which of the following dosimeters uses a positively charged electrode to collect electrons that have been released following exposure to ionizing radiation?

a. photographic emulsion (film badge)
b. thermoluminescence dosimeter (TLD)
c. optically stimulated luminescence (OSL)
d. gas filled detector

Question #50: Review

Gas Filled Detectors:

- This is a very broad category of detectors that all possess the same characteristic: they are filled with a gas.
- These detectors have a positively charged central electrode that is passed through a gas filled chamber.
- As radiation ionizes the gas, the liberated electrons are attracted to the positive electrode, amplified & then finally measured.
- The measurement is then displayed on a gauge.
- Most Common Types of Gas Filled Detectors are:

1. Pocket Ionization Chamber
2. Ionization or Ion Chamber
3. Geiger-Muller (GM) Counter
4. Dose Area Product (DAP) Meter
5. Scintillation Detector (Really in a class by itself because it is used exclusively in CT scanners and gamma cameras for

Question #51:

Proper stretcher etiquette requires that the stretcher be left at the lowest possible position to ensure patient safety.

a. true
b. false

Question #51: Review

Stretcher Etiquette:

- Always keep the rails up.
- Lock the stretcher when it is to be left in a stationary position.
- Always keep the stretcher at in the lowest possible position.
- Be sure to keep the patient covered to preserve their dignity.

Question #52:

Which of the following is an example of a negative contrast agent?

a. barium-based contrast agents
b. iodine-based contrast agents
c. Gastrografin
d. air

Question #52: Review

Negative Contrast Agents

- This is a contrast agent that absorbs less radiation than the organ in which it is placed.
- The best example is air:

Crystals that add air to the stomach upon ingestion.

Air in the fundus of the stomach following ingestion of effervescent granules.

Question #53:

Which of the following medications is administered to prevent seizures?

a. diphenhydramine
b. atropine
c. dilantin
d. lasix

Question #53: Review

Common Types of Medications:

- Benadryl or Diphenhydramine

  This is an antihistamine and sedative mainly used to treat allergies, insomnia, and symptoms of the common cold.

  It is also less commonly used for tremor in parkinsonism, and nausea.

  It is a bronchodilator.

- Atropine

  Is used to increase the heartrate to combat bradycardia.

- Dilantin

  This medication is administered to prevent seizures.

- Heparin/Aspirin/Coumadin

  These medications are blood thinners that prolong clotting and help to prevent thrombus formation.

- Lasix

  This medication is a diuretic that is used to treat swelling of the ankles, feet, legs or even the brain or lungs.

  It may be used in some patients with more serious kidney problems who may have some fluid retention.

Question #54:

According to the NCRP, if operating above 70 kVp, each tube must possess at least ____ mm of total aluminum filtration.

a. 0.25
b. 0.5
c. 1.0
d. 2.5

Question #54: Review

Designing for Radiation Protection:

- The Bucky slot cover must contain 0.25 mm of Pb or its equivalent.
- Protective gloves must contain 0.25 mm of Pb or its equivalent.
- Fluoroscopy protective drapes must contain 0.25 mm of Pb or its equivalent.
- The source-to-skin distance for stationary fluoroscopy units must be at least 15” or 38 cm.
- The source-to-skin distance for mobile fluoroscopy (c-arm) units must be at least 12” or 30 cm.
- If operating above 70 kVp, each tube must possess at least 2.5 mm of total aluminum filtration.
- The exposure switch on a mobile imaging system must allow the radiographer to stand at least 6’ or 2 m from the source during the exposure.

Question #55:

The NCRP sets the annual dose limit for the lens of the eye for occupationally exposed individuals to no more than _____ rem/year.

a. 0.5
b. 5
c. 15
d. 50

Question #55: Review

Dose Limits Set by the NCRP:

- The following is a partial list of dose limits set by the NCRP for both occupationally exposed individuals and for the general public:

  The annual whole body dose limits for occupationally exposed personnel is as follows:

  Entire Body: 5 rem/year or 50 mSv/year

  Lens of the Eye: 15 rem/year or 150 mSv/year

  All other individual organs (liver, hands, skin etc.) of the body: 50 rem/year or 500 mSv/year

  Pregnant radiographers and students must keep their dose limits below the following:

  0.05 rem/month or 0.5 mSv/month

  0.5 rem/year or 5 mSv/year

Question #56:

Which of the following refers to the amount of carbon dioxide in the blood and is referred to as carbamino-hemoglobin?

a. oxygen tension
b. PO_2
c. PCO_2
d. oxygen saturation

Question #56: Review

Oxygen Therapy Terminology:

- Oxygen Tension or Partial Pressure (PaO_2)

  This is the amount of oxygen dissolved in arterial blood plasma.

- PO_2

  This is the amount of oxygen in the blood and is referred to as oxyhemoglobin.

