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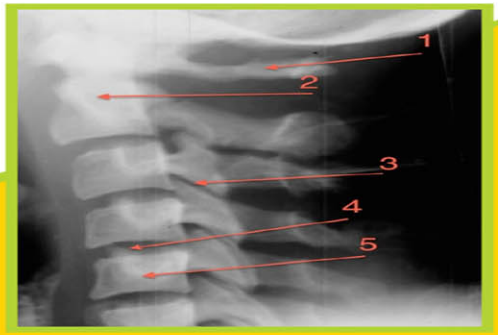
RADIOGRAPHY REVIEW FLASHCARDS

294 flashcards offer a fun, fast, and effective way to prepare for the ARRT® examination



D.A. Saia

Radiography Review Flashcards

D.A. Saia, MA, RT(R) (M)
Director, Radiography Program
Stamford Hospital
Stamford, Connecticut

New York / Chicago / San Francisco / Athens / London / Madrid
Mexico City / Milan / New Delhi / Singapore / Sydney / Toronto

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ISBN: 978-0-07-183206-9

MHID: 0-07-183206-8

The material in this eBook also appears in the print version of this title: ISBN: 978-0-07-183462-9, MHID: 0-07-183462-1.

eBook conversion by codeMantra
Version 1.0

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Preface

Preparing for tests, especially the ARRT certification examination can be a daunting prospect.

There are many approaches to, and methods of, preparing and studying for tests. Students usually elect to use more than one method of study, based on their personal learning style.

In *classroom* learning, the student prepares for each class by completing assignments and reviewing previous notes. Students use active listening skills, participate in discussion, and take effective and accurate notes.

Learning with others, ie, *collaborative* learning, can be effective for groups of 3 to 5 students; larger groups often find it difficult to keep everyone involved. Small study groups are excellent for sharing ideas and helping each other grasp concepts. Discussing and explaining difficult concepts with/to others is an excellent way to reinforce your own knowledge.

Probably the most common type of study is *independent* study. Well-planned and structured independent study can be very successful. The student should use a variety of resources best suited to their learning style and to the desired goal. Selection of study materials, planning, organization, and time management are essential.

The student desiring effect of study should carefully consider the following questions:

What time of day are my study efforts most effective?
Have I scheduled uninterrupted study time for each day?
Where can I study most effectively, free from unwanted distraction?
What type of test am I preparing for (essay, multiple choice, practical, presentation, etc)?
What resources will I use each time?
Have I evaluated my strengths and weaknesses?
How can I continue to reinforce my learning, even throughout the day?

Studying well is half the battle

How good a test taker am I: Do I get focused and stay focused? Do I read each question carefully, yet without "reading into" a question? Do I change my answers frequently—are they changed for the better or worse?

Flashcards are one simple and effective means of studying—since they can be carried with you, you can take advantage of every little study opportunity. The act of reviewing throughout the day, in unplanned little pockets of opportunity, is a very effective means of reinforcing your learning.

These *flashcards* can be used to help prepare for tests in individual subjects throughout your educational program, and they are especially designed to help you prepare for the ARRT certification examination that you will take upon completion of your radiography program.

Studying one subject at a time is probably the best way to start. If you can answer all the questions on one card, wonderful! If not, review the answer(s)—but be certain to quiz yourself on that card again in the next 10 minutes, *and again* in the following 10 minutes.

If you believe you know the answer to a question, but can't put the explanation into words, you just don't know it well enough. Review the concept and be certain you can explain it.

My best wishes to all of you who will be taking their ARRT certification examination in the near future. I hope you will find these flashcards useful in your preparation. Most of all, I hope that you have a satisfying and successful career in medical imaging!

Acknowledgments

I am greatly indebted to all my students—past, present, and those still to come. Their questions, enthusiasm, and desire to learn has made my job a pleasant task. Thank you all—there are so many memories to cherish!

Heartfelt thanks goes to Olive Peart M.S., R.T.(R)(M) and Teresa Whiteside B.A., R.T.(R)(BD), CDBT; they are very special colleagues and friends. A particular note of appreciation goes to another colleague, David Sack B.S., RT(R) CRA FAHRA, an exceptional professional and educator, for permission to use several of his excellent teaching images.

Special thank you is extended to Gene Rodda AB, RT(R), Jayme Frangione BA, R.T.(R), and Cheryl Cashell M.S., R.T.(R)(M)(QM) for the time they took to review the flashcards and provide timely and insightful feedback.

A note of appreciation is extended to Stamford Hospital for permission to reproduce some of their diagnostic images here.

A special note of thanks goes to the professional staff of McGraw-Hill, especially Andrew Moyer and Christie Naglieri and Kritika Kaushik for their patient guidance and support for this new project.

Lastly here, but first in my heart, a loving thanks goes to my husband Tony for his never-failing support and encouragement.

D.A. Saia
May, 2014

Reviewers

Cheryl Cashell, M.S., R.T.(R)(M)(QM)
Clinical Coordinator
Care Point Health School of Radiography
Care Point Heath-Christ Hospital
Jersey City, NJ

Jayme Frangione, B.A., R.T.(R)
Diagnostic Radiographer
Chelsea Piers Imaging
Stamford, CT

Gene Rodda, A.B., R.T.(R)
Diagnostic Radiographer
Tully Imaging Center
Stamford, CT

1. What type of dose-response relationship is characterized by an early response to a high-dose exposure?
2. What type of dose-response relationship is characterized by a late response to low-dose exposure(s)?
3. What is described as a measure of the rate at which energy is transferred from ionizing radiation to soft tissue?

1. Deterministic (nonstochastic)
2. Stochastic (probabilistic)
3. LET (linear energy transfer)

1. What are two examples of radiation-induced conditions that follow a linear nonthreshold dose-response relationship?
2. Skin effects that result from fluoroscopic exposure follow what type of dose-response relationship?
3. What type of effects are described as: “those biologic somatic effects of ionizing radiation that exhibit a threshold dose below which the effect does not normally occur and above which the severity of the biologic damage increases”?

1. Genetic effects, radiation-induced cancer, leukemia
2. Nonlinear (sigmoid), threshold dose response
3. Nonstochastic (deterministic) effects

1. What is the cellular component having the greatest radiobiological significance?
2. What effect does the presence of oxygen have on radiosensitivity?
3. Which of the following ionizing radiations has the highest LET?
   alpha, beta, gamma

1. DNA
2. Oxygen increases radiosensitivity.
3. Alpha

1. What is the term used to describe the human sequence of events following high-level radiation exposure, and leading to death in a short time?
2. List the three major types of acute radiation syndrome.
3. Which of the three types of acute radiation syndrome requires the least amount of ionizing radiation dose to occur?
4. Fill in the W_r:

	W_r
Gamma	
x	
Alpha	

1. Acute radiation syndrome
2. Hematological, gastrointestinal, and CNS (central nervous system)
3. Hematological
4.

	W_r
Gamma	1
x	1
Alpha	20

1. Describe the energy and LET of occupational radiation.
2. Give two examples of common *local* tissues that can be affected by ionizing radiation.
3. *Erythema* can be an effect of excessive ionizing radiation exposure to what body part?
4. List the following in order of decreasing radiosensitivity:
   skin, lungs, gonads, liver

1. Low energy and low LET
2. Skin, lens of eye, chromosomes
3. Skin
4. Gonads, lungs, liver, skin

1. Radiation-induced biologic damage to living organisms is termed _____ effects.
2. Nonstochastic effects may also be referred to as _____ effects.
3. Fill in the NCRP-recommended dose limits:

Lens of eye (annual)	_____ mSv
Embryo/fetus (1 month)	_____ mSv
Thyroid (annual)	_____ mSv
Skin, hands, and feet (annual)	_____ mSv
Gonads (annual)	_____ mSv

1. somatic
2. deterministic
3.

Lens of eye (annual)	150 mSv
Embryo/fetus (1 month)	0.5 mSv
Thyroid (annual)	500 mSv
Skin, hands, and feet (annual)	500 mSv
Gonads (annual)	50 mSv

1. Somatic effects that occur within minutes, hours, days, or weeks after initial irradiation are termed_____.
2. What minimum radiation dose is required in order for acute radiation syndrome (ARS) to occur?
3. The latent period (in ARS) decreases as radiation exposure _____.

1. early, or short-term, effects
2. 100 rad (1 Gy)
3. increases

1. How does oxygenation affect cell/tissue radiosensitivity?
2. What is the LD 50/30 for adult humans?

1. The presence of oxygen increases cell/tissue radiosensitivity.
2. 300 to 400 rad (3-4 Gy)

1. A dose of 200 rad (2 Gy) to the skin can cause a radiation-induced reddening, termed _____.
2. Ionizing radiation-induced hair loss is termed _____.
3. What is the name of the particularly radiosensitive male sex cell?

1. erythema
2. epilation or alopecia
3. Spermatogonia

1. What is the target organ believed responsible for radiation-induced leukemia?
2. What radiation exposure dose to the ovaries will result in temporary infertility?
3. In which portion of pregnancy is the embryo/fetus most radiosensitive?

1. Bone marrow
2. 200 rad (2 Gy)
3. The first trimester

1. What is defined as "the estimated dose to the gonads that, if received by the total population gene pool, would produce the total genetic effect on the population as the sum of the individual doses actually received"?
2. What are the three guidelines for determining when the gonads should be shielded?
3. What three parts of the body should be shielded from the useful beam whenever possible?

1. Genetically significant dose (GSD)
2. When the gonads are within 5 cm of the *collimated* primary beam, when the patient is of reproductive age, and when clinical objectives permit
3. The lens of the eye, the breasts, the reproductive organs

1. When a 1-mm Pb flat contact shield is used to shield female reproductive organs, their dose is reduced by about how much?
2. When a 1-mm Pb flat contact shield is used to shield male reproductive organs, their dose is reduced by about how much?

1. 50%
2. 90% to 95%

1. List four types of *late* effects of ionizing radiation exposure.
2. What skin layer is most radiosensitive?

1. Carcinogenesis, cataractogenesis, embryological effect, and lifespan shortening
2. Basal cell

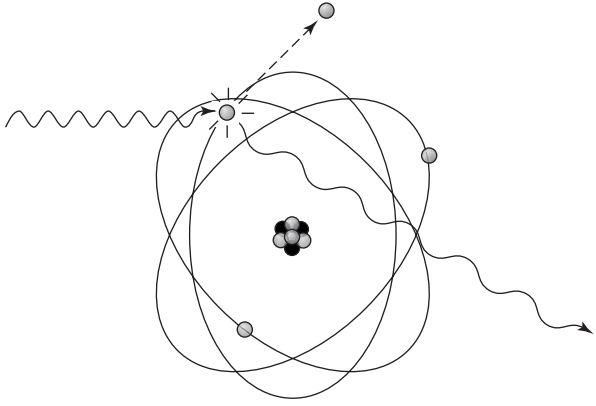
1. Which are the two interactions between x-ray photons and tissue cells that occur most often?
2. Which of the major interactions between x-ray photons and tissue cells occurs with high-energy photons?
3. Which of the major interactions between x-ray photons and tissue cells is most likely to occur with tissues having high atomic number?
4. Which of the major attractions between x-ray photons and tissue cells results in total absorption of the incident photon?

1. Compton scatter and photoelectric effect
2. Compton scatter
3. Photoelectric effect
4. Photoelectric effect

1. Which of the major interactions between x-ray photons and tissue cells is a major contributor to patient dose?
2. Which of the major interactions between x-ray photons and tissue cells predominates in the diagnostic x-ray range?
3. Which of the major interactions between x-ray photons and tissue cells is responsible for scattered radiation fog?
4. Which of the major interactions between x-ray photons and tissue cells poses a radiation hazard to personnel?

1. Photoelectric effect
2. Compton scatter
3. Compton scatter
4. Compton scatter

1. The diagram illustrates which interaction between x-ray photons and matter?
2. What kind of incident photon energy is involved?
3. With what frequency does this interaction occur in comparison to other types of interactions between x-ray photons and matter?

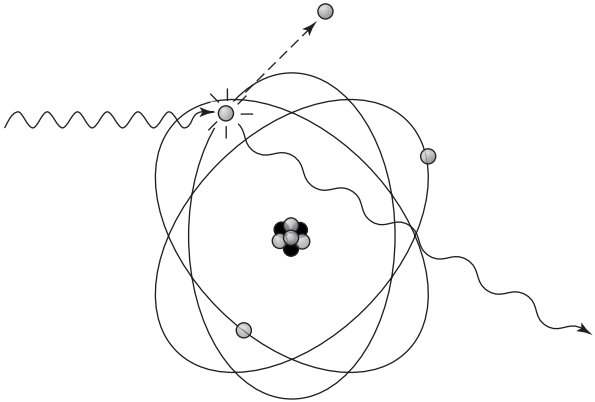


1. Compton scatter
2. High energy
3. Compton scatter occurs most frequently

1. Which interaction between x-ray photons and matter involves an outer shell electron and only partial transfer of energy?
2. Which interaction between x-ray photons and matter involves a low-energy (low kV) incident photon?
3. Which interaction between x-ray photons and matter is most damaging to the diagnostic image?
4. Which interaction between x-ray photons and matter involves the greatest patient dose?

1. Compton scatter
2. Photoelectric effect
3. Compton scatter
4. Photoelectric effect

1. Which interaction between x-ray photons and matter occurs least often and is the only interaction that does not cause ionization?
2. Which interaction between x-ray photons and matter involves a recoil electron?
3. Which interaction between x-ray photons and matter is most likely to occur in high-density tissues like bone?
4. What name is given to the ejected electron in the interaction pictured here?



1. Coherent scatter/unmodified scatter
2. Compton scatter
3. Photoelectric effect
4. Recoil electron

1. Which interaction between x-ray photons and matter involves most potential radiation hazard to personnel?
2. Which interaction between x-ray photons in matter produces a characteristic ray?
3. Which interaction between x-ray photons and matter is more likely to produce short-scale contrast?

1. Compton scatter
2. Photoelectric effect
3. Photoelectric effect

1. What component of personal dosimeters functions to evaluate radiation quality?
2. Which of the following three types of personal radiation monitoring devices is most sensitive? thermoluminescent dosimeter, optically stimulated luminescence dosimeter, film badge
3. What are the two weighting factors that are used to determine the Sievert?

1. Filters
2. Optically stimulated luminescence dosimeter
3. W_t and W_r

1. What combination of kV and mAs is recommended to decrease patient exposure?
2. List at least three types of patient shields.

1. Low mAs with high kV
2. Flat contact shields, shaped contact shields, shadow shields, and breast shields

1. What is the single most important way to reduce patient exposure?
2. List three types of beam restrictors.

1. Restriction of the useful beam
2. Collimators, cones, and aperture diaphragms

1. The x-ray tube glass envelope and its insulating oil function as what kind of filtration?
2. How much total filtration is required for equipment operating above 70 kV?
3. What is the primary purpose of filtration of the useful x-ray beam?

1. Inherent filtration
2. 2.5 mm aluminum equivalent
3. To reduce patient skin dose

1. How does added filtration affect the average energy of the x-ray beam?
2. How does added filtration affect the minimum wavelength of the x-ray beam?
3. What are the two ways used to express x-ray beam quality?

1. The average energy is *increased.*
2. Added filtration has no effect on the *minimum* wavelength of the x-ray beam.
3. kV and HVL (half value layer)

1. Because the primary x-ray beam is polyenergetic, the entrance dose is often significantly _____ than the exit dose.
2. To reduce exposure to the lens, the reproductive organs, and the breasts, it is helpful to perform these examinations in what position?
3. What is the concept employed every day, with every examination, in order to achieve optimal radiation protection?

1. greater
2. PA
3. ALARA (as low as reasonably achievable)

1. Who of the following is likely to be the most radiosensitive: 1-year-old child, 20-year-old young adult, 50-year-old adult?
2. What is the feature of most x-ray imaging systems that terminates the x-ray exposure once adequate exposure reaches the image receptor?
3. How is imaging system speed related to patient exposure?

1. 1-year-old child
2. Automatic exposure control (AEC)
3. Faster-speed systems reduce required exposure.

1. Changing from nongrid to grid procedure will require a/an _____ in patient exposure.
2. A/an _____ technique can function similar to, or in place of, a low ratio grid when distance is introduced between the patient/part and the image receptor.
3. When used correctly, digital imaging can significantly _____ patient dose.

1. increase
2. air gap
3. reduce

1. What is the principal reason that fluoroscopy potentially delivers a significantly higher patient dose than general radiography?
2. Grids improve the radiographic image by reducing the amount of scattered radiation fog, but necessitate a/an _____in exposure.
3. During C-arm fluoroscopic procedures, the patient-to-image intensifier distance should be as _____ as possible to reduce patient entrance dose.

1. Because the source of x-ray photons is much closer to the patient in fluoroscopy
2. increase
3. short

1. How does fluoroscopic magnification mode affect patient dose?
2. According to CFR, Title 21, for continued awareness of patient exposure during fluoroscopic procedures, cumulative air kerma is displayed in what unit of measure?
3. What are the two features of digital fluoroscopy that function to reduce patient dose?

1. Magnification mode increases patient dose.
2. mGy_a (milligray in air)
3. *Pulsed* fluoroscopy and *last image hold*

1. The exposure switch on mobile x-ray equipment must allow the operator to be at least what distance from the x-ray tube during the exposure?
2. The SSD in mobile fluoroscopy must be at least _____.
3. The SSD in stationary fluoroscopy must be at least _____.
4. In what type of mobile x-ray equipment does the kV decrease during the exposure?

1. 2 m/6 ft
2. 30 cm/12 in
3. 38 cm/15 in
4. Capacitor/condenser discharge mobile units

1. How is patient entrance skin exposure (ESE) affected as fluoroscopic SSD is decreased?
2. What must be the lead equivalent of the fluoroscopic image receptor assembly?
3. Fluoroscopic total filtration must be at least _____.

1. Patient ESE increases as SSD is decreased.
2. 2.0 mm Pb equiv
3. 2.5 mm Al equiv

1. The fluoroscopy timer must provide signal after how much fluoroscopic time has elapsed?
2. Fluoroscopic tabletop intensity should not exceed _____ per mA operated 80 kV.
3. *High-level control* fluoroscopic tabletop exposure must not exceed _____.
4. Automatic adjustment of the kV and/or mAs for adequate visualization during fluoroscopic examinations, according to part thickness, is termed _____.

1. 5 minutes
2. 21 mGy_a/min (2.1 R/min)
3. 200 mGy_a/min (20 R/min)
4. automatic brightness control (ABC)

1. Under what condition(s) may the radiographer be exposed to the primary/useful x-ray beam?
2. What does the acronym ALARA stand for?
3. What is the radiographer's principal source of exposure to scattered radiation?

1. Never
2. As low as reasonably achievable
3. The patient

1. What are the cardinal principles of radiation protection?
2. What is used to evaluate the effectiveness of personnel radiation protection?
3. How can each of the cardinal principles of radiation protection be used to decrease personnel exposure?

1. Distance, shielding, and time
2. Radiation monitoring/dosimeters
3. Increase distance from the source of radiation (eg, further away from the x-ray tube)

   Place shielding between the source and yourself (eg, lead apron)

   Decrease the amount of time exposed (eg, length of fluoroscopic examination)

1. What are the two types of secondary radiation?
2. Ionizing radiation that is emitted from the x-ray tube housing in directions other than that of the useful beam is termed _____.
3. Primary x-ray photons that strike matter and undergo a change in direction are termed _____.

1. Scattered radiation and leakage radiation
2. leakage radiation
3. scattered radiation

1. In C-arm imaging, for what three reasons is it always recommended that the image intensifier be placed *above* the patient?
2. In C-arm imaging, which position of the x-ray tube increases exposure to the eyes, head, and neck areas of the operator?
3. What is the term used to describe the hypothesis that a positive effect exists for certain populations that are continuously exposed to moderate levels of radiation?

1. Decreased OID, increased resolution, decreased scattered radiation
2. X-ray tube positioned *above* the patient increases exposure to the operator.
3. Radiation hormesis

1. Where must the Bucky tray be placed during fluoroscopic examination?
2. The Bucky slot cover must have at least what lead equivalent?
3. The fluoroscopic protective curtain must have at least what lead equivalent?

1. At the end of the table
2. 0.25 mm Pb equiv
3. 0.25 mm Pb equiv

1. How does the intensity of scattered radiation 1 m from the patient compare to the intensity of the useful beam at the patient's skin?
2. If patient entrance skin exposure (ESE) is 225 mR for a particular projection, what will be the intensity of scatter 1 m from the patient?
3. What are the two basic types of protective barriers?

1. The intensity of scatter 1 m from the patient is about 1/10% (ie, 1/1000th) of the useful beam.
2. 0.225 mR
3. Primary barriers and secondary barriers

1. What kind of protective barrier is the control panel/console?
2. Our most important source of scattered radiation is the _____.
3. Leakage radiation emitted from the x-ray tube housing must not exceed _____.

1. Secondary
2. patient
3. 100 mR/h

1. The fluoroscopic exposure switch must be what type of switch?
2. Protective lead aprons must have *at least* (according to CFR, Title 21) what Pb equivalent?
3. Protective lead gloves must have at least what Pb equivalent?

1. “Deadman”-type switch
2. 0.25 mm Pb equiv
3. 0.25 mm Pb equiv

1. Protective lead aprons and gloves are worn to protect from _____ radiation.
2. How are lead aprons and other protective apparel checked for effectiveness?
3. A 0.5-mm Pb equivalent apron will attenuate what percentage of the scattered beam at 100 kV?

1. scattered
2. They are cared for appropriately and are *imaged annually* to check for cracks/damage.
3. 75%

1. List three types of protective apparel for personnel.
2. What type of radiation does personnel protective apparel protect from?
3. According to NCRP #102, what is the minimum lead equivalent for lead aprons?

1. Lead aprons, lead gloves, and thyroid shields
2. Scattered radiation
3. 0.5 mm Pb equiv

1. The product of what two factors equals total exposure?
2. If the radiographer is exposed to 0.93 mGy_a/h (93 mR/h), what will be the total occupational exposure after 15 minutes?

1. Exposure rate × exposure time = total exposure
2. 0.2325 mGy_a (23.25 mR)

1. What unit is used to describe ionization in air?
2. What unit is used to describe absorbed dose?
3. What unit is used to describe occupational exposure?

1. Roentgen/Gy_a (gray in air/air kerma)
2. rad/Gy_t (Gray in tissue)
3. rem/Sv (Sievert)

1. What traditional unit measures X or gamma radiation only?
2. What traditional unit is valid up to 3 MeV?
3. For which traditional unit of measure are all the ions of *either* sign collected and measured?

1. Roentgen
2. Roentgen
3. Roentgen

1. What traditional unit of measure is valid up to 3 MeV?
2. Which traditional unit of measure is described as equivalent to 100 ergs/g of irradiated material?
3. The amount of energy deposited and resulting possible biologic damage are related on what four factors?

1. Roentgen
2. rad
3. Type of ionizing radiation, atomic number of tissue, mass density of tissue, and energy of the radiation

1. The acronym *rad* refers to _____.
2. The acronym *rem* refers to _____.
3. rad × QF = ?

1. radiation absorbed dose
2. radiation equivalent man
3. rad × QF = rem

1. $Gy \times W_r \times W_t =$ _____
2. Which portion of the above equation represents the degree of radiosensitivity of the irradiated organ/tissue?
3. Which portion of the above equation represents the ionizing capability of the irradiating photons?
4. Which portion of the above equation represents absorbed dose?

1. EfD (effective dose)
2. W_t
3. W_r
4. Gy (gray)

1. CFR states that radiation monitoring must be provided for occupationally exposed individuals who are likely to receive more than_____.
2. List four types of personal radiation monitors.
3. What is the active ingredient in optically stimulated luminescence dosimeters?

1. 1/10th the dose equivalent limit
2. Optically stimulated luminescence (OSL), thermoluminescent dosimeter (TLD), film badge, and pocket dosimeter
3. Aluminum oxide (Al_2O_3)

1. What is the active ingredient in a thermoluminescent dosimeter?
2. Which is the most accurate personal dosimeter?
3. Which type of dosimeter may be used to obtain an immediate reading?
4. What device serves as the standard for comparison with all the personal dosimeters returned to the processing facility?

1. Lithium fluoride
2. OSL
3. Pocket dosimeter
4. The control badge

1. Where/how should a typical personal radiation monitor be worn?
2. How should a typical personal radiation monitor be worn with respect to a lead apron?
3. Where/how should a fetal personal radiation monitor be worn?
4. Where should the control badge be kept?

1. At collar level, facing forward
2. Outside the lead apron
3. Under the lead apron, at waist level
4. In a radiation-free area

1. The filters used in personal radiation monitors serve to identify _____.
2. Which personal radiation monitor sensing *material* emits blue light when stimulated by green light?
3. What is the annual dose limit for occupationally exposed individuals 18 years of age and older?
4. What does the control badge measure?

1. the type and energy of ionizing radiation
2. Aluminum oxide
3. 50 mSv/5 rem
4. Background radiation

1. What is the annual effective dose (EfD) limit for radiography students participating in clinical education before the age of 18?
2. A pregnant radiographer's gestational fetal exposure must not exceed _____.
3. A pregnant radiographer's monthly fetal exposure must not exceed _____.

1. 0.1 rem/100 mrem/1 mSv
2. 0.5 rem/500 mrem/0.5 mSv
3. 0.05 rem/50 mrem/0.5 mSv

1. What acronym serves as a reminder to us to keep exposure to patients and ourselves to a judicious minimum?
2. What words does this acronym represent?
3. How can a radiation worker determine lifetime cumulative effective dose (CumEfD) limit?
4. What is a 35-year-old radiation worker's lifetime cumulative effective dose limit?

1. ALARA
2. As low as reasonably achievable
3. Their age in years × 10 mSv (or years × 1 rem)
4. 350 mSv (35 rem)

1. The NCRP's recommendation for infrequent exposure to nonoccupationally exposed individuals is _____ annual EfD limit.
2. The NCRP recommends an annual whole-body EfD limit to the occupationally exposed of _____.
3. The NCRP recommends an annual lens of eye EfD limit to the occupationally exposed of _____.

1. 5.0 mSv (0.5 rem)
2. 50 mSv (5 rem)
3. 150 mSv (15 rem)

1. What mechanism is used to ensure that occupational radiation exposure levels are kept well below the annual effective dose (EfD) limit?
2. Radiographers should wear their dosimeter at collar-level in order to approximate dose to what organ?
3. What obligation does the employer/health care facility have with respect to personnel monitoring records?
4. Who is the individual that receives and reviews personnel monitoring reports to ensure radiation safety compliance?

1. Personnel monitoring
2. Thyroid
3. Records of dosimeter reports must be maintained.
4. The RSO (radiation safety officer)

1. What percentage of the total energy used to produce x-rays is actually converted to x-rays?
2. When the x-ray tube filament is heated to incandescence/white hot, this is termed _____.
3. Heating the x-ray tube filament to incandescence functions to provide a source of _____.

1. 0.2%
2. thermionic emission
3. electrons

1. Organize the following electromagnetic radiations in order of longest wavelength to shortest wavelength: visible light, x-rays, and microwaves.
2. Which of the three electromagnetic radiations above is most likely to be considered *ionizing*?

1. Microwaves (longest)
   Visible light
   X-rays (shortest)
2. X-rays

1. Which characteristic x-rays of tungsten are the only x-rays that are useful for diagnostic purposes?
2. What kind of x-rays are emitted when an outer shell electron fills an inner shell vacancy?

1. K characteristic x-rays
2. Characteristic x-rays

1. What type of x-rays are produced when a high-speed electron is decelerated by the nuclear field of the target atom nucleus?
2. How are x-ray energy and x-ray wavelength related?

1. Bremsstrahlung x-rays
2. Inversely, ie, as x-ray energy increases, wavelength decreases

1. What serves to accelerate the electrons toward the anode?
2. Which device functions to direct the electrons toward the anode's focal spot?
3. Rapid deceleration of electrons at the anode results in _____.
4. What is the electrical charge of the anode?

1. The application of high voltage (kilovoltage)
2. The nickel (Ni) or molybdenum (Mo) focusing cup
3. production of x-rays
4. Positive

1. Although all electromagnetic radiations travel at the same velocity, in which ways do they differ?
2. What are the two types of x-radiation that are produced at the anode through energy conversion processes?
3. Which of the two x-ray production processes predominates?

1. Wavelength and frequency
2. Bremsstrahlung (Brems) and characteristic
3. Bremsstrahlung

1. How are wavelength and frequency related?
2. What term is used to describe the breaking apart of electrically natural atoms by high-energy electromagnetic radiation?
3. What term is used to describe the number of cycles per second?
4. The distance between two consecutive crests is termed _____.

1. They are inversely related, ie, as one increases, the other decreases.
2. Ionization
3. Frequency
4. wavelength

1. The x-ray beam emerging from the x-ray tube, before striking anything, is referred to as the _____.
2. The x-ray beam emerging from the part and striking the image receptor is referred to as the _____.
3. How is a shorter wavelength photon associated with: frequency, energy, ionizing potential?
4. Structures that absorb x-ray photons are termed _____.

1. primary beam
2. remnant or exit beam
3. Shorter wavelength = higher frequency, higher energy, increased ionizing potential
4. Radiopaque

1. What exposure factor regulates x-ray beam quantity?
2. What exposure factor regulates x-ray beam quality?
3. What exposure factor regulates x-ray photon wavelength and beam penetration?

1. mA
2. kV
3. kV

1. What is defined as the reduction in intensity resulting from scattering and absorption processes?
2. How is the intensity of electromagnetic radiation related to distance?
3. X-rays have a/an _____ effect on all matter.
4. X-rays have a/an _____ effect on living tissue.

1. Attenuation
2. Electromagnetic radiation intensity is inversely related to the square of the distance from its source.
3. penetrating
4. physiological

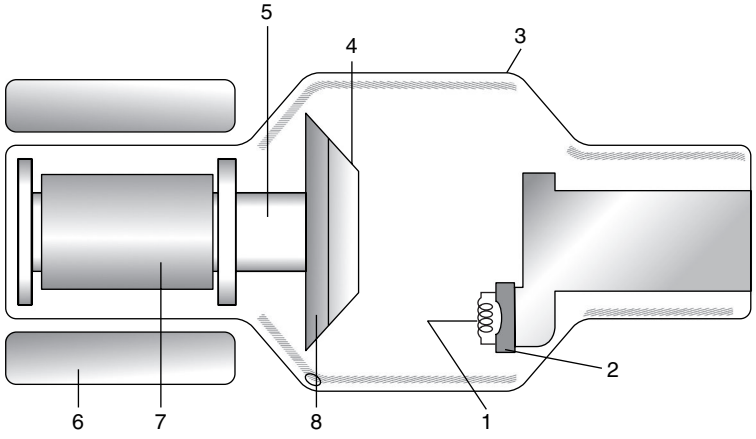
1. How can the energy of an x-ray beam be described?
2. What is the electrical charge of an x-ray beam?
3. What kind of effect do x-rays have on air?

1. Polyenergetic, ie, having a spectrum of energies
2. X-rays are electrically neutral.
3. Ionizing

1. Examples of dedicated x-ray equipment include _____.
2. What part of the x-ray equipment is used for the selection of exam parameters?
3. In a general purpose x-ray room, the fluoroscopy tube will usually be located_____.
4. What characteristics would the x-ray table require if it were to be used for fluoroscopy?

1. mobile equipment, dedicated chest units
2. The operating console
3. under the x-ray table
4. It would have to be a tilting table; tilting 90° to the foot side and 30° to the head side.

1. What does #1 in this illustration represent?
2. Of what material is #5 usually made?
3. What does #2 represent?
4. At what number is the source of electrons?



1. The tungsten filament
2. Copper
3. The focusing cup (nickel or molybdenum)
4. #1

1. For what three reasons is tungsten (W) the target material of choice?
2. What device functions to rotate the anode?
3. How do the actual and effective focal spots differ in size?

1. High atomic (Z) number, high melting point, and high thermal conductivity
2. The induction motor
3. The effective focal spot is smaller than the actual focal spot.

1. To what does the line focus principle refer?
2. The stator and the rotor are the two parts of which device?
3. Of what material is the anode stem usually made, and what is its purpose?

1. The relationship between the actual and effective focal spots (the effective is always smaller than the actual)
2. The induction motor
3. Copper, to conduct heat away from the face of the anode

1. List two reasons why x-ray tubes are surrounded with oil.
2. What is the heat unit (HU) formula?
3. What is used to determine the maximum safe exposure for a particular x-ray tube?

1. To conduct heat away from the anode, and for insulation
2. HU = mA × time × kV
3. Tube rating chart

1. The x-ray tube may accurately be described as a/an _____.
2. List the three fundamental parts of the typical diagnostic x-ray tube.
3. A double-focus x-ray tube is one that has _____.

1. diode
2. anode, cathode, and vacuum glass envelope
3. two focal spots with two filaments

1. The x-ray tube filament is made of what material?
2. The body of the anode is made of _____ and its focal track is made of _____.
3. What is most damaging to the x-ray tube?
4. What is the device that automatically terminates the exposure once the IR has received the required radiation intensity/exposure?