- PCO_2

  This is the amount of carbon dioxide in the blood and is referred to as carbamino-hemoglobin.

- Oxygen Saturation

  This is the amount of oxygen that is bound to the hemoglobin.

Question #57:

Which of the following methods of sterilization uses steam under pressure to sterilize medical equipment and devices?

a. dry heat
b. microwaves
c. EO gas
d. autoclav

Question #57: Review

Methods of Sterilization:

1. Autoclave

   This is a device that uses steam under pressure to sterilize medical equipment and devices.

   Commonly found in hospitals.

   They are fast, convenient, and economical.

   The pressure characteristic allows for higher temperatures to be achieved during the sterilization process.

2. Ethylene Oxide (EO) Gas
3. Hydrogen Peroxide Gas Plasma
4. Liquid Chemicals
5. Dry Heat
6. Microwaves
7. Ozone

Question #58:

Bremsstrahlung x-rays comprise approximately _____ % of the primary beam when the exposure is made at 100 kVp.

a. 15
b. 45
c. 65
d. 85

Question #58: Review

Bremsstrahlung X-ray Production:

- Bremsstrahlung x-rays comprise 85% of the primary beam at 100 kVp.
- Bremsstrahlung (or "braking radiation") refers to x-rays that are released by projectile electrons from the filament that are deflected by the shells of the target atom (tungsten).
- Below is a list of interactions that occur during the formation of bremsstrahlung x-rays:
  - The projectile electron manages to avoid the orbital electrons of the target atoms.
  - They pass close enough to the positively charged nucleus that they slow down or brake.
  - Energy can neither be created nor destroyed but can change from one form to another according to the Law of the Conservation of Energy.
  - The electromagnetic energy released by the slowed electron is now called a bremsstrahlung x-ray.
  - The projectile electron may lose all, none, or any of the ranges in between.
  - This produces what is referred to as a polyenergetic or heterogeneous x-ray beam.
- The Continuous X-ray Emission Spectrum is used to compare x-ray production to bremsstrahlung x-ray energy level.

Question #59:

Which of the following means of microbe transmission occurs when insects or animals transmit disease?

a. direct
b. fomite
c. vector
d. airborne

Question #59: Review

Means of Microbe Transmission:

- Direct Contact
- Indirect Contact
    1. Fomites
    2. Droplet Transmission
    3. Airborne Transmission
    4. Vehicle Transmission
    5. Vector Transmission
        - This is when insects or animal transmit disease.

Question #60:

The NCRP sets the annual whole body dose limit for infrequent exposures to the general population to no more than _____ rem/year.

a. 0.5
b. 5
c. 15
d. 50

Question #60: Review

Dose Limits Set by the NCRP:

- There are two categories for annual whole body dose limits for the general population and the they are as follows:

  Frequent Exposures

  - This group includes individuals that work in the hospital other than radiographers and their dose limit must be below 0.1 rem/year.
  - This guideline is meant to ensure that x-ray rooms are properly designed to prevent radiation leakage.

  Infrequent Exposures

  - This group includes the general population, and their dose limit must be below 0.5 rem/year or 5 mSv/year.

Question #61:

Which of the following is a measurement of the pressure created by the flow of blood against the walls of blood vessels?

a. respirations
b. temperature
c. pulse
d. blood pressure

Question #61: Review

Blood Pressure:

- A measurement of the pressure created by the flow of blood against the walls of blood vessels.
- A single BP is almost always inaccurate.

Question #62:

The NCRP sets the annual liver dose limit for occupationally exposed individuals to no more than _____ rem/year.

a. 0.5
b. 5
c. 15
d. 50

Question #62: Review

Dose Limits Set by the NCRP:

- The following is a partial list of dose limits set by the NCRP for both occupationally exposed individuals and for the general public:

  The annual whole body dose limits for occupationally exposed personnel is as follows:

  Entire Body: 5 rem/year or 50 mSv/year

  Lens of the Eye: 15 rem/year or 150 mSv/year

  All other individual organs (liver, hands, skin etc.) of the body: 50 rem/year or 500 mSv/year

  Pregnant radiographers and students must keep their dose limits below the following:

  0.05 rem/month or 0.5 mSv/month

  0.5 rem/year or 5 mSv/year

Question #63:

Which of the following types of shock is an emergency condition that is often associated with some type of trauma and loss of blood volume?

a. hypovolemic
b. cardiogenic
c. anaphylactic
d. septic

Types of Shock:

- Hypovolemic Shock

  This an emergency condition that is often associated with some type of trauma and loss of blood volume.

- Cardiogenic Shock

  This may occur when the heart fails to supply blood to vital organs.

- Anaphylactic Shock

  This type of shock can be caused by a hypersensitivity to antigens that can lead to an allergic reaction.