1. Tungsten (W) wire
2. molybdenum (Mo) or graphite disk; tungsten and rhenium (Re) alloy
3. Heat
4. The AEC (automatic exposure control)

1. The type of AEC located behind the IR is the _____.
2. The type of AEC most often used, which is placed between the patient and IR is the _____.
3. When using AEC, the electronic (manual) timer acts as the _____ and should be set to 1.5 times the expected exposure time. This is done to protect the _____ and the _____.

1. photomultiplier/phototimer type
2. ionization chamber type
3. backup timer; patient; x-ray tube

1. What permits density/exposure adjustments when using AEC?
2. What type of AEC uses a fluorescent screen to terminate the exposure?
3. In order to produce predictable and accurate results, AECs require precise _____ and _____.

1. Plus (+) density and minus (–) density/exposure controls
2. Photomultiplier/phototimer type
3. positioning; centering of CR

1. List three types of beam restrictors.
2. Why are the uppermost collimator shutters placed as close as possible to the x-ray tube port window?
3. What are the two important functions of beam restriction?

1. Cones (cylinder and flare), collimators, and aperture diaphragms
2. To reduce the amount of off-focus/stem radiation exiting the x-ray tube
3. To reduce patient dose and improve image contrast

1. X-ray photons produced when projectile electrons interact with structures other than the focal spot are termed_____.
2. What are the two devices that function to reduce the amount of scattered radiation reaching the IR?
3. In what two ways can we reduce the production of scattered radiation?
4. What is the name of the electrical device that operates on the principle of mutual induction and functions to change the magnitude of voltage and current?

1. off-focus or stem radiation
2. Beam restrictors and grids
3. Use of beam restriction and appropriate level kV
4. A transformer

1. What type of current is required to operate a transformer?
2. A step-up transformer has a _____ number of turns in the secondary coil than in the primary coil.
3. How does a step-up transformer change voltage and amperage?
4. Step-up and step-down transformers operate on what principle?

1. Alternating current
2. greater
3. Voltage is increased, and amperage is decreased proportionally.
4. Mutual induction

1. What type of transformer has a turns ratio greater than 1?
2. In a step-up transformer, the secondary current is _____ the primary current.
3. What type of transformer has one coil and varies both the current and voltage?
4. What type of transformer is the high-voltage transformer?

1. A step-up transformer
2. less than
3. An autotransformer
4. A step-up transformer

1. What type of transformer is the filament transformer?
2. The high-voltage side of the typical x-ray circuit contains which three principal parts?
3. The process of converting alternating current to unidirectional pulsating current/direct current is called _____.

1. A step-down transformer
2. The high-voltage transformer, the filament transformer, and the rectifiers
3. rectification

1. Electronic devices found in the x-ray circuit that allow current to flow in only one direction are called _____.
2. On what type of current does the x-ray tube most efficiently operate?
3. Most solid-state diode rectifiers are made of what semiconductor material?
4. X-ray equipment operated by three-phase 12-pulse power produces what percentage voltage ripple?

1. rectifiers
2. Unidirectional/dc
3. Silicon
4. 4% ripple

1. What type of electrical power utilizes three simultaneous voltage waveforms out of step with each other by 120°?
2. How does the voltage applied to the x-ray tube differ between single-phase and three-phase power?
3. What type of voltage generators uses inverter circuits to convert dc into a series of square pulses?
4. X-ray equipment operated by single-phase power produces what percentage voltage ripple?

1. Three-phase power
2. With three-phase power, the applied voltage never drops to zero; it is nearly constant potential.
3. High-frequency generators
4. 100%

1. How much kV reduction can be expected using three-phase equipment compared to single-phase equipment?
2. How are x-ray quantity and quality affected when changing from half-wave to full-wave rectification?
3. What is the name of the electronic vacuum tube that functions to amplify the fluoroscopic image, thereby reducing patient dose?

1. 10 kV
2. X-ray quantity doubles; quality remains unchanged.
3. The image intensifier

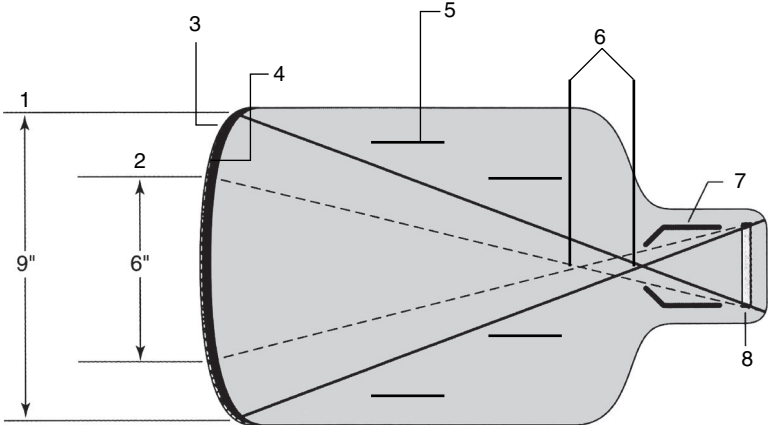
1. Fluoroscopic x-ray photons exiting the patient first encounter which part of the image intensifier?
2. What component of the image intensifier emits electrons?
3. How does the image on the image intensifier's output phosphor compare with the image on its input phosphor?

1. The input phosphor
2. The photocathode
3. The image on the output phosphor is minified, brighter, and inverted.

1. Of what material is the image intensifier's input phosphor usually made?
2. What is emitted by the photocathode when it is struck by light photons emitted by the input phosphor?
3. What component of the image intensifier assists in directing electrons toward the output phosphor?

1. Cesium iodide
2. Electrons
3. Electrostatic focusing lenses

1. Which number in the illustration identifies the photocathode?
2. Which number in the illustration identifies the output phosphor?
3. Which number illustrates the use of the default mode?



1. Number 4
2. Number 8
3. Number 1

1. The equation to the right is used to determine _____.

$$\left(\frac{\text{Input screen diameter}}{\text{Output screen diameter}}\right)^2$$

2. The equation to the right is known as _____.

$$\frac{V_s}{V_p} = \frac{N_p}{N_s}$$

3. Minification gain × flux gain =

1. minification gain
2. the transformer law
3. total brightness gain

1. How is fluoroscopic magnification mode related to spatial resolution, contrast resolution, and patient dose?
2. The reduction in brightness around the periphery of the fluoroscopic image is termed _____.
3. What two kinds of devices may be used to convert the fluoroscopic output phosphor image into an electronic signal?
4. The use of pulsed fluoroscopy can function to _____ patient dose.

1. Fluoroscopic magnification = improved spatial resolution, improved contrast resolution, higher patient dose
2. vignetting
3. A TV camera or a CCD (charge coupled device)
4. decrease

1. A TV camera and a CCD each function to convert the output phosphor image into _____.
2. Which of the above two devices has greater sensitivity to light and provides a higher SNR (signal-to-noise ratio) and improved contrast resolution?
3. The fluoroscopic x-ray tube operates in the radiographic mode during what kind of fluoroscopy?
4. A stored fluoroscopic image, from the immediately previous fluoroscopic exposure, is a dose-reducing feature termed _____.

1. an electronic signal
2. CCD
3. Digital (DF)
4. last image hold

1. What type of exposures are made during digital fluoroscopy (DF)?
2. In DF, what is the term used to describe the time required for the x-ray tube to be switched on and reach the selected factors?
3. In DF, what is the term used to describe the time required for the x-ray tube to terminate its exposure?
4. During DF, the (under-table) x-ray tube operates in the _____ mode.

1. Pulsed exposures (pulse progressive fluoroscopy)
2. Interrogation time
3. Extinction time
4. radiographic

1. What device is connected to the output phosphor of the DF image intensifier tube?
2. How is the use of CCDs related to spatial resolution, SNR, DQE, and patient dose?
3. How do flat-panel digital fluoroscopy (FPDF) detectors compare to CCDs with respect to contrast resolution, image distortion, and DQE?
4. When comparing CR and DR, which CR step is omitted in DR?

1. The CCD
2. CCDs provide high spatial resolution, high SNR, high DQE, and lower patient dose.
3. FPDF detectors provide better contrast resolution, uniformly distortion-free images, and high DQE.
4. The scintillation step

1. What shape is the image display format in flat-panel digital fluoroscopy (FPDF) compared to traditional image-intensified fluoroscopy?
2. In which of the above systems are pixels less likely to be distorted?
3. What do FPDF units use to convert x-rays directly into electrical charges?
4. What x-ray scintillator may be used for *in*direct flat-panel radiographic or fluoroscopic imaging?

1. FPDF has a rectangular image display format, while traditional image intensifier display is circular.
2. FPDF
3. An amorphous selenium (a-Se) photoconductor
4. Cesium iodide (CsI) or gadolinium oxysulfide (Gd_2O_2S)

1. What is the digital imaging postprocessing function that can reregister an image to correct for patient motion during serial image acquisition?
2. What is the digital imaging postprocessing function that enables addition of text to an image?
3. The process of transmitting images remotely, and viewing remote images is termed _____.

1. Pixel shift
2. Annotation
3. teleradiology

1. What is the fluoroscopic feature that changes kV and/or mA according to part thickness?
2. Certain materials emit light when they are exposed to another type of light. This characteristic is called _____.
3. The storage screens typically used in CR contain what type of phosphor material?

1. ABC (automatic brightness control)
2. photostimulable luminescence (PSL)
3. Europium-activated barium fluorohalide (BaFl:Eu)

1. Arrange the following six layers of a PSP screen in correct order from front to back: reflective layer, phosphor layer, base, protective coat, lead, antistatic layer.
2. What is the function of the image plate (IP)?
3. Arrange the following CR steps in CR in correct order from first to last: read, stimulate, erase, expose.
4. What kind of light is used to stimulate the PSP?

1. (Front) protective coat, phosphor layer, reflective layer, base, antistatic layer, lead (back)
2. To house and protect the PSP
3. Expose, stimulate, read, erase
4. Monochromatic helium neon (HeNe) gas laser or a solid-state laser beam

1. Why must image plates be erased after use?
2. What is used to erase the PSP?
3. Why should PSPs be processed and read soon after exposure?

1. To remove any residual image, “ghost image,” on subsequent images
2. Intense white light
3. Signal loss (image fading) becomes apparent after approx 8 hours.

1. Name the two most common types of mobile/portable x-ray equipment.
2. List three common uses of mobile/portable x-ray equipment.
3. What is the term used to describe radiation dose *and* volume of irradiated tissue?
4. What type of mobile x-ray unit uses a grid-controlled x-ray tube?

1. Battery operated and capacitor discharge
2. Trauma radiography, bedside radiography, and surgical radiography
3. Dose area product (DAP)
4. Condenser/capacitor discharge mobile unit

1. What program has the following three component parts: acceptance testing, routine performance monitoring, and maintenance?
2. When evaluating collimator accuracy, the illuminated light field must coincide with the actual x-ray field to within what percent of the SID?
3. What three tools can be used to measure the focal spot size; which is the most commonly used?

1. Quality control (QC) program
2. 2%
3. Slit camera, the pinhole camera, and the star pattern; slit camera is most commonly used.

1. A line-pair test tool is used to evaluate _____.
2. The SSD in diagnostic mobile radiography must not be less than _____ in (_____ cm).
3. When evaluating kVp calibration, the measured kVp should be within what percentage of the selected kVp?

1. Spatial frequency/resolution
2. 12 in; 30 cm
3. 10%

1. Exposure timer accuracy (greater than 10 ms) should be within what percentage of the selected exposure time?
2. Various combinations of mA and exposure time that produce the same mAs value should produce constant radiation output; this is termed _____.
3. With a selected mA, exposure time, and kVp, repeated exposures should produce identical radiation output; this is called _____.

1. 5%
2. exposure linearity
3. exposure reproducibility

1. Exposure linearity between adjacent mA stations must be accurate to within _____.
2. Exposure reproducibility should be consistent to within what percentage?
3. How/when are lead-protective apparel such as aprons, gloves, thyroid shields, and gonad shields determined to meet quality control standards?

1. 10%
2. ±5%
3. They must be radiographed or fluoroscoped annually to ensure that no holes, cracks, or other defects are present.

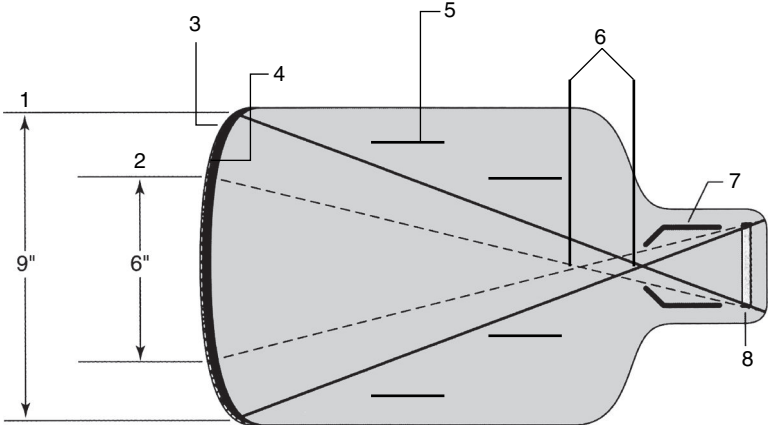
1. What device is used to measure the luminance of image display monitors and their uniformity; in what unit is it measured?
2. Pincushion distortion is common in what type of display device?
3. The TG 18-QC test pattern is used for_____.

1. A photometer; candela per square meter (cd/m^2)
2. Cathode ray tubes (CRT)
3. visual appraisal of monitor image geometric distortion

1. If a grid used in CR has a frequency similar to the CR processor's scan frequency, what type of artifact can result?
2. What it is the grid frequency recommended for CR?
3. What causes "ghost" images on PSPs?

1. Aliasing/Moiré effect
2. 178 lines/in or 70 line/cm
3. Incomplete erasure of the PSP

1. Which number in the illustration shown refers to the magnification mode?
2. Which number in the illustration shown indicates the electrostatic focusing lens?
3. The electron focal point in the magnification mode is _____ the output phosphor than the focal point in the default mode.



1. Number 2
2. Number 5
3. Farther from

1. In what two ways do the PSPs europium-activated barium fluorohalide phosphors react when stimulated by x-ray exposure?
2. When trapped PSP electrons are scanned by the laser beam, in what form is electron energy released?
3. Some materials absorb x-ray energy and emit visible light in response. This is termed _____.

1. They *emit* some light, and they *store* some energy as the latent image.
2. They emit light, ie, photostimulable luminescence (PSL).
3. scintillation

1. What is the term used to describe the number of gray shades that can be displayed within a pixel?
2. What device is used to collect light emitted by storage plate phosphors?
3. What is the device that converts PSL to an electronic signal for display?
4. How does sampling frequency of PSPs impact spatial resolution?

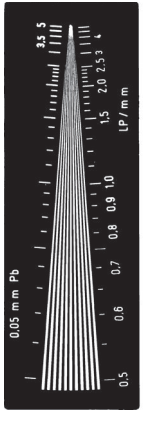
1. Bit depth
2. Photodetector
3. ADC (analog-to-digital converter)
4. As sampling frequency increases, spatial resolution increases.

1. What is the *photodetector* generally used with a TFT array in *indirect* capture digital imaging?
2. What is the *photoconductor* generally used with a TFT array in *direct* capture digital imaging?
3. TFT size in (cassetteless) digital systems impacts what image characteristic?

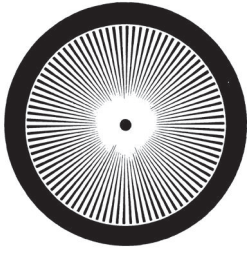
1. Amorphous silicon (a-Si)
2. Amorphous selenium (a-Se)
3. Spatial resolution

1. The tools shown in the illustration are used to measure what image quality?
2. In what unit is this quality measured?
3. What other factors can impact this image quality?

07-515
07-523
07-539



07-503 07-542
07-509 07-543



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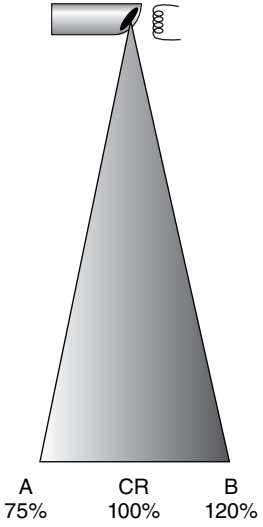
1. Resolution/recorded detail
2. lp/mm
3. Focal spot size, motion, SID, OID

1. What x-ray beam phenomenon is shown here?
2. How is x-ray beam intensity impacted by this phenomenon?
3. In what three ways can this phenomenon be deemphasized?