- Septic Shock

  This is a life-threatening condition that happens when your blood pressure drops to a dangerously low level after an infection.

Question #64:

Which of the following refers to the study of human use of space and the effects that population density has on behavior, communication, and social interaction?

a. posture
b. verbal communication
c. nonverbal communication
d. proxemics

Question #64: Review

Elements of Communication:

- Verbal Communication
- Nonverbal Communication
- Paralanguage
- Proxemics

  This is the study of human use of space and the effects that population density has on behavior, communication, and social interaction.

  Proxemics is one among several subcategories in the study of nonverbal communication.

  Proxemics involves understanding the difference between social vs. personal space.

  This can also be culturally determined.

Question #65:

Which of the following refers to the patient condition that is characterized by an increase in arterial blood carbon dioxide levels is referred to as which of the following?

a. hypoxia
b. hypoxemia
c. hypercapnia
d. oxygen saturation

Question #65: Review

Oxygen Therapy Terminology:

- Hypoxia

  This is low levels of oxygen in body tissues.

  It causes confusion, restlessness, difficulty in breathing, rapid heart rate, and bluish skin.

- Hypoxemia

  This is a below-normal level of oxygen in arterial blood.

  This will likely lead to shortness of breath.

- Hypercapnia

  This is an increase in arterial blood carbon dioxide levels.

- Oxygen Saturation

  This is the amount of oxygen that is bound to the hemoglobin.

Question #66:

Which of the following is a balance between heat production and heat loss?

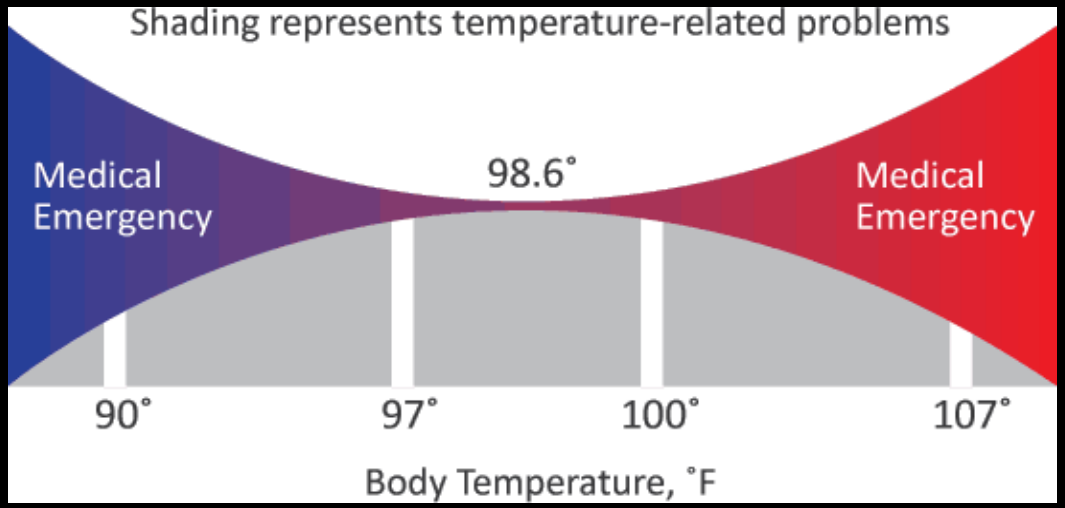
a. respirations
b. body temperature
c. pulse rate
d. blood pressure

Question #66: Review

Vital or Cardinal Signs:

- Pulse Rate
- Respirations
- Blood Pressure
- Body Temperature

  This is the result of the balance between heat production and heat loss.



Symptoms: Dizziness, confusion, comatose

Question #67:

Which of the following interactions is responsible for producing up to 99% of all scattered x-rays that are produced during an exposure?

a. coherent
b. photoelectric
c. compton
d. pair production

Question #67: Review

The Compton Interaction (CI):

- This interaction comprises 99% of all scatter that is produced.
- In this interaction, the incident x-ray photon from the primary beam ionizes an outer shell electron of an atom within the patient.
- This ejected electron is referred to as a Recoil, Secondary, or Compton Electron.
- The Compton electron is eventually absorbed by the body.
- However, the incident photon is not absorbed.
- It will change direction and lose energy but, it will retain at least 2/3 of its original energy.
- It is now called a scattered x-ray and it is the primary source of image receptor noise.
- This interaction results in low patient dose but is the source of the healthcare worker's dose.

  Healthcare workers may absorb this scattered radiation through the photoelectric effect.
- As the kVp increases, the number of Compton interactions will actually decrease.

  However, the number of photoelectric interactions drops off more rapidly.