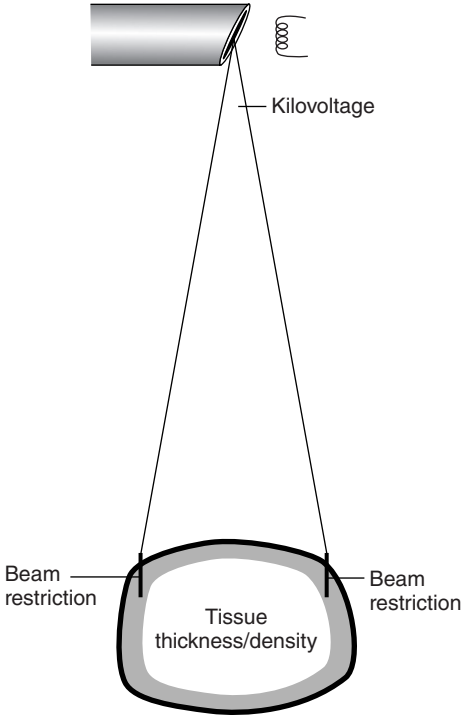


1. The anode heel effect
2. X-ray intensity increases toward the cathode end of the beam.
3. With longer SIDs, with smaller size IRs, and with x-ray tubes having greater anode angles.

1. The greatest enemy of recorded detail is _____.
2. The exposure factor used to regulate contrast scale in film/screen imaging is _____.
3. The exposure factor used to regulate image density in film/screen imaging is _____.
4. SID has its greatest impact on what two image quality features?
5. Focal spot size impacts what image quality?

1. motion
2. kV (kilovoltage)
3. mAs (milliampere-seconds)
4. Image density and recorded detail/spatial resolution
5. Recorded detail/spatial resolution

1. The features/factors illustrated here have a significant impact on what quality of the x-ray image?
2. How does each of these features/factors affect that production?



1. scattered radiation
2. As kV increases, scattered radiation production increases; as field size increases, scattered radiation production increases; as tissue thickness/density increases, scattered radiation production increases.

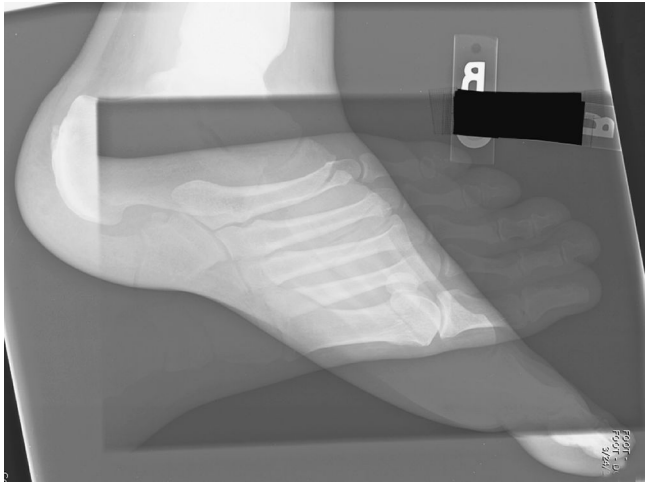
1. From the following list, select the factor(s) that are most likely to have an impact on image *contrast* in film-screen imaging: focal spot size, SID, OID, kVp, mAs.
2. From the following list, select the factor(s) that are most likely to have an impact on image *contrast*: motion, beam restriction, protective filtration, grids.
3. From the following list, select the factor(s) that are most likely to have an impact on image *contrast*: part thickness, anode heel effect, pathology.

1. OID, kVp
2. Beam restriction, grids
3. Part thickness, pathology

1. From the following list, select the factor(s) that are most likely to have an impact on image *spatial resolution*: focal spot size, SID, OID, kVp, mAs.
2. From the following list, select the factor(s) that are most likely to have an impact on image *spatial resolution*: motion, beam restriction, protective filtration, grids.
3. From the following list, select the factor(s) that are most likely to have an impact on image *spatial resolution*: part thickness, anode heel effect, pathology.

1. Focal spot size, SID, OID
2. Motion
3. Part thickness (resulting in OID)

1. What exposure error is illustrated in the image here?
2. Why is this CR image not overexposed?
3. Lack of adequate collimation and/or selection of incorrect processing algorithm is likely to cause _____ errors.



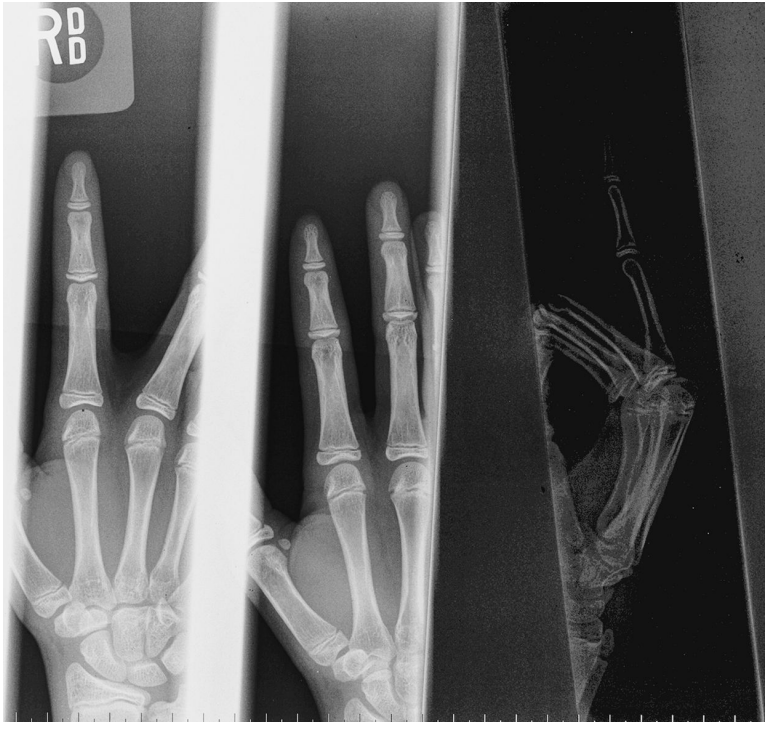
(Used with permission of Stamford Hospital, Department of Radiology.)

1. Double exposure
2. Because of automatic rescaling
3. histogram analysis

1. From the following list, select the factor(s) that are most likely to have an impact on image *distortion*: focal spot size, SID, OID, kVp, mAs.
2. From the following list, select the factor(s) that are most likely to have an impact on image *distortion*: motion, beam restriction, protective filtration, grids.
3. From the following list, select the factor(s) that are most likely to have an impact on image *distortion*: part thickness, x-ray tube angle, IR angle.

1. SID, OID
2. Motion
3. Part thickness, x-ray tube angle, IR angle

1. What was the cause of the exposure problem seen in this image?
2. What does the abbreviation ROI refer to?
3. CR artifacts that appear as random small black spots are usually representative of _____.



(Reproduced, with permission, from Shephard CT. Radiographic Image Production and Manipulation: McGraw-Hill, 2003.)

1. Improper partitioning of the IP, causing failure of exposure field recognition
2. Region of interest
3. fog from environmental sources

1. What is the name of the computerized system in which the radiographer has a selection of exams available on the console from which to choose?
2. What is the name of the computerized system in which preprogrammed exposure techniques are available?
3. What is the name of the device that can be used to measure anatomical parts?

1. Anatomically programmed radiography
2. Anatomically programmed radiography
3. Calipers

1. What is the name of the exposure system that is used to make small incremental changes in exposure to compensate for variations in body part thickness?
2. What is the name of the exposure system that uses an established, optimum kV for each anatomical part?
3. What kV increase is indicated for a medium-sized plaster cast?

1. Variable kilovoltage (kV) system
2. Fixed kilovoltage (kV) system
3. 5 to 8 kV increase

1. Using the variable kV exposure system, how is kV adjusted for each centimeter increase or decrease of tissue thickness?
2. Select the condition(s) that are likely to require an increase in exposure: atelectasis, gout, pneumonia, emphysema, osteochondroma.
3. Select the condition(s) that are likely to require a decrease in exposure: congestive heart failure, sclerosis, pneumothorax, osteoporosis, cirrhosis.
4. What type of cast often requires no change in exposure?

1. ±2 kV
2. Atelectasis, pneumonia, and osteochondroma
3. Pneumothorax and osteoporosis
4. Fiberglass

1. How should technical factors be adjusted in pediatric radiography to minimize possible motion?
2. List some examples of immobilization devices, techniques, and equipment used in pediatric radiography.
3. What are the two basic types of artificial contrast media?

1. Short exposure time with higher mA should be used.
2. Pigg-O-Stat, Papoose Board, sheet wrap (“mummifying”), sandbags, compression band, stockinette, tape, radiolucent sponges, etc
3. Positive and negative

1. What are the two types of compound substances used to make positive contrast media?
2. Artificial contrast media are required when subject contrast is _____.
3. Artificial contrast agents can be introduced into the body in what two ways?
4. Which type of contrast agent produces increased brightness in tissues?

1. Iodine and barium
2. low
3. Injection and ingestion
4. Positive contrast agents

1. What can be used to increase image contrast when radiographing tissues having low subject contrast?
2. Which system uses preprogrammed sets of exposure factors available for selection by the radiographer?
3. What is the system that terminates the x-ray exposure, thereby consistently controlling the amount of radiation reaching the IR?

1. An artificial contrast agent
2. Anatomically programmed radiography (APR)
3. Automatic exposure control (AEC)

1. What are the component parts of the AEC that function to measure the amount of radiation transmitted?
2. What type of AEC uses a photomultiplier tube?
3. What type of AEC is considered an “entrance-type” device?

1. The detectors (also called: cells, chambers, sensors)
2. Phototimer
3. Ionization chamber

1. When using AEC, the radiographer should set the backup time to _____ of the total expected required exposure time.
2. Regulations require that AECs have a _____ mAs safety override.
3. Why is part positioning/centering so critical when using AEC?

1. 150%
2. 600
3. If the part is not accurately centered to the appropriate detector, over- or underexposure is likely to occur.

1. If a PA chest was performed with the center detector selected, the resulting image is likely to be _____.
2. If a lateral lumbar spine were performed with the center detector selected and the spinous processes centered to the sensor, the resulting image is likely to be _____.
3. What is the term used to describe the shortest exposure time that a particular AEC system can produce?

1. overexposed
2. underexposed
3. Minimum response time

1. From the following list, select the factors that can have a significant impact on *receptor exposure*: focal spot size, SID, OID, kVp, mAs.
2. From the following list, select the factors that can have a significant impact on *receptor exposure*: motion, beam restriction, protective filtration, grids.
3. From the following list, select the factors that can have a significant impact on *receptor exposure*: part thickness, anode heel effect, pathology.

1. SID, kVp, and mAs
2. Beam restriction and grids
3. Part thickness, anode heel effect, and pathology

1. For the same FOV, arrange the following matrix sizes in order of increasing spatial resolution: 1024 × 1024, 512 × 512, 4096 × 4096.
2. The extent/number of exposure intensities an image receptor can accurately detect is termed _____.
3. What is the term used to describe a combination of rows and columns of small picture elements?

1. 512 × 512, 1024 × 1024, 4096 × 4096
2. dynamic range
3. Matrix

1. In film/screen imaging, what impact does intensifying screen speed have on image density?
2. In film/screen imaging, what impact does intensifying screen speed have on image recorded detail?
3. In film/screen imaging, fast film speed is likely to produce what kind of image contrast?

1. Increased speed = increased image density
2. Increased speed = decreased image recorded detail
3. Increased film speed = higher/shorter scale contrast

1. What characteristics impact intensifying screen speed?
2. Intensifying screens made with large phosphors in a thick layer are likely to be what general speed?
3. In film/screen imaging, why is perfect film/screen contact essential?

1. Phosphor type, thickness of active/phosphor layer, size of phosphors
2. Fast speed
3. To maintain good detail, any area of poor contact results in considerable blurriness/loss of recorded detail.

1. In diagnostic imaging, how are pixel size and matrix size related?
2. What term is used to describe the volume elements within a matrix?
3. The larger the matrix size, for a given FOV, the _____ the pixel size and the _____ the spatial resolution.

1. As matrix size increases, pixel size decreases.
2. Voxel
3. smaller; better/greater

1. A digital image is made up of a 2D array of numbers called a _____.
2. What term is used to describe the picture elements within a matrix?
3. What formula is used to determine pixel size?

1. matrix
2. Pixel
3. FOV/matrix size

1. What kind of image contrast results from a narrow/decreased window width?
2. What is the term used to describe number of pixels per unit area?
3. What is the term used to describe distance from the center of one pixel to the center of the adjacent pixel?

1. Increased/higher contrast
2. Pixel density
3. Pixel pitch

1. How do changes in pixel density and pixel pitch impact spatial resolution?
2. How is receptor exposure related to quantum mottle/noise?
3. How is TFT DEL size related to spatial resolution in cassetteless digital imaging?

1. Increased pixel density increases spatial resolution; decreased pixel pitch increases spatial resolution.
2. As receptor exposure (quantity of x-ray photons) decreases, the likelihood of quantum noise increases.
3. The smaller the DEL size, the better the spatial resolution.

1. What kind of dynamic range allows optimal visualization of both soft tissue and bony structures in a given image?
2. Undesirable fluctuations in image brightness, dependent on the number of x-ray photons reaching the IR, is termed _____.
3. How is increased mA likely to affect SNR?

1. Wide dynamic range
2. quantum/image noise
3. Increased mA = increased SNR

1. What are three methods of providing proper identification on radiographic image?
2. What is the minimum information legally required on every x-ray image?
3. In film/screen imaging, under what general environmental conditions should boxes of film be stored?

1. Photographic, radiographic, and electronic
2. Patient name/identification number, date, institution/office, and side marker
3. In a cool, dry place

1. In x-ray film processing, what type of solution is the developer; the fixer?
2. In x-ray film processing, where are exposed silver bromide grains changed to black metallic silver?
3. In x-ray film processing, what processing solution is responsible for removing unexposed silver from the film emulsion?

1. Alkaline, acid
2. In the developer solution
3. In the fixer solution

1. Arrange the following film processor components in their correct order:
   fixer, dryer, developer, wash.
2. What system of the film processor is responsible for keeping correct solution levels?
3. What are some causes of film processor jam-up?

1. Developer, fixer, wash, dryer
2. Replenishment system
3. Improper solution temperature, contamination, improper solution replenishment

1. Which processing solution is closely related to film archival quality?
2. From which processing solution is silver recovery made?
3. How should boxes of unexposed radiographic film be stored?

1. The fixer solution
2. The fixer solution
3. In a cool dry place, away from ionizing radiation, with appropriate darkroom safelight, and stored in a vertical position (not stacked horizontally)

1. What is the name of the graphic representation of the amount of exposure, and the frequency of pixels for each exposure amount?
2. How can image degradation from scattered radiation be reduced when making more than one exposure on a CR image plate?
3. How does the sensitivity of digital detectors compare to the sensitivity of x-ray film?

1. Histogram
2. Shield any unexposed and/or exposed areas during each individual exposure.
3. Digital detectors are far more sensitive to environmental, background, scatter, and off-focus radiation.

1. The pathologic condition shown in this image is likely to require a/an (increase/decrease) in exposure factors.
2. What anatomical structure is seen as the darker areas within the abdominal image shown here?
3. Was this image made in the recumbent or the erect body position?

(From the American College of Radiology Learning File. Used with permission of the American College of Radiology.)

1. decrease
2. Small bowel
3. Recumbent (no air/fluid levels seen)

1. Why are there many preestablished, programmed histograms available in digital x-ray equipment?
2. Scattered and off-focus radiation outside of the collimated field can have what effect on the width of the histogram?
3. Why is it important to erase an IP that has not been used for 48 hours, or if there is any question about when it was last erased?

1. To be available for a wide variety of anatomic parts to be imaged
2. Causes widening of the histogram
3. To avoid background radiation artifacts

1. What is the name of the computer system that tracks admission and discharge information, diagnostic and treatment services, pharmaceutical and equipment information, and billing information?
2. What is the name of the computer system that tracks radiological procedure ordering and scheduling, patient database maintenance, reporting and transcription, and billing?
3. What is the name of the network of computers capable of acquiring, storing, and transmitting medical images?

1. HIS (hospital information system)
2. RIS (radiology information system)
3. PACS (Picture Archiving and Communication System)

1. In CR, to what does the term “saturation” refer?
2. In digital systems, pixel pitch is related to spatial resolution. The _____ the pixel pitch, the better the spatial resolution.
3. How are the Nyquist frequency and pixel pitch related to spatial resolution?

1. Overexposure of the PSP
2. smaller
3. Maximum spatial resolution = Nyquist frequency (which is equal to one-half the pixel pitch [mm])

1. In CR, "beyond a certain exposure level, a large number of pixels reach maximum digital value resulting in loss of detail visibility." This defines _____.
2. If a 0.050-mm pixel pitch yields a Nyquist of 10 lp/mm, a 0.100-mm pixel pitch will yield a Nyquist of _____.
3. Direct digital (cassetteless) systems have a fixed spatial resolution that is determined by _____.

1. image *saturation*
2. 5 lp/mm (Nyquist = 0.5 pixel pitch in mm)
3. thin film transistor (TFT) *detector element (DEL) size*

1. As sampling frequency increases, spatial resolution increases. How is sampling frequency expressed?
2. What is the most common cause of histogram analysis errors?
3. The feature of digital imaging that provides correction of over- or underexposure by way of histogram shift is referred to as _____.

1. Pixels/millimeter (or pixel density)
2. Exposure field recognition errors
3. Automatic rescaling

1. How/why do exposure field recognition errors usually occur?
2. What does the abbreviation VOI represent?
3. During image processing, what determines the numbers assigned to pixel values resulting in brightness and contrast changes?

1. From inclusion of scatter and off-focus radiation outside the VOI area, often as a result of improper alignment of part, x-ray beam, and IP
2. Values of interest
3. The LUT (lookup table)

1. The higher/greater the bit depth in digital imaging, the _____ the number of gray shades.
2. What are the two most common ways of adjusting brightness and/or contrast levels in digital imaging?

1. greater
2. LUT (lookup table) and windowing

1. What is the primary factor influencing image contrast in digital imaging?
2. The representation of reference luminance values that assess input intensities and assign predetermined VOI (values of interest/grayscale values) describes _____.
3. Once VOIs are assigned, what process then adjusts an over/underexposed image?

1. Lookup tables (LUTs)
2. lookup tables (LUTs)
3. Rescaling

1. Which of the postprocessing functions serves to increase contrast along image borders?
2. Which of the postprocessing functions serves to adjust under/overexposed areas, giving the image an overall appearance of lower contrast?
3. Which of the postprocessing functions serves to suppress image noise?

1. Edge enhancement
2. Equalization
3. Smoothing

1. Which of the postprocessing functions allows text to be added to the image?
2. Which of the postprocessing functions permits changing of the image from negative to positive?
3. What is the postprocessing function that serves to protest the viewer's eyes from extraneous illuminator light?

1. Annotation
2. Image inversion
3. Electronic masking

1. A wide window width will display an image having what kind of contrast?
2. Quality assurance testing of monitor luminance requires the use of what device?
3. What are some important guidelines regarding monitor display and lighting in primary display workstations?

1. Low contrast
2. A photometer
3. Minimal ambient lighting and reflection, minimal veiling glare, luminance of at least 171 candelas/m^2, at least 8-bit luminance resolution

1. What is a primary display workstation?
2. What postprocessing function manipulates image contrast?
3. What postprocessing function manipulates image brightness?

1. One that is used for image interpretation
2. Adjusting window width
3. Adjusting window level

1. What is the common language that enables communication and exchange between image acquisition modalities, display stations, and storage?
2. What is the term used to describe the electronic network for communication between image acquisition modalities, display stations, and storage?
3. The abbreviation HIS refers to _____.

1. DICOM (**D**igital **I**maging and **CO**mmunications in **M**edicine)
2. PACS (picture archiving and communication system)
3. hospital information system

1. What component of HIS functions to provide each modality work list, patient tracking, scheduling, and image tracking?
2. What is the comprehensive integrated system that is designed to manage medical, administrative, financial, and legal aspects of hospitals?
3. Compared to the H&D/characteristic curve typical of film emulsion, the digital image has a _____ response to x-ray exposure.

1. RIS (radiology information system)
2. HIS (hospital information system)
3. linear

1. Digital receptor exposure is _____ to the selected mAs.
2. Digital receptor exposure is _____ the selected SID.
3. In (cassette-based) CR, what is used to express an acceptable exposure level to the PSP?
4. What is the term used to describe the numeric value representative of the exposure the IR receives in digital radiography?

1. directly proportional
2. inversely proportional to the square of
3. The recommended exposure range—expressed as S number, EI value, lgM number, dependent on equipment type
4. Exposure indicator (EI)

1. What should the radiographer use as a guide to evaluate a CR image and determine if it has been optimally exposed?
2. From these list of factors, select the one(s) that have an effect on *digital* image contrast/grayscale: pixel bit depth, window width, window level, matrix size, pixel density, LUT.
3. From these list of factors, select the one(s) that have an effect on *film-screen* image contrast/grayscale: grid ratio, SID, kilovoltage, mAs, protective filtration, focal spot size, OID.

1. The exposure indicator should indicate values within the recommended range.
2. Pixel bit depth, window width, LUT
3. Grid ratio, kilovoltage, OID

1. From these list of factors, select the one(s) that have an effect on digital image brightness: pixel bit depth, window width, window level, matrix size, pixel density.
2. From these list of factors, select the one(s) that have an effect on digital image resolution: pixel density, window level, pixel pitch, matrix size, window width.
3. What is the exposure indicator in digital (cassetteless) systems?

1. Window level
2. Pixel density, pixel pitch, matrix size
3. DAP (dose-area product)

1. What is the location of the DAP meter used in digital imaging?
2. From these list of factors, select the one(s) that have an effect on recorded detail in film-screen imaging: focal spot size, film-screen contact, OID, SID, filtration, motion, mAs, kVp, tube angle.
3. What are the two types of distortion?

1. At the collimator
2. Focal spot size, film-screen contact, OID, SID, motion
3. Size and shape

1. What influences shape distortion?
2. What influences size distortion?
3. What kind of patient information can be made part of the recorded image?

1. Tube, part, and IR alignment
2. OID and SID
3. Patient name/identification number, date, institution/office, side marker, patient position (eg, decubitus, erect), and time (eg, number of minutes after injection or ingestion of contrast)

1. Select the condition(s) that are likely to require an increase in exposure: ascites, multiple myeloma, pleural effusion, congestive heart failure.
2. Select the condition(s) that are likely to require a decrease in exposure: emphysema, bowel obstruction, hydrocephalus, edema.
3. What change in exposure is required when using iodine or barium contrast agents?

1. Ascites, pleural effusion, congestive heart failure
2. Emphysema, bowel obstruction
3. An increase in exposure

1. What causes an aliasing artifact in digital imaging?
2. When might background radiation artifacts occur in CR imaging?
3. The aliasing artifact, occasionally seen in digital imaging, is sometimes called _____.

1. If a grid used in CR has a frequency similar to the CR processor's scan frequency, aliasing effect can result.
2. When using an IP that has not been used or erased for 48 hours or more
3. Moiré effect

1. What do crescent-like artifacts represent on images in film-screen imaging?
2. What do black, branchlike artifacts represent in film-screen imaging?
3. What are some sources of image fog in film-screen imaging?

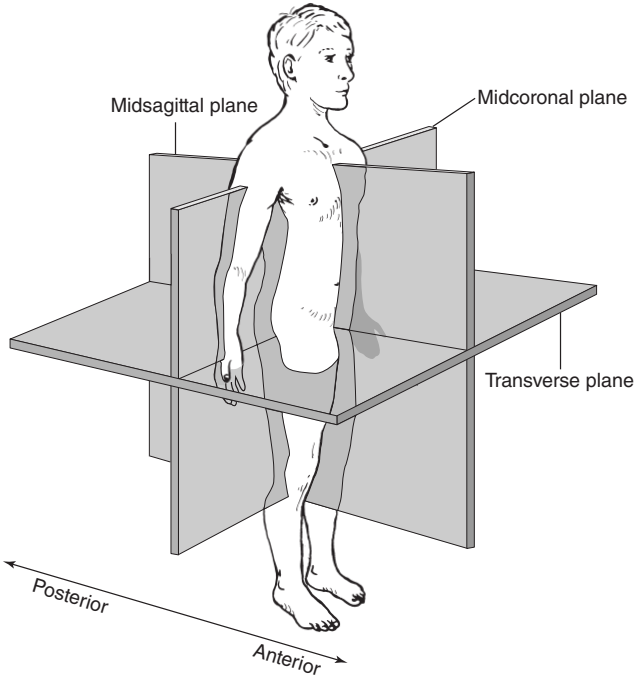
1. Bending the film acutely, before or after exposure
2. Static electrical discharge
3. Age (outdated film), chemical, radiation, temperature, darkroom safelight, loose cassette hinges, and darkroom light leaks

1. What does the abbreviation MTF represent?
2. What is the best way to express digital detector image resolution?
3. What does mAs control/regulate in digital imaging?

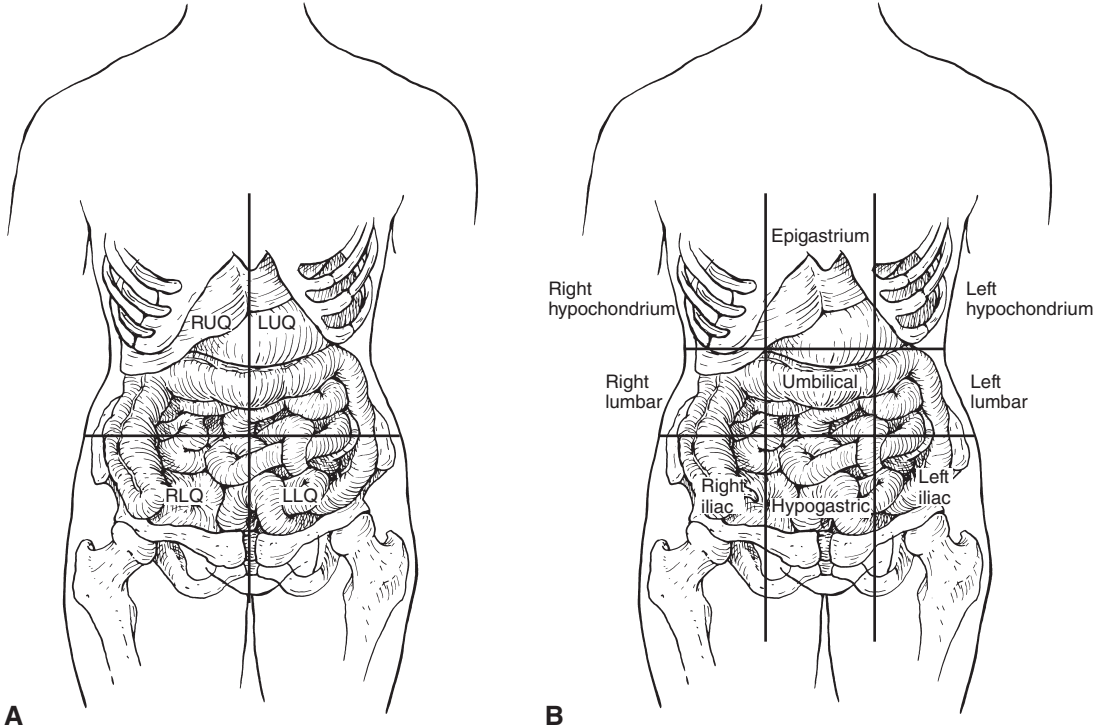
1. Modulation transfer function
2. MTF
3. Patient dose, receptor exposure, quantity of image-forming radiation

1. How will resultant image appear if there are too few x-ray photons reaching the digital image receptor?
2. What do exposure indicators (EI), expressed as S number, EI value, or lgM number depending on equipment type, indicate in digital imaging?
3. Digital imaging systems are _____ sensitive to scattered radiation than film emulsion.
4. _____ collimation should always be used with digital systems because excessive scatter causes _____ errors.

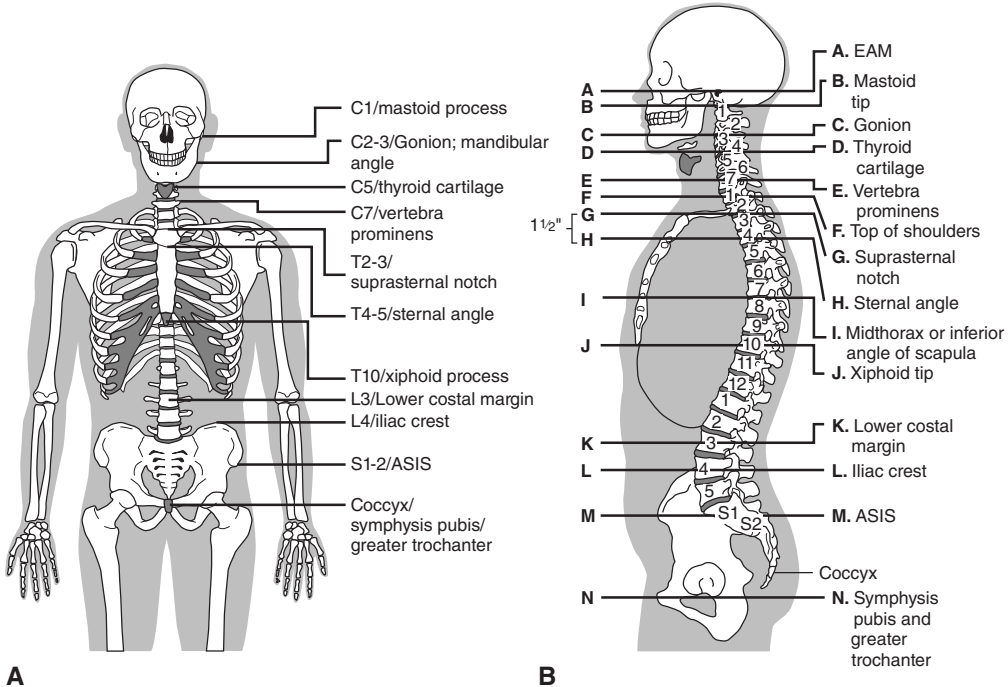
1. Noisy/quantum mottle/graininess
2. The acceptable range of exposure
3. more/significantly more
4. Precise/close; histogram analysis


Midsagittal plane
Midcoronal plane
Transverse plane
Posterior
Anterior

Body planes.



Abdomen: four quadrants, nine regions.



Body surface landmarks and localization points.

Vertebra(e)		Localization Point
Cervical region	C1	Mastoid process
	C5	Thyroid cartilage (Adam's apple)
	C7	Vertebra prominens
Thoracic region	T2–3	Suprasternal (jugular) notch
	T4–5	Sternal angle
	T7–8	Inferior angle of scapula
	T9	Xiphoid (ensiform) process
	T10	Xiphoid tip
Lumbar region	T12–L3	Kidneys
	L1	Transpyloric plane
	L3	Inferior costal margin
	L3–4	Umbilicus
	L4	Iliac crest
Sacral and coccygeal regions	S1–2	Anterosuperior iliac spine (ASIS)
	Coccyx	Symphysis pubis and greater trochanter

Positioning Terminology

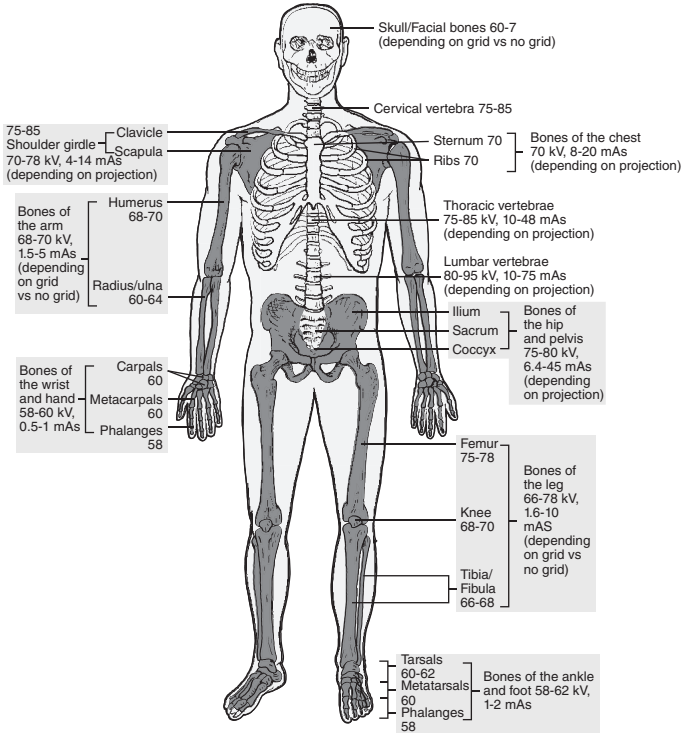
Radiographic position
Refers to body's physical position, eg, recumbent, erect, prone, supine, Trendelenburg, etc

Radiographic projection
Describes the path of the CR, eg, PA (CR enters posteriorly, exits anteriorly)

Radiographic view
Describes the body part as seen by the IR, eg, palmar view of the hand; infrequently used

General Terminology

1. Recumbent/lying down in any position
   - lying on back, face up = *supine*
   - lying on abdomen, face down = *prone*
   - supine, prone, or lateral, using horizontal CR = *decubitus*
2. Erect/upright/standing or sitting up
   - facing the IR = *anterior position*
   - with back toward IR = *posterior position*
3. Oblique position—erect or recumbent
   - *RAO/Right Anterior Oblique*: body rotated, with right anterior aspect nearest the IR
   - *LAO/Left Anterior Oblique*: body rotated, with left anterior aspect nearest the IR
   - *RPO/Right Posterior Oblique*: body rotated, with right posterior aspect nearest the IR
   - *LPO/Left Posterior Oblique*: body rotated, with left posterior aspect nearest the IR



Optimal kV ranges (and suggested mAs values *using digital equipment.*

1. What is the name of the plane that divides the body into left and right halves?
2. What is the name of the plane that divides the body into anterior and posterior halves?
3. What is the name of a plane that divides the body into superior and inferior portions?