  This happens because the primary beam has more penetrating ability and is more likely to pass through the patient as transfer radiation.
- Increasing kVp changes the ratio of the number of Compton interaction to the number of photoelectric interactions changes in favor of the Compton interactions.
- The net result the image will lose contrast.

Question #68:

Which of the following gas filled detectors takes into consideration both tube output and the area exposed when determining total patient dose?

a. ionization chamber
b. Geiger-Muller counter
c. dose area product (DAP) meter
d. scintillation detector

Question #68: Review

Dose Area Product (DAP) Meter:

- This device is sometimes referred to as the air-Kerma Product (KAP) meter.
- Modern fluoroscopic and general-purpose radiography tubes are equipped with DAP meters.

  With attention being given to reduce patient doses from diagnostic procedures in recent years, these meters have proven very useful.
- DAP meters use a formula to calculate dose, and it is defined as the absorbed dose in Gy multiplied by the area irradiated.
- The most common unit for DAP is gray-centimeters squared or $Gy*cm^2$.
- DAP meters generate a measurement that reflects not only the dose but also the area of tissue being irradiated.

  Because the area exposed is taken into consideration, a DAP meter is thought to be a better indicator of risk than using just tube output alone.
- The DAP meter is attached below the collimator in a manner whereby the primary beam must pass through it to reach the patient.

  The setting on the collimator is used to determine the area of the patient that is exposed.

  This area is used to calculate the total dose.

Question #69:

During the process of infection, which of the following stages is characterized by a period of recovery or remission?

a. latent
b. prodromal
c. active
d. convalescence

Question #69: Review

The Process of Infection:

1. Incubation or Latent Stage
   - The disease cannot be detected.
   - This is a dormant period.
2. Prodromal Stage
   - Early signs and symptoms of the disease appear.
3. Active/Full Stage
   - This is when the disease peaks.
4. Convalescence
   - This is a period of recovery or remission.
   - It is possible to re-enter the latent stage.

Question #70:

In reference to the grieving process, which stage is characterized by the individual trying to earn forgiveness by being compliant with all aspects of their treatment?

a. denial
b. anger
c. bargaining
d. depression

Question #70: Review

Stages of the Grieving Process:

1. Deniel
2. Anger
3. Bargaining

    This is where the individual tries to earn forgiveness by "being good."

    They also follow the doctors' orders very closely.

    They seldom complain.

    They hope that good behavior will spare them.
4. Depression
5. Acceptance

Question #71:

The ability of the speaker to communicate at the level of their receiver is known as:

a. speaker empathy.
b. paralanguage.
c. proxemics.
d. nonverbal communication.

Question #71: Review

- What is Speaker Empathy?

  This is the ability of the speaker to communicate at the level of the receiver's understanding.

Question #72:

Oxygen should always be administered to the patient at the highest possible level.

a. true
b. false

Question #72: Review

Oxygen Administration:

- The administration of oxygen and sparks do not mix as this will support combustion.

  Patients are not allowed to smoke while oxygen is being delivered.

- Always administer oxygen at lowest possible level.

  Oxygen toxicity occurs when too much supplemental oxygen has been inhaled.

  Oxygen also dries out mucous membranes which if damaged, could lead to an infection.

- Humidifiers

  These devices add moisture during oxygen delivery as a means to prevent the oxygen from drying out lung tissue.

Question #73:

Which of the following is not one of the three primary technical factors when selecting a technique?

a. kVp
b. mA
c. time
d. SID

Question #73: Review

Three Primary Technical Factors:

- There are three primary technical factors that are employed to determine the dose required to produce a diagnostic image.
- The three primary technical factors are as follows:

1. Kilovoltage Peak or kVp
2. Milliamperage or mA
3. Exposure Time

- Each of these factors will be examined on subsequent slides.

Question #74:

What percentage of lifetime information is gathered by sight alone?

a. 1.5
b. 3.5
c. 7
d. 87

Question #74: Review

Elements of Communication:

- People gather 87% of their lifetime information by sight alone.
  - 7% by hearing
  - 3.5% by smell
  - 1.5% by touch
  - 1% by taste
- Communication consists of:
  - 50% body language
  - 43% voice inflection
  - 7% of what is actually spoken

Question #75:

The x-ray emission spectrum is a combination of both the Discrete X-ray Emission Spectrum for characteristic x-rays and the _____ x-ray emission spectrum for bremsstrahlung x-rays.

a. continuous
b. endless
c. infinite
d. endless

Question #75: Review

- The X-ray Emission Spectrum is a combination of the following:
  - Discrete X-ray Emission Spectrum

    This consists of characteristic x-rays
  - Continuous X-ray Emission Spectrum

    This consists of bremsstrahlung x-rays

Question #76:

Which of the following medications is a diuretic that is used to treat swelling of the ankles, feet, legs, or even the brain or lungs?

a. diphenhydramine
b. atropine
c. dilantin
d. lasix

Question #76: Review

Common Types of Medications:

- Benadryl or Diphenhydramine

  This is an antihistamine and sedative mainly used to treat allergies, insomnia, and symptoms of the common cold.