1. Mid-sagittal plane (MSP)
2. Mid-coronal plane (MCP)
3. Transverse plane

1. What is the name of a plane that is parallel to the mid-sagittal plane?
2. What is the name of a plane that is parallel to the mid-coronal plane?
3. How do we describe a projection that is made angled to the long axis of the body?
4. What type of projection can be termed inferosuperior or superoinferior?

1. Sagittal plane
2. Coronal plane
3. Axial
4. Axial

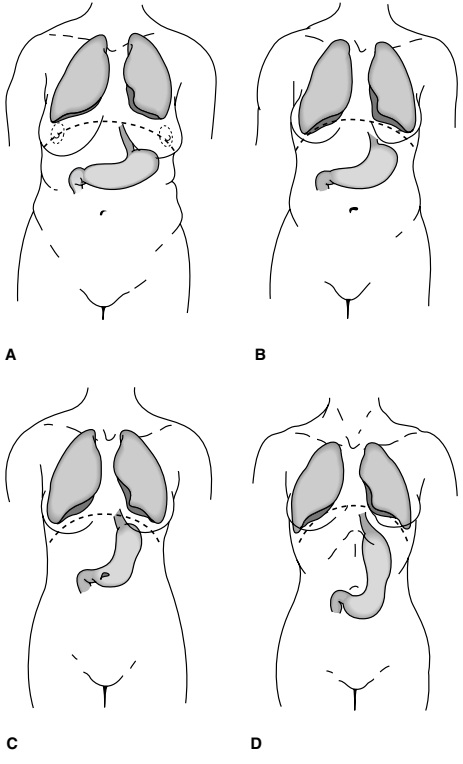
1. What is the name of the plane formed by the biting surfaces of the upper and lower teeth?
2. What term refers to the front part of the body; what term refers to the back part of the body?
3. What is the term that refers to:
   - the palm of hand.
   - the sole of the foot.
   - the palm of the hand or the sole of the foot.
4. What term is used to describe a projection that projects a part in profile by skimming surface?

1. Occlusal plane
2. Anterior/ventral; posterior/dorsal
3. Palmar; plantar; volar
4. Tangential

1. Which body system functions to permit movement, produce blood cells (hematopoiesis), support and protect body organs, and store calcium?
2. Which body system supplies oxygen to the blood and eliminates carbon dioxide from the blood?
3. Which body system functions to regulate fluid and electrolyte balance, eliminate some body wastes, and regulate the chemical composition of the blood?

1. Skeletal system
2. Respiratory system
3. Urinary/excretory system

1. What are the four types of body habitus?
2. Which type of body habitus is likely to have a short and wide lung area?
3. Which type of body habitus is likely to have redundant bowel loops?
4. Which type of body habitus is likely to have a high, transverse stomach?
5. Which of these figures illustrates the asthenic body habitus?



1. Hypersthenic, sthenic, hyposthenic, and asthenic
2. Hypersthenic
3. Hyposthenic, asthenic
4. Hypersthenic
5. Figure D is asthenic

1. The axial skeleton consists of _____.
2. The adults skeleton consists of _____ bones.
3. What are the four classifications of bones?

1. skull, vertebral column, ribs, and sternum
2. 206
3. Long, short, flat, and irregular

1. What is another term to describe dorsal recumbent?
2. What is another term to describe lying on the left or right side?
3. What is the term used to describe the recumbent body position, with head positioned at a level lower than the feet?

1. Supine
2. Lateral recumbent
3. Trendelenburg

1. Vertebra prominens is another name for _____.
2. The suprasternal/jugular notch is at what vertebral level?
3. The xiphoid/ensiform process is at what vertebral level?
4. The iliac crest is at what vertebral level?
5. The anterior superior iliac spine (ASIS) is at what vertebral level?

1. C7 (the 7th cervical vertebra)
2. T2-3
3. T10
4. L4
5. S1-2

1. What term is used to describe turning of the body or arm so that the palm faces backward, with the thumb toward the midline of the body?
2. What term describes movement of a part away from the body's MSP?
3. What term describes bending motion of an articulation, decreasing the angle between associated bones?
4. What term describes a turning outward or lateral motion of an articulation, sometimes with an external tension or stress applied?
5. What term describes movement of a limb that produces circular motion; circumscribing a small area at its proximal end and a wide area at the distal end?

1. Pronation
2. Abduction
3. Flexion
4. Eversion
5. Circumduction

1. In radiography of long bones, every effort should be made to include _____articulations associated with the injured bone, but it is *essential* to include at least the articulation _____.
2. Radiography of most structures usually requires a minimum of _____ projections; what is their relationship to each other?
3. Side-to-side (L/R) relationships are demonstrated in the _____ projection.

1. both; nearest the site of the injury
2. two; at right angles (perpendicular) to each other
3. frontal (AP/PA)

1. Anterior/posterior relationships are demonstrated in the _____ projection.
2. What is the most effective means of reducing voluntary motion?
3. What is the most important way to reduce involuntary motion?

1. lateral
2. Good communication
3. Use the shortest possible exposure time

1. Small bones found in tendons are termed_____.
2. The body/shaft of a long bone is mostly made of_____ type tissue, while the extremities of long bones are typically made of _____ tissue.
3. The hollow central portion of a long bone is termed the _____ and is filled with _____.
4. What are at least two examples of flat bones?
5. What are at least two examples of irregular bones?

1. sesamoid
2. compact/cortical; spongy/cancellous
3. medullary cavity/canal; bone marrow
4. Calvarium, sternum, ribs, scapulae
5. Facial bones, vertebra, pelvis bones

1. The membranous covering of bone is termed _____.
2. The membranous covering of cartilage is termed _____.
3. The type of cartilage found at the extremities of long bones and at their articulating surfaces is called _____.
4. The term used to describe secondary centers of ossification is _____; the term for primary ossification centers is _____.

1. periosteum
2. perichondrium
3. articular/hyaline cartilage
4. epiphysis; diaphysis

1. What is the name of the somewhat wider portion of a long bone adjacent to the epiphyseal plate?
2. Name and briefly describe the three classifications of joints/articulations.

1. Metaphysis
2.
   - Synarthrodial, fibrous, and immovable
   - Amphiarthrodial, cartilaginous, and partially movable
   - Diarthrodial, synovial, and freely movable

1. Identify the labeled parts 1 through 12 seen in this image.
2. What is the most lateral carpal of the distal carpal row?
3. The radiocarpal joint is the articulation between the radius and which carpal?
4. What articulation is formed by the ulnar notch and radial head?
5. The lateral aspect of the distal humerus presents a raised smooth surface called the _____, which articulates with the superior surface of the _____.
6. Tennis elbow is a painful condition that affects what bony area of the elbow?

1. 1: radial tuberosity, 2: neck of radius, 3: head of radius, 4: proximal radioulnar joint, 5: radius, 6: ulna, 7: base of fifth metacarpal, 8: lunate, 9: styloid process of ulna, 10: head of ulna, 11: scaphoid, 12: radial styloid process
2. Trapezium/greater multangular
3. Scaphoid
4. Proximal radioulnar articulation
5. capitulum; radial head
6. Lateral epicondyle (and sometimes radial head)

1. In which projection of the elbow should the coronoid process be viewed in profile?
2. How and where should the CR enter for the PA projection of the hand?
3. How and where should the CR enter for the AP projection of the shoulder?
4. How and where should the CR enter for the PA projection of the second digit?
5. Which projection on the digits will best demonstrate forward/backward fracture displacement?

1. Medial/internal oblique
2. Perpendicular to the third MPJ (metacarpophalangeal joint)
3. Perpendicular and 1 inch inferior to the coracoid process
4. Perpendicular to the proximal IPJ (interphalangeal joint)
5. Lateral

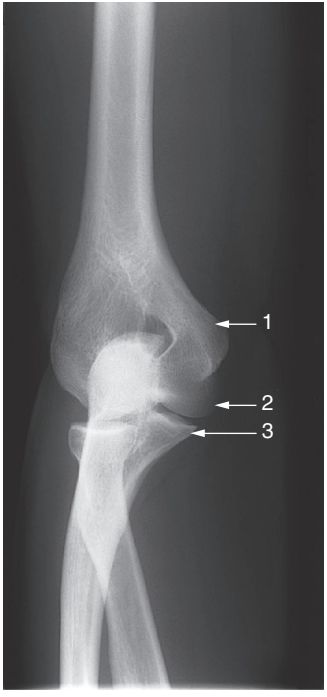
1. The common fracture located at the base of the first metacarpal is called a/an _____ fracture.
2. The type of fracture common to the neck of the fourth or fifth metacarpal is the _____ fracture.
3. A fracture of the distal radius characterized by anterior displacement of the fragments is termed a _____ fracture.
4. The "sail sign" or "spinnaker sail sign" (ie, billowing sail) seen in a lateral elbow radiograph indicates a/an _____.

1. Bennett fracture
2. boxer
3. Smith fracture (Colles = *posterior* displacement)
4. joint effusion/radial head fracture

1. Identify the numbered structures in this image; with what bone does #3 articulate?
2. The bones that form the palm of the hand are called the _____ ; that form the digits are called the _____.
3. The "knuckles" are actually what articulations?
4. The articulations between the wrist bones and the bones of the palm are termed the _____.
5. If the AP diameter of the concave carpel arrangement is diminished, the _____ nerve is impinged upon; this condition is called _____.
6. What is the most commonly fractured carpal?

1. 1: distal interphalangeal joint of second digit, 2: sesamoid bone, 3: base of 1st metacarpal, 4: head of 5th metacarpal; 3: articulates with the trapezoid
2. metacarpals; phalanges
3. Metacarpophalangeal articulations/joints
4. carpometacarpal articulations/joints
5. median nerve; carpal tunnel syndrome
6. Scaphoid

1. The image seen here is a _____ projection of the elbow. Identify the labeled parts.
2. Fracture of the distal radius, accompanied by posterior displacement and fracture of the ulnar styloid process, is typical of what type fracture?
3. The _____ portion of the radius and ulna are superimposed when the hand is _____.
4. What elbow fat pad, usually unseen in a normal and accurately positioned lateral elbow, is often visible in the presence of pathology?
5. What position will best demonstrate medial/lateral fracture displacement?



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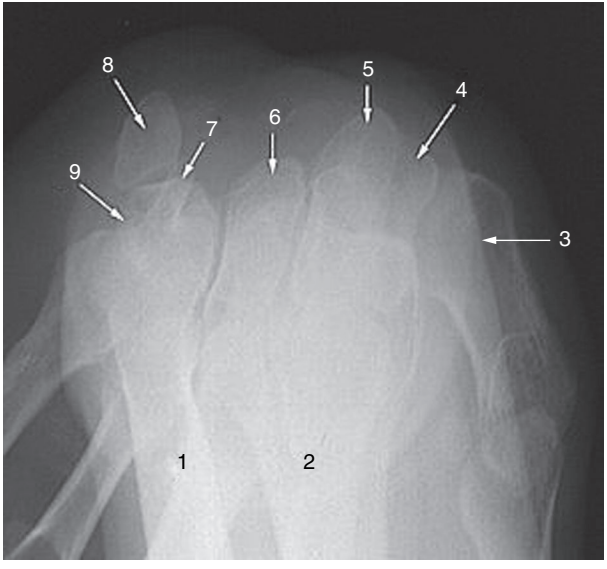
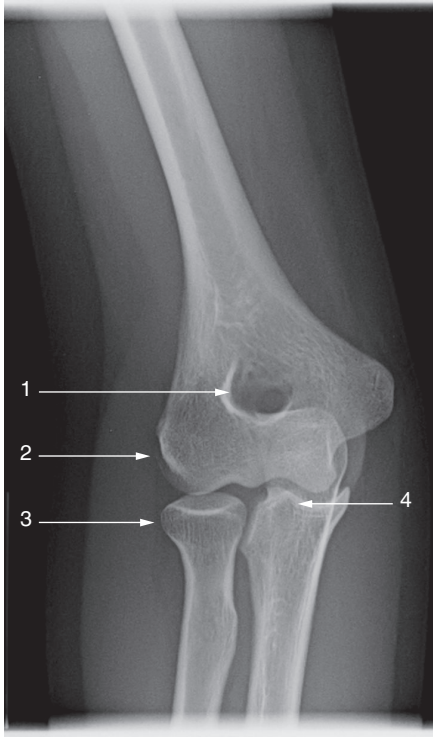
1. AP oblique medial (internal) rotation; 1: medial epicondyle, 2: trochlea, 3: coronoid process
2. Colles fracture
3. proximal; pronated
4. The posterior fat pad
5. AP

1. What position/projection is this image? Label the numbered structures.
2. What bones form the shoulder girdle?
3. What structure is composed of the supraspinatus, infraspinatus, teres minor, deltoid, and subscapularis muscles?
4. An oblique hand image demonstrates foreshortening of the digits and poor visibility of the interphalangeal joints. How can this be corrected?
5. The PA wrist with ulnar deviation is done to better demonstrate the carpal _____.
6. Where should the CR enter for an AP projection of the first digit?



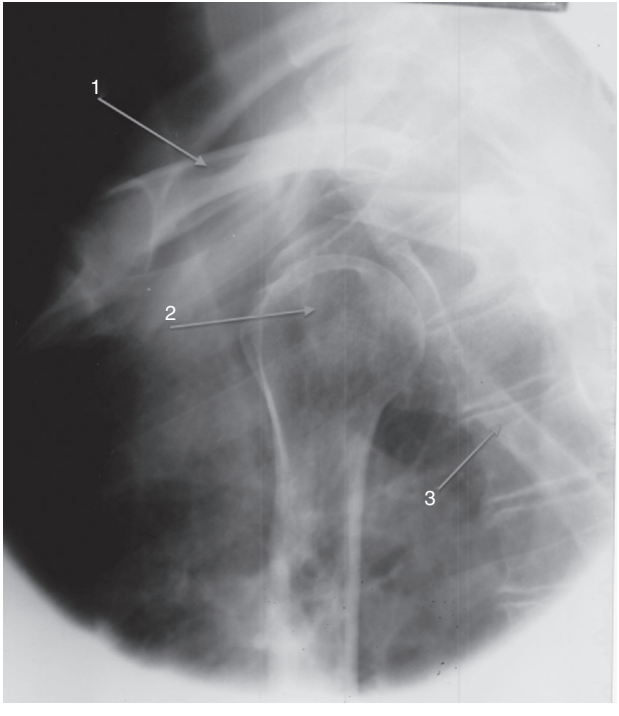
1. Carpal canal/tunnel position (inferosuperior projection); 1: ulna, 2: radius, 3: first metacarpal, 4: trapezium, 5: scaphoid, 6: capitate, 7: hamate (hamulus of), 8: pisiform, 9: hamate (body of)
2. Two scapulae and two clavicles
3. Rotator cuff
4. Extend the fingers and support them parallel to the IR (eg use a finger sponge)
5. scaphoid
6. Perpendicular to the first MCP (metacarpophalangeal joint)

1. Identify the labeled structures in this image.
2. The PA projection of the hand provides a/an _____ projection of the first digit.
3. The carpal canal/tunnel, tangential inferosuperior, projection of the wrist requires a CR angulation of how many degrees and in what direction?
4. If a lateral projection of the forearm demonstrates the epicondyles not superimposed, how should that positioning be corrected?
5. When the elbow cannot be extended for an AP projection of the elbow, what projections can be taken to demonstrate the required (AP) anatomy?
6. The AP lateral oblique, external rotation, projection of the elbow should demonstrate what structure free of superimposition?