  It is also less commonly used for tremor in parkinsonism, and nausea.

  It is a bronchodilator.

- Atropine

  Is used to increase the heartrate to combat bradycardia.

- Dilantin

  This medication is administered to prevent seizures.

- Heparin/Aspirin/Coumadin

  These medications are blood thinners that prolong clotting and help to prevent thrombus formation.

- Lasix

  This medication is a diuretic that is used to treat swelling of the ankles, feet, legs or even the brain or lungs.

  It may be used in some patients with more serious kidney problems who may have some fluid retention.

Question #77:

Which of the following refers to x-rays that are released by projectile electrons from the filament that are deflected by the shells of the target atom?

a. infrared radiation
b. characteristic x-ray production
c. bremsstrahlung x-ray production
d. coherent scatter production

Question #77: Review

Bremsstrahlung X-ray Production:

- Bremsstrahlung (or "braking radiation") refers to x-rays that are released by projectile electrons from the filament that are deflected by the shells of the target atom (tungsten).
- Below is a list of interactions that occur during the formation of bremsstrahlung x-rays:
  - The projectile electron manages to avoid the orbital electrons of the target atoms.
  - They pass close enough to the positively charged nucleus that they slow down or brake.
  - Energy can neither be created nor destroyed but can change from one form to another according to the Law of the Conservation of Energy.
  - The electromagnetic energy released by the slowed electron is now called a bremsstrahlung x-ray.
  - The projectile electron may lose all, none, or any of the ranges in between.
  - This produces what is referred to as a polyenergetic or heterogeneous x-ray beam.
- Bremsstrahlung x-rays comprise 85% of the primary beam at 100 kVp.
- The Continuous X-ray Emission Spectrum is used to compare x-ray production to bremsstrahlung x-ray energy level.

Question #78:

According to the NCRP, the source-to-skin distance for stationary fluoroscopy units must be at least ____ inches.

a. 11
b. 12
c. 15
d. 20

Question #78: Review

Designing for Radiation Protection:

- The Bucky slot cover must contain 0.25 mm of Pb or its equivalent.
- Protective gloves must contain 0.25 mm of Pb or its equivalent.
- Fluoroscopy protective drapes must contain 0.25 mm of Pb or its equivalent.
- The source-to-skin distance for stationary fluoroscopy units must be at least 15” or 38 cm.
- The source-to-skin distance for mobile fluoroscopy (c-arm) units must be at least 12” or 30 cm.
- If operating above 70 kVp, each tube must possess at least 2.5 mm of total aluminum filtration.
- The exposure switch on a mobile imaging system must allow the radiographer to stand at least 6’ or 2 m from the source during the exposure.

Question #79:

Which of the following refers to naturally occurring changes to DNA that results in mutations?

a. mutagens
b. spontaneous mutations
c. mutation frequency
d. doubling dose

Question #79: Review

Genetically Significant Dose (GSD):

- The doubling dose is that dose of ionizing radiation that is required to double the mutation frequency.

  The doubling dose is thought to be between 50 and 250 rad in humans.

  This wide range of values is due to the fact that there are some individuals that are naturally more radioresistant or radiosensitive than others.

- Mutagens are any agent that may cause some type of a mutation.

  Examples include but are not limited to viruses, drugs, and exposure to ionizing radiation.

- Spontaneous mutations are naturally occurring changes to DNA that result in mutations.
- The mutation frequency is the number of naturally occurring spontaneous mutations that occur per generation.

Question #80:

Which of the following refers to the amount of oxygen dissolved in arterial blood plasma?

a. oxygen tension
b. PO_2
c. PCO_2
d. oxygen saturation

Question #80: Review

Oxygen Therapy Terminology:

- Oxygen Tension or Partial Pressure (PaO_2)

  This is the amount of oxygen dissolved in arterial blood plasma.

- PO_2

  This is the amount of oxygen in the blood and is referred to as oxyhemoglobin.

- PCO_2

  This is the amount of carbon dioxide in the blood and is referred to as carbamino-hemoglobin.

- Oxygen Saturation

  This is the amount of oxygen that is bound to the hemoglobin.

Question #81:

During a typical x-ray exposure, what percentage of the energy imparted on the tube is converted into heat?

a. 0.2
b. 37
c. 63
d. 99.8

Question #81: Review

Infrared Radiation (Heat) Production:

- 99.8% of the energy imparted on the anode is converted into heat.
- Only 0.2% of that energy is converted into x-rays.As you can see, x-ray production is a very inefficient process.
- Electrons are generated at the filament of the x-ray tube by a process known as, thermionic emission.
- Following the exposure, these electrons are released from the filament in the direction of the positively charged anode.
- These projectile electrons interact with an outer shell electron of an atom of tungsten that is found in the target of the anode.

Question #82:

Which of the following refers to oral questioning under oath?

a. standard of care
b. malpractice
c. litigation
d. deposition

Question #82: Review

Medicolegal Terminology:

- Standard of Care

  Treatment that is accepted by medical experts as a proper treatment for a certain type of disease and that is widely used by healthcare professionals.

- Malpractice

  Improper or unethical conduct or unreasonable lack of skill by a holder of a professional or official position.

- Litigation

  This is the process of taking legal action.

- Deposition

  Refers to oral questioning under oath.

Question #83:

The contraction phase of the heart is referred to as:

a. systole.
b. diastole.
c. vasoconstriction.
d. apnea.

Question #83: Review

Vital Signs Terminology:

- Systole

  This is the contraction phase of heart.

  This is a measurement of the integrity of the left ventricle of the heart.

- Diastole

  This is the relaxation phase of the heart.

  The left ventricle relaxes and fills with oxygenated blood from the lungs.

- Dyspnea

  Difficulty in breathing caused by shortness of breath.

- Apnea

  This is the lack of breathing.

- Vasodilation

  The widening of blood vessels as a result of the relation of the blood vessel's muscular walls.

- Vasoconstriction

  The narrowing or constriction of blood vessels by small muscles in their walls.

Question #84:

Which of the following is responsible for developing the model for electron arrangement that is widely accepted to illustrate x-ray production?

a. Thomas Edison
b. Nikola Tesla
c. Wilhelm Conrad Roentgen
d. Niels Bhor

Question #84: Review

Niels Bohr (1895 to 1962):

- In this model, there is a positively charged nucleus.
- Electrons are arranged in shells (1-7 or K-Q) that radiate out from the nucleus.
- The closer an electron is in relation to the nucleus, the greater the binding energy.

  In other words, the nucleus has a tighter grip on electrons that are located in the K-shell than in the Q-shell.

  In order to remove an electron from a shell, this binding energy must at least be matched.

Question #85:

Which of the following means of microbe transmission occurs when there is a medium that transports microbes such as food, drugs, or contaminated blood?

a. direct
b. fomite
c. vector
d. vehicle

Question #85: Review

Means of Microbe Transmission:

- Direct Contact
- Indirect Contact
    1. Fomites
    2. Droplet Transmission
    3. Airborne Transmission
    4. Vehicle Transmission
        - In this transmission, there is a medium that transports microbes such as food, drugs, or contaminated blood.
    5. Vector Transmission

Question #86:

Hypotension is characterized by having a diastolic pressure of less than than ____ mm of Hg.

a. 60
b. 80
c. 120
d. 140

Question #86: Review

Vital Signs Terminology:

- Vasodilation

  The widening of blood vessels as a result of the relation of the blood vessel's muscular walls.

- Vasoconstriction

  The narrowing or constriction of blood vessels by small muscles in their walls.

- Hypotension

  This can be caused by loss of blood, anemia, shock i.e., burns, trauma, vomiting, diarrhea, heart exhaustion.

  The threshold is less than 90 mm Hg for a systolic pressure and less than 60 mm Hg for a diastolic pressure.

- Hypertension

  This is caused by a constriction of blood vessels, stress, medication, obesity, and smoking.

  The threshold is greater than 140 mm Hg for a systolic pressure and greater than 90 mm Hg for a diastolic pressure.

Question #87:

There is no need to disinfect a mobile unit prior to bringing it into an isolation patient's room to complete a procedure.

a. true
b. false

Question #87: Review

Portable Radiography in Isolation Rooms:

- Disinfect and bring the portable into the isolation room.
- Perform a 30 second scrub.
- Don a lead apron and required personal protective equipment (PPE) i.e., bonnet, mask, gown, and gloves.
- Adjust and position the portable in a suitable location for the examination.
- Acquire and cover the image receptor.
- Position patient and image receptor for optimal image quality.
- Remove soiled gloves and don clean gloves after positioning the patient and image receptor.
- Make the exposure and remove the portable from the isolation room.
- Remove the image receptor and hand it to the “clean” person that is assisting you with the procedure.
- Untie your waist band and carefully remove your gloves, bonnet, mask, and gown.
- Disinfect the portable and the image receptor.
- Perform a 30 second scrub.