1. 1: olecranon fossa, 2: capitulum, 3: radial head, 4: coronoid process
2. oblique
3. 25° to 30° to the long axis of hand
4. Place the humerus and forearm on the same plane
5. One AP with forearm parallel to IR; another AP with humerus parallel to IR
6. Radial head

1. Identify the labeled anatomic parts seen in this image.
2. The AP medial oblique, internal rotation, projection of the elbow should demonstrate what structure free of superimposition?
3. Images made of the elbow in the lateral position with the hand in external rotation, lateral position, pronation, and internal rotation are done to demonstrate what structure?
4. What is the long-curved process that extends laterally above the head of the humerus?
5. What is the only articulation between the upper extremity and thorax?



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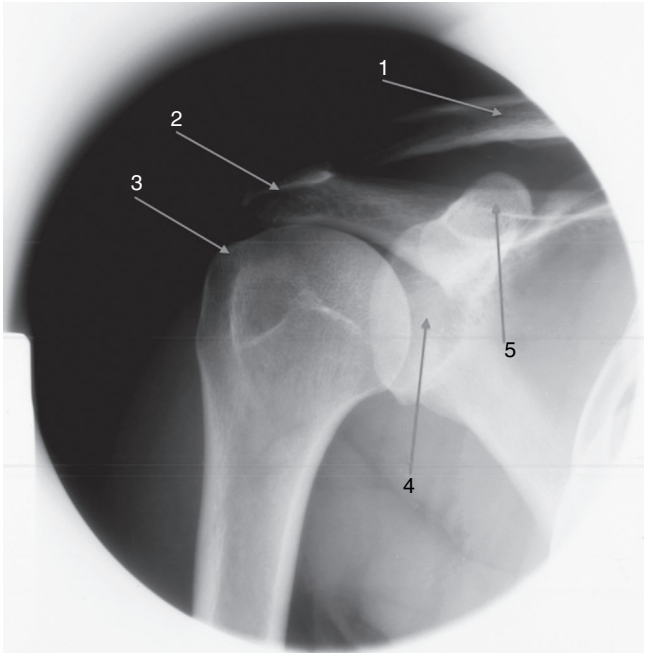
1. 1: clavicle, 2: head of humerus, 3: scapula
2. Coronoid process
3. Radial head
4. Acromion process
5. Sternoclavicular joint

1. Identify the labeled anatomic parts seen in this image.
2. A true AP projection of the shoulder is obtained in the _____ rotation position; the _____ should be seen in profile laterally.
3. The lateral projection of the humerus or elbow requires that the epicondyles be _____ to the IR.
4. What is the usual way of obtaining a lateral projection of the humerus in cases of trauma?
5. The inferosuperior axial projection of the shoulder requires that the arm be abducted 90° from the body and should be in the _____ rotation position.
6. The posterior oblique position, Grashey method, of the shoulder requires that the part be rotated so that the _____ of the affected side is parallel to the IR.



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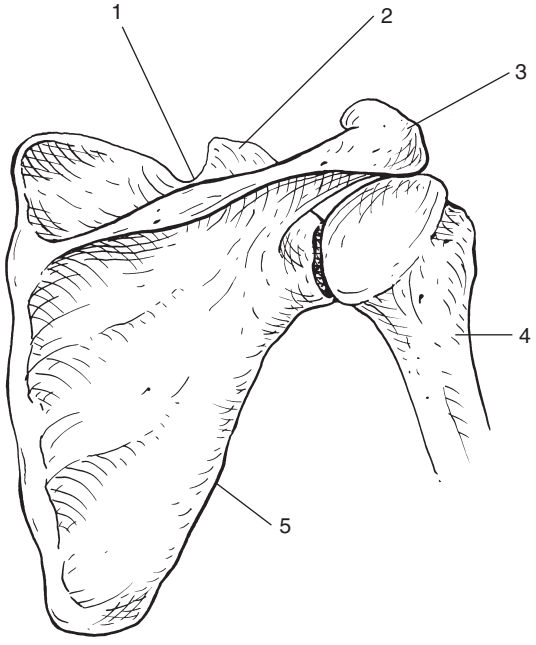
1. 1: clavicle, 2: acromion process, 3: greater tubercle/tuberosity, 4: glenoid fossa, 5: coracoid process
2. external; greater tubercle
3. perpendicular
4. Transthoracic lateral
5. external
6. scapula

1. Identify the numbered anatomical parts in the illustration seen here.
2. An internal rotation projection of the shoulder should demonstrate _____ in profile medially.
3. The AP projection of the humerus or elbow requires that the epicondyles be _____ to the IR.
4. Where should the CR enter for an AP projection of the glenohumeral/shoulder joint?
5. The anterior oblique position, scapular Y method, anterior dislocation is demonstrated when the humeral head is seen _____.
6. How are acromioclavicular articulations usually examined in order to demonstrate small separations?



1. 1: scapular notch, 2: coracoid process, 3: acromion process, 4: humerus, 5: axillary/lateral border
2. lesser tubercle
3. parallel
4. 1 in inferior to the coracoid process
5. beneath the coracoid process
6. Bilateral, with and without weights

1. In order to visualize a larger portion of the scapula in the AP projection, the arm should be placed _____.
2. The vertebral and axillary borders should be superimposed in the _____ projection of the scapula.
3. Which metatarsal has a large tuberosity, commonly subject to trauma?
4. Which tarsal lies immediately anterior to the talus and immediately anterior to the calcaneus?
5. Bones formed in tendons, often near articulations, are called _____.

1. in abduction
2. lateral
3. The fifth metatarsal
4. navicular; cuboid
5. sesamoids

1. What bones form the ankle joint?
2. The lateral malleolus is the distal expanded end of which bone?
3. What position best demonstrates visualization of the entire ankle mortise?
4. Osgood-Schlatter disease affects what bony part?
5. Why should the CR be directed 5° to 7° cephalad in the lateral projection of the knee?
6. What positioning change(s) should be made to improve this image?

1. Tibia, fibula, and talus
2. Fibula
3. 15° internal oblique ankle
4. Tibial tuberosity
5. To superimpose the femoral condyles
6. Too much anterior rotation; rotate part posteriorly enough to superimpose femoral condyles and open femoropatellar joint

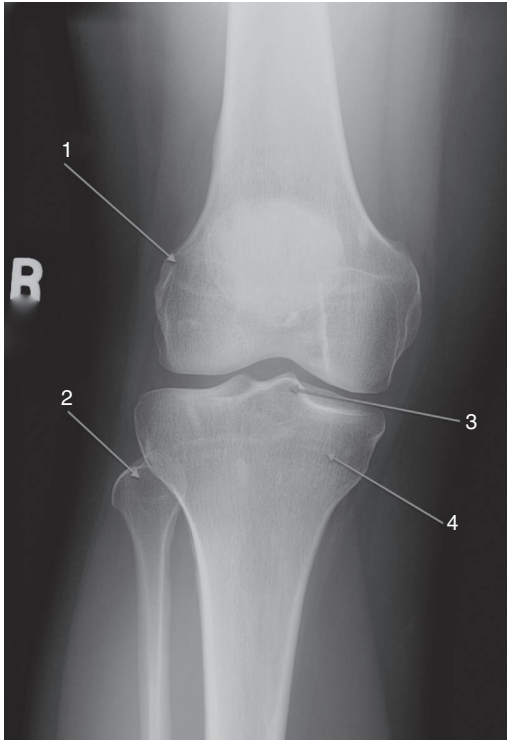
1. What are the names of the crescent-shaped fibrocartilage discs located on the tibial plateau?
2. Which projection of the toes should demonstrate no overlapping of soft tissues?
3. The dorsoplantar projection of the foot requires that the CR be directed how much, in what direction, and to what point?
4. Cuboidal articulations and the sinus tarsi are well visualized in which projection of the foot?
5. What is the relationship between the plantar surface and the IR in the lateral projection of the foot?
6. Identify the numbered anatomical structures in this image.

1. Medial and lateral menisci
2. AP projection
3. 10° posteriorly to the base of the third metatarsal
4. AP medial oblique
5. Perpendicular
6. 1: 1st metatarsophalangeal joint, 2: 3rd cuneiform, 3: navicular, 4: base of metatarsal, 5: cuboid

1. The AP medial oblique projection of the foot requires what degree of obliquity?
2. How should the foot be examined in order to demonstrate the longitudinal arches and ligament injuries?
3. The dorsoplantar axial projection of the calcaneus requires that the CR be directed how many degrees and in what direction to the plantar surface?
4. Where should CR be directed for the AP projection of the ankle?
5. For the AP projection to demonstrate congenital clubfoot, Kite method, how should the foot be aligned on the IR?

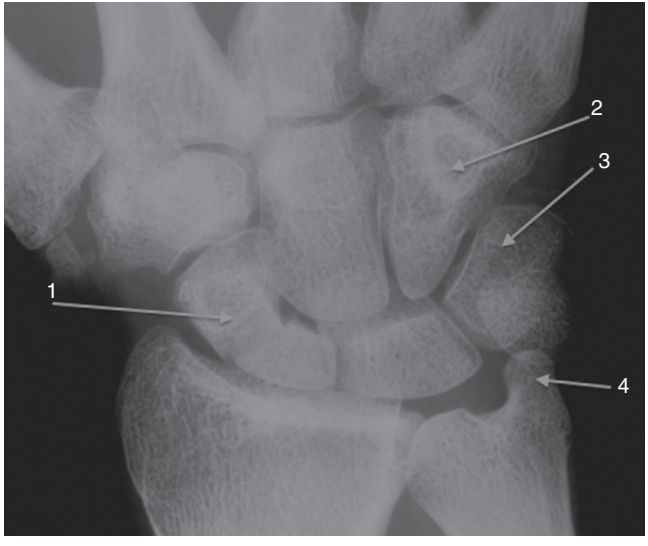
1. 30°
2. Weight-bearing
3. 40° caudad
4. Midway between the malleoli
5. In its normal AP position; ie no attempt should be made to straighten the foot.

1. Identify the numbered anatomical structures in this image.
2. What is the relationship between the plantar surface and the IR in the plantodorsal axial projection of the calcaneus?
3. The AP oblique, medial rotation, of the ankle requires what degree of obliquity?
4. A 15° medial oblique ankle is performed to demonstrate the _____.
5. In order to demonstrate both the ankle and knee joints on an examination of the lower leg, the IR is often placed _____ to the long axis of the lower leg.
6. An AP projection of the knee should be centered to what point?



1. 1: lateral femoral epicondyle, 2: head of fibula, 3: intercondylar eminence, 4: medial tibial condyle
2. Perpendicular
3. 45°
4. ankle mortise
5. diagonal
6. 0.5 in distal to the patellar apex

1. Identify the numbered anatomical structures in this image.
2. If the distance between the ASIS and tabletop is less than 19 cm, what tube angle should be employed for the AP projection of the knee?
3. What are two evaluation criteria for correct positioning of the lateral knee?
4. To evaluate knees for arthritis, it is recommended that they be imaged in the _____ position.
5. To visualize the proximal tibiofibular articulation, the AP knee should be obliqued how many degrees in which direction?
6. The PA axial projection of the intercondyloid fossa requires that the CR be directed _____ to the long axis of the tibia.



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1. 1: scaphoid (note fracture), 2: hamate, 3: triquetrum, 4: ulnar styloid process
2. 5° caudad
3. Femoral condyles superimposed, patellofemoral joint space open
4. erect weight-bearing
5. 45° medially
6. perpendicular

1. The PA tangential projection (Hughston method) of the patella and patellofemoral joint requires that the knee may be flexed about 50° and the CR directed how many degrees and in what direction?
2. In femur radiography, if both femoral articulations cannot be recorded on one IP, how should the radiographer proceed?
3. What image is usually made to determine pediatric bone age?
4. Long bone measurement examinations are usually performed to detect _____.
5. "Punched-out" radiolucent lesions are representative of the malignant condition called _____, and the x-ray examination most frequently requested to diagnose this condition is _____.

1. 45° cephalad
2. Be certain to include the joint nearest the injury/pathology OR make two images: one from the hip down, the other from the knee up.
3. PA (left) wrist and hand
4. Limb length differences between left and right sides
5. multiple myeloma; skeletal/bone survey

1. X-ray imaging of bony articulations, and their soft tissue structures, using positive and/or negative contrast agents is termed _____.
2. Fluoroscopic and radiographic examination of the spinal cord and its meninges using positive contrast agents is termed _____.
3. What is the type of fracture that vertebral bodies are subject to, especially in cases of osteoporosis?
4. What is the name of the final stage of healing/repair of a bone fracture?

1. arthrography
2. myelography
3. Compression fracture
4. Remodeling

1. The study/projection shown here is most likely performed for _____. Identify the part indicated as #1.
2. What is the type of bony fracture where bone appears shattered or broken into several fragments?
3. What is the type of fracture that can be common to the patella or cranium, radiating from a central point, ie, star-shaped?
4. What is the term used to describe movement of fractured ends of bones away from each other? Name the term used to describe the gap between fractured ends of bones?
5. A break in the bony cortex on one side of the shaft/body of a long bone, especially in children, is termed _____.
6. A small chip of bone that breaks away when a joint is dislocated, or when a tendon is pulled, is termed _____.

1. bone age study (PA of left hand); epiphyseal plate
2. Comminuted
3. Stellate
4. Displacement; distraction
5. greenstick
6. avulsion

1. What are the four general divisions of the respiratory system?
2. Which hemidiaphragm is higher and why?
3. Which portion of the respiratory system is also common to the digestive system?
4. What is the medical term for the Adam's apple?
5. How many lobes does each lung have?

1. Pharynx, trachea, bronchi, and lungs
2. Higher on the right because of the large liver below it
3. The pharynx (specifically, the oropharynx)
4. Laryngeal prominence
5. Right lung has three; left lung has two.

1. What is the name of the condition in which air or gas is present in the pleural cavity?
2. What is the name of the uppermost portion of the lungs, ie, above the level of the clavicles?
3. The ridge located at the bifurcation of the trachea is termed the _____.
4. The base of each lung rests on what muscle?
5. The space between the right and left lungs is termed the _____, and is occupied by what structures?

1. Pneumothorax
2. Apex (plural = apices)
3. carina
4. The diaphragm
5. mediastinum; thymus gland, heart and great vessels, trachea, and esophagus

1. When performing chest radiography, the diaphragm moves to its lowest position on which phase of respiration?
2. What SID is generally recommended for chest radiography? Why?
3. What is the recommended exact centering point for a PA chest, average-size patient?
4. What kV range is recommended for chest radiography?
5. What structures might appear "blunted" on a chest radiograph of a patient with pleural effusion?

1. Second full inspiration
2. 72 inches (6 feet) SID; to reduce heart magnification
3. To the MSP at the level of T7
4. 110 to 125 kV
5. Costophrenic angles

1. For what two reasons should chest imaging be done in the erect position?
2. For what diagnosis might an expiration chest image be requested?
3. What is the best way to determine rotation of a PA chest image?

1. To permit the diaphragm to move to its lowest position, to permit visualization of air and/or fluid levels
2. Pneumothorax
3. There is evidence of no rotation when the medial/sternal ends of the clavicles are the same distance from the center of the vertebra.

1. What is the relationship between the MSP and the IR in the lateral projection of the chest?
2. What is the relationship between the MCP and the IR in the PA projection of the chest?
3. What position, other than erect, is used to demonstrate small amounts of air or fluid in the chest?

1. They should be parallel.
2. Parallel
3. Lateral decubitus

1. When performing lateral decubitus chest to show small amounts of fluid in the pleural cavity, the affected side should be _____.
2. Which photocell should be selected for the typical lateral chest projection?
3. What projection is used to demonstrate the uppermost portion of the lungs free of superimposition with the clavicles?

1. down
2. The center cell
3. Apical lordotic projection

1. What kV range is recommended for imaging the upper airway?
2. When is the exposure made during imaging of the upper airway?
3. Why must the shoulders be rolled forward for a PA protection of the chest?
4. How should a PA chest be evaluated for adequate inspiration?
5. In what position was this image obtained? What kind of mA and time combination was probably employed?

1. 75 to 85 kV
2. During slow, deep inspiration (to fill the airway with air)
3. To remove the scapulae from the lung fields
4. 10 posterior ribs should be visualized above the diaphragm.
5. RAO sternum; low mA with lengthened exposure time (breathing technique)

1. List the five articulations of the thorax.
2. Ribs are attached posteriorly to the vertebra and angle _____ toward their anterior aspects.
3. The last two pairs of ribs, having no anterior attachment, are termed _____.
4. The spaces between the ribs, occupied by two sets of muscles, are termed _____ spaces.
5. What is the usual protocol for a sternum examination?