Question #88:

Which of the following interactions is primarily know as an x-ray absorption interaction?

a. coherent
b. photoelectric
c. compton
d. photodisintegration

Question #88: Review

The Photoelectric Effect (PE):

- The salient thing to remember about this interaction is that the incident x-ray from the primary beam is absorbed.
- The incident photon ionizes an inner shell electron of an atom and is completely absorbed, and the patient receives a dose at this point.
- The ionized electron is called a photoelectron, and it will eventually be absorbed.
- An unstable hole has been created in the atom after the ejection of the photoelectron.
- This hole is then filled by an outer shell electron.
- As this occurs, a secondary x-ray is produced that has no diagnostic value.
    - Much like scatter radiation, a secondary x-ray has no diagnostic value and contributes to image noise.
- Since this is a photon absorption interaction, the greater the tissue atomic number, the more likely the photoelectric effect will occur.
    - As a result, the photoelectric effect results in high image contrast and high patient exposure.
- The photoelectric effect is dominate in the 50 to 75 kVp range.
    - The photoelectric effect decreases as the kVp is increased.

Question #89:

Which of the following types of shock may occur when the heart fails to supply blood to vital organs?

a. hypovolemic
b. cardiogenic
c. anaphylactic
d. septic

Question #89: Review

Types of Shock:

- Hypovolemic Shock

  This an emergency condition that is often associated with some type of trauma and loss of blood volume.

- Cardiogenic Shock

  This may occur when the heart fails to supply blood to vital organs.

- Anaphylactic Shock

  This type of shock can be caused by a hypersensitivity to antigens that can lead to an allergic reaction.

- Septic Shock

  This is a life-threatening condition that happens when your blood pressure drops to a dangerously low level after an infection.

Question #90:

The NCRP sets the annual whole body dose limit for pregnant radiographers to no more than _____ rem/year.

a. 0.5
b. 5
c. 15
d. 50

Question #90: Review

Dose Limits Set by the NCRP:

- The following is a partial list of dose limits set by the NCRP for both occupationally exposed individuals and for the general public:

  The annual whole body dose limits for occupationally exposed personnel is as follows:

  Entire Body: 5 rem/year or 50 mSv/year

  Lens of the Eye: 15 rem/year or 150 mSv/year

  All other individual organs (liver, hands, skin etc.) of the body: 50 rem/year or 500 mSv/year

  Pregnant radiographers and students must keep their dose limits below the following:

  0.05 rem/month or 0.5 mSv/month

  0.5 rem/year or 5 mSv/year

Question #91:

Which of the following refers to the amount of oxygen in the blood and is referred to as oxyhemoglobin?

a. oxygen tension
b. PO_2
c. PCO_2
d. oxygen saturation

Question #91: Review

Oxygen Therapy

- Oxygen Tension or Partial Pressure (PaO_2)

  This is the amount of oxygen dissolved in arterial blood plasma.

- PO_2

  This is the amount of oxygen in the blood and is referred to as oxyhemoglobin.

- PCO_2

  This is the amount of carbon dioxide in the blood and is referred to as carbamino-hemoglobin.

- Oxygen Saturation

  This is the amount of oxygen that is bound to the hemoglobin.

Question #92:

Which of the following dosimeters uses a laser to release light from crystals that have been exposed to ionizing radiation?

a. photographic emulsion (film badge)
b. thermoluminescence dosimeter (TLD)
c. optically stimulated luminescence (OSL)
d. gas filled detector

Question #92: Review

Optically Stimulated Luminescence or OSL:

- For an OSL dosimeter, Aluminum Oxide (Al_2O_3) is used as the radiation detection compound.
- Following exposure to x-rays, some electrons will be moved out of their normal alignment within the Al_2O_3 crystal.
- During processing, a laser causes these electrons to move back to their original position.

  Note that the laser is causing the electrons to move.

  This is where the name "optically stimulated" originates.

- As the electrons move back into their normal position, light is released that is in proportion to the radiation exposure that it originally received.
- The light is directed toward a photodiode which generates an electric signal denoting the radiographer's level of exposure.
- An OSL dosimeter can be worn up to three months between readings.
- The primary advantage of an OSL dosimeter is that it can measure doses as low as 0.01 mGy

Question #93:

The bag for a standard contrast enema requires _____ milliliters of warm water for an average patient.

a. 500 to 1000
b. 1000 to 1500
c. 1500 to 2000
d. 2000 to 2500

Question #93: Review

Contrast Enema Procedure:

- Fill the enema bag with 1500 to 2000 milliliters of warm water.
- Shake the bag to form a suspension of barium.
- Hang the bag approximately 30 inches above the table on an IV pole.

Question #94:

Which of the following terms is used to describe how something is said?

a. proxemics
b. posture
c. paralanguage
d. body orientation

Question #94: Review

Elements of Communication

- Paralanguage refers to how something is said and includes the following examples:
  - Pitch
  - Voice Inflection
  - Rate of Speech
  - Volume
  - Silence
  - Pauses
  - Eye Contact
  - Body Position

Question #95:

The patient's heels are a common area for the formation of a decubitus ulcer to occur.

a. true
b. false

Question #95: Review

Decubitus Ulcer Formation

- Common areas for the formation of decubitus ulcers:
    1) scapulae
    2) sacrum
    3) trochanters
    4) knees
    5) heels

Question #96:

The normal adult average respirations per minute is:

a. 8.

b. 16.

c. 24.

d. 32.

Question #96: Review

Respirations:

- Average Respirations
  - Adults
    - 12 to 20 respirations per minute with an average of 16 per minute.
    - There is a 5:1 ratio of pulses to respirations.
  - Infants
    - 30 to 60 respirations per minute with an average of 45 per minute.

Question #97:

According to the NRCP, the source-to-skin distance for mobile fluoroscopy (c-arm) units must be at least ____ inches.

a. 10
b. 12
c. 15
d. 20

Question #97: Review

Designing for Radiation Protection:

- The Bucky slot cover must contain 0.25 mm of Pb or its equivalent.
- Protective gloves must contain 0.25 mm of Pb or its equivalent.
- Fluoroscopy protective drapes must contain 0.25 mm of Pb or its equivalent.
- The source-to-skin distance for stationary fluoroscopy units must be at least 15” or 38 cm.
- The source-to-skin distance for mobile fluoroscopy (c-arm) units must be at least 12” or 30 cm.
- If operating above 70 kVp, each tube must possess at least 2.5 mm of total aluminum filtration.
- The exposure switch on a mobile imaging system must allow the radiographer to stand at least 6’ or 2 m from the source during the exposure.

Question #98:

In reference to the grieving process, which stage is characterized by the individual recognizing their loss and then losing interest in the outside world?

a. denial
b. anger
c. bargaining
d. acceptance

Question #98: Review

Stages of the Grieving Process:

1. Deniel
2. Anger
3. Bargaining
4. Depression
5. Acceptance

    The individual accepts the loss and loses interest in the outside world.

    They may focus on family, a support system, or their immediate surroundings.

    This is also characterized by a period of rehab.

Question #99:

Which of the following is the primary means of microbe transmission for direct contact?

a. hands
b. infected food
c. infected blood
d. insects

Question #99: Review

Means of Microbe Transmission:

- Direct Contact

  The hands are the primary means of transmission.

  The host is touched by infected person and colonized organisms are placed in direct contact with susceptible tissue.

- Indirect Contact

  1. Fomites
  2. Droplet Transmission
  3. Vector Transmission
  4. Vehicle Transmission
  5. Airborne Transmission

Question #100:

Which of the following terms is used to refer to a bed sore or pressure sore?

a. atrophy
b. defecation
c. enteric
d. decubitus ulcer

Question #100: Review

General Patient Care Terminology:

- Ambulatory

  The patient is able to walk and is not bedridden.

- Atrophy

  This refers to a decrease in size of a muscle, tissue or organ.

- Defecation

  This is the evacuation of fecal matter from rectum.

- Decubitus Ulcer

  This ulcer is commonly referred to as a bed sore or pressure sore.

- Enteric

  This pertains to the intestines.

Congratulations, you have just completed the Mastery Test!!

Now, just snap a picture of your completed answer sheet and text it to John Fleming at (727) 744-7946. If you score a 75% or higher, your certificate of completion will be emailed back to you within one week of us receiving your completed answer sheet and payment. *You will be allowed no more than three attempts to achieve a passing score on the mastery test.*

I hope that you have enjoyed this format for earning your continuing education and thanks for your support.

Contact Information:

Mailing Address:	Three Phase CEUs c/o John Fleming 80 Bay Woods Drive Safety Harbor, FL 34695
Cell Phone:	(727) 744-7946 (please send a text)
Website:	http://www.ceuarmy.com/
Email:	threephaseceus@tampabay.rr.com

About the Author:

John Fleming graduated from the St. Petersburg College (SPC) Radiography Program in Pinellas Park, Florida in December of 1985. He has been employed by SPC since May of 1987 and is currently the Radiography Program Director.

John completed a Master of Education Degree from the University of South Florida in December of 1998, and he has passed the American Registry of Radiologic Technology's Computed Tomography and Magnetic Resonance Imaging certification examinations.

References:

Fauber, Terri L.; Radiographic Imaging and Exposure, 6th Edition, Elsevier, St. Louis, Missouri, 2020

Bushong, Stewart Carlyle; Radiologic Science for the Technologist, 12th Edition, Elsevier, St. Louis, Missouri, 2021

Ehrlich, Ruth Ann & Coakes, Dawn M.; Patient Care in Radiography, 10th Edition, Elsevier, St. Louis, Missouri, 2020

Adler, Arlene M. & Carlton, Richard & Stewart, Kori; Introduction to Radiologic and Imaging Sciences and Patient Care, 8th Edition, Elsevier, St. Louis, Missouri, 2022