1. Sternoclavicular, sternochondral, costochondral, costovertebral, and costotransverse
2. inferiorly
3. vertebral/floating
4. intercostal
5. RAO and lateral

1. How can pulmonary vascular markings be made less obvious in the RAO sternum position?
2. Why is the RAO the recommended oblique in sternum radiography?
3. An RAO sternum on a patient having a deep chest will require _____ obliquity than an RAO sternum on a patient having a shallow chest.
4. Anterior obliques of the sternoclavicular joints require _____ degrees rotation, _____ side down.

1. Using “breathing technique” with extended exposure time
2. To project the sternum superimposed on the heart shadow, for uniform density/brightness
3. less
4. 15; affected

1. The axillary aspect of ribs is best demonstrated in the _____ position.
2. Anterior oblique positions of the ribs are done using _____ degrees, _____ side closest to the IR.
3. It is recommended that images of below diaphragm ribs be made on what phase of respiration?
4. Which two oblique positions could be used to demonstrate the right posterior ribs?

1. oblique
2. 45; unaffected
3. Expiration
4. RPO and LAO

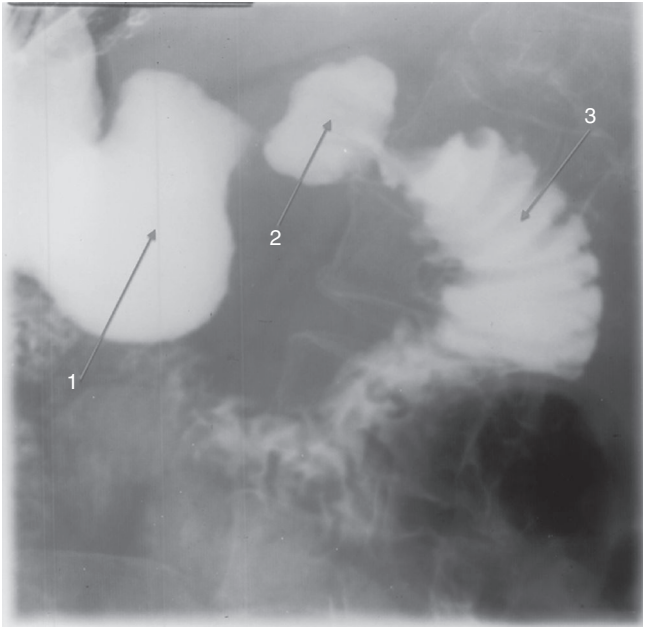
1. What musculomembranous structure separates the thoracic and abdominal cavities?
2. What two muscles are located on either side of the lumbar vertebrae and can be fairly well visualized on a quality abdominal image?
3. What does the abbreviation KUB represent?

1. The diaphragm
2. Psoas major (left and right)
3. Kidneys, ureter, and bladder

1. What structures constitute the *upper* GI tract?
2. What are the parts of the lower GI tract, ie, the colon/large intestine?
3. What is the name of the sphincter muscle located at the junction of the terminal ileum and cecum?
4. What part of what structure lies within the loop of the duodenum?
5. What is the largest solid organ of the body that occupies the RUQ?

1. Mouth, pharynx, esophagus, stomach, and small intestine
2. Cecum, ascending colon, right colic/hepatic flexure, transverse colon, left colic/splenic lecture, descending colon, sigmoid colon, rectum, and anus
3. Ileocecal valve
4. The head of the pancreas
5. The liver

1. What organ lies in the anatomical loop illustrated here? Identify the anatomy indicated in the image here.
2. What is the double-walled serous membrane associated with the abdomen?
3. What is the relationship of the kidneys, ureter, pancreas, duodenum, ascending and descending colon, and aorta to the peritoneum?
4. What is the name of the upper, middle region of the abdomen? ... the lower lateral regions?
5. There are seven palpable landmarks that can be used for abdominal positioning. Name at least four.
6. What three projections are generally included in an acute abdomen survey?



1. Pancreas; 1: pylorus, 2: duodenal bulb, 3: descending duodenum
2. The peritoneum
3. They are all retroperitoneal structures.
4. Epigastrium; left and right iliac/inguinal
5. Xiphoid/ensiform process, inferior costal margin, iliac crest, anterior superior iliac spine, greater trochanter, symphysis pubis, ischial tuberosity
6. AP supine abdomen, erect or lateral decubitus abdomen, PA chest

1. Images of the abdomen are most generally exposed upon what phase of respiration?
2. What kV range is usually recommended for most abdominal imaging?
3. Abnormal accumulation of fluid in the peritoneal cavity is termed _____ ; abnormal accumulation of air is termed _____.
4. The condition characterized by telescoping of a portion of bowel into an adjacent portion is termed _____.
5. What is another name for Crohn disease?

1. Expiration
2. 70 to 80 kV
3. ascites; pneumoperitoneum
4. intussusception
5. Regional enteritis

1. The CR should be directed to midline at the level of the _____ for an AP projection of the abdomen.
2. When performing lateral decubitus abdomen to show small amounts of air in the peritoneal cavity, the affected side should be _____.
3. The CR should be directed to midline and _____ for a lateral decubitus projection of the abdomen.
4. The CR should be directed to midline and _____ for an AP erect projection of the abdomen.
5. When evaluating the abdomen for small amounts of air or fluid, both _____ should be visualized.

1. iliac crest
2. up
3. 2 in above the level of the iliac crest
4. 2 in above the level of the iliac crest
5. hemidiaphragms

1. List the salivary glands and their associated duct(s).
2. Protrusion of a portion of the upper stomach through the esophageal hiatus of the diaphragm describes _____.
3. List the four layers of GI tissue, from inner to outer.
4. Which layer of stomach tissue forms folds called rugae?
5. Which portion of the small intestine has a "feathery" appearance when filled with barium?

1.
   - Parotid gland/Stensen's duct (parotid duct)
   - Submandibular gland/Wharton's duct (submandibular duct)
   - Sublingual ducts/ducts of Rivinus (the largest is Bartholin's duct)
2. hiatal hernia
3. Mucosa, submucosa, muscular, serosa
4. Mucosa
5. Jejunum

1. The large right lobe of the liver is separated from the left by the _____ ligament.
2. One of the principal functions of the liver is to produce _____, which leaves the liver via the right and left _____ ducts.
3. What two ducts unite to form the common bile duct?
4. The common bile duct and the pancreatic duct unite to form the short _____ duct that opens into the _____.
5. What is the name of the procedure used to examine the biliary and pancreatic ducts by fiber-optic means?

1. falciform
2. bile; hepatic
3. The cystic duct and the common hepatic duct
4. hepatopancreatic ampulla of Vater; descending duodenum
5. Endoscopic retrograde cholangiopancreatography (ERCP)

1. During ERCP, contrast material is injected into the _____.
2. What is the medical term that describes condition of stones in the gallbladder?
3. What is sialography?
4. Which type of membrane lines body cavities that open to the exterior?
5. The greater curvature forms the _____aspect of the stomach. What is the name of the distal gastric sphincter?

1. common bile duct
2. Cholelithiasis
3. Radiographic examination of the salivary glands and their ducts
4. Mucous
5. lateral; pyloric

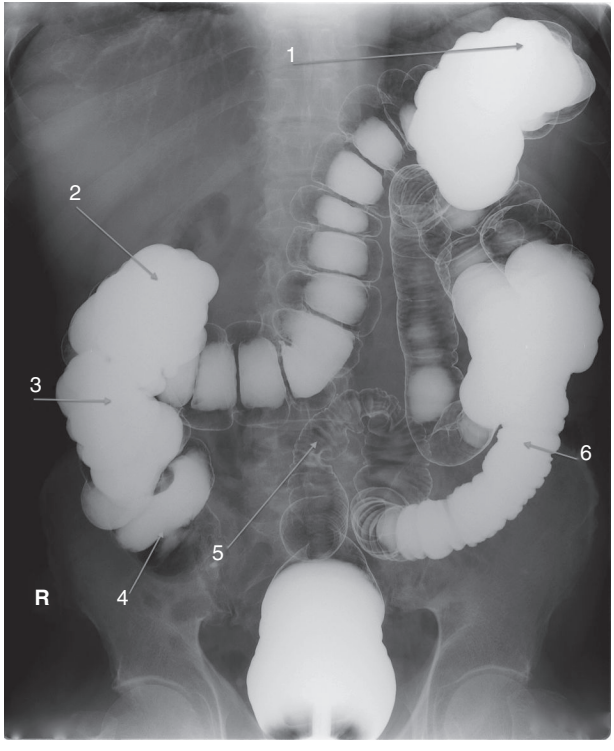
1. What surgical procedure may be done to demonstrate biliary anatomy and rule out residual biliary stones?
2. Twisting of the bowel upon itself, causing obstruction is called _____.
3. The length of the small bowel, as measured in the cadaver, is approximately _____ in length. The length of the large intestine is approximately _____.
4. What structure is located at the terminus of the small intestine?
5. List the three parts of the stomach; of the small intestine?

1. Surgical/operative cholangiography
2. volvulus
3. 23 ft; 6 ft (in a living person, the small bowel measures approximately 10 ft; the large bowel, approximately 5 ft)
4. Ileocecal valve
5. Fundus, body, pylorus; duodenum, jejunum, ileum

1. What is the first, most proximal, portion of the large intestine?
2. The muscular taeniae coli pulls the large intestine into "pouches" called _____.
3. Small saccular protrusions of intestinal mucosa through the intestinal wall are called _____.
4. An abnormal growth of tissue projecting from mucous membrane into a lumen is termed _____.

1. Cecum
2. haustra
3. diverticula
4. polyp

1. What is the name of the pouches/segmentations seen in this image? Identify the anatomy indicated in the image.
2. What type of radiographic examination is required to demonstrate colonic polypoid lesions?
3. What position demonstrates the esophagus projected between the heart and vertebrae? What is usually the optimal obliquity?
4. A radiographic examination of the esophagus must be performed in the recumbent position in order to demonstrate what two types of pathology?
5. In the AP recumbent position of the stomach, barium will be seen in the _____.



1. haustra; 1: left colic/splenic flexure, 2: right colic/hepatic flexure, 3: ascending colon, 4: cecum, 5: sigmoid colon, 6: descending colon
2. Air contrast (double contrast) barium enema
3. RAO; 35° to 40°
4. Hiatal hernia and esophageal varices
5. fundus

1. What is the best position to demonstrate a barium-filled pylorus and duodenum in the sthenic patient? _____ to see double contrast of the pylorus and duodenum?
2. What position will best demonstrate the retrogastric space?
3. What body type has a high transverse stomach with indistinguishable curvatures?
4. What method of radiologic gastrointestinal examination is used to demonstrate mucosal and other intraluminal lesions?

1. RAO; AP/LPO
2. Lateral
3. Hypersthenic
4. Double (air/negative and barium or iodine/positive) contrast

1. What method of BE examination will best demonstrate polypoid lesions?
2. List some diagnoses that would indicate use of water-soluble iodinated contrast agent for UGI or BE exams. What are some contraindications to the use of water-soluble iodinated contrast agents?
3. Progressive wavelike movement occurring involuntarily in hollow tubes, especially the alimentary canal, is called _____.
4. The term *deglutition* refers to _____. What does the term *aspiration* refer to?

1. Double (air) contrast
2. Perforated ulcer, obstruction; iodine sensitivity, dehydration
3. peristalsis
4. the act of swallowing; the act of inhaling fluid or solid foreign body into the bronchi and lungs

1. Dilation of the esophageal veins, often seen in acute liver disease, is termed _____; the term used to describe difficulty in swallowing is _____.
2. Modified barium swallow examinations are particularly useful for patients who have suffered what incident?
3. Small bowel series using GI intubation is termed _____.
4. What is the usual patient preparation for an upper gastrointestinal series?
5. Images made during the latter part of a small bowel series require that the CR point of entry is _____ than images made during the first part of the examination.

1. esophageal varices; dysphagia
2. Stroke (especially), and any other difficulty swallowing conditions
3. enteroclysis
4. npo after midnight (at least 8 hours)
5. lower/more inferior

1. What two positions may be used to demonstrate the right colic/hepatic flexure without self-superimposition?
2. During double-contrast BE, what part of the large intestine is likely to be filled with barium in the PA recumbent projection?
3. During double-contrast BE, what projection may be used to demonstrate the posterior wall of the rectum?
4. How much and in what direction should the CR be directed for an AP axial projection of the sigmoid colon?

1. LPO, RAO
2. Transverse colon
3. Ventral decubitus, lateral rectum
4. 30° to 40° cephalad

1. During double-contrast BE, what part of the large intestine is likely to be filled with air in the AP recumbent projection?
2. During radiographic examination of the large bowel, what projection is used to "open up" the sigmoid colon?
3. During double-contrast BE, what position will best demonstrate the lateral wall of ascending colon and medial wall of the descending colon?
4. If the surgeon suspects residual biliary stones during cholecystectomy, a catheter can be inserted into the common bile duct with one end extending outside of the body; the patient can later come to the radiology department to rule out biliary stones with what radiologic examination?

1. Transverse colon
2. AP or PA axial
3. Left lateral decubitus position
4. Postoperative/T-tube cholangiogram

1. The _____ kidney is narrower, longer, and in a higher/more superior position in the body than the opposite kidney.
2. The term nephroptosis means _____.
3. One functional unit of the kidney is termed _____.
4. The term *micturition* refers to_____.

1. left
2. drooping or downward displaced kidney
3. nephron
4. the act of urination/voiding

1. The ureters lie _____ to the kidneys and are therefore best demonstrated contrast-filled in the _____ position during intravenous urography.
2. What position will demonstrate the left kidney parallel to the IR, as well as the right ureter free of superimposition?
3. What is the correct degree of obliquity used in intravenous urography?
4. What additional type of image identification is required for intravenous urography?
5. What degree of obliquity is recommended for cystography?

1. anterior; prone
2. RPO
3. 30°
4. Minute (time) markers
5. 45° to 60°

1. Radiographic examination of the contrast-filled bladder is termed _____.
2. When examining the contrast-filled bladder, how much and what direction is the x-ray tube angled in order to project the symphysis pubis inferior to the urinary bladder?
3. Which of the following radiologic examinations do/does not demonstrate function?
   - Excretory urography
   - Retrograde urography
   - Voiding cystourethrography
   - Retrograde cystography
4. The term *cystourethrography* refers to radiologic examinations of what structures?

1. cystography
2. 10° to 15° caudad
3. Retrograde urography, retrograde cystography
4. Urinary bladder and urethra

1. What are the two parts of a typical vertebra?
2. The typical vertebra has what number of processes? Name them.
3. The articulation between two vertebral bodies is called the _____; is occupied by the _____, and is classified as a _____ joint.
4. Articulations formed between adjacent superior and inferior articular processes are termed _____ and are classified as _____ joints.
5. Adjacent vertebral notches form the_____.

1. Body and vertebral/neural arch
2. Seven; two superior articulating processes, two inferior articulating processes, one spinous process, two transverse processes
3. intervertebral articulation/joint; intervertebral disc; amphiarthrodial
4. zygapophyseal articulations; diarthrodial
5. intervertebral foramina

1. The vertebral body connects with its vertebral arch by way of the _____; the upper and lower portions of this structure are called the _____.
2. Vertebral laminae unite posteriorly to form the _____.
3. Thoracic vertebrae are unique in that they provide rib articulation at the vertebra's _____ and _____.
4. Name the two parts, outer and inner, of the intervertebral disc.
5. What is the medical term for slipped disc?

1. pedicles; vertebral notches
2. spinous process
3. body and transverse processes
4. Annulus fibrosus (outer portion) and nucleus pulposus (inner portion)
5. Herniated nucleus pulposus (HNP)

1. What is the unique characteristic of cervical *spinous* processes; of cervical *transverse* processes?
2. Cervical intervertebral foramina are _____ degrees to the MSP and _____ degrees to a transverse plane.
3. A vertebral foramen is bounded anteriorly by the _____ and posteriorly by the _____.
4. The cervical zygapophyseal articulations are _____ degrees to the MSP.
5. What structure separates the anterior and posterior arches of C1?

1. Spinous processes are bifid; transverse processes each have a transverse foramen.
2. 45°; 15° to 20°
3. vertebral body; vertebral arch
4. 90°
5. The transverse atlantal ligament

1. What bony structure articulates with the posterior aspect of the anterior arch of C1?
2. With what structures do the superior articular facets of the atlas/C1articulate? What is the name of the articulation?
3. With what two thoracic vertebra structures do the ribs articulate?
4. The thoracic intervertebral foramina are _____ to the MSP?
5. The thoracic zygapophyseal articulations are _____ to the MSP and _____ to the MCP.

1. The odontoid process/dens
2. Occipital condyles; occipitoatlantal articulation
3. Body and transverse processes
4. 90°
5. 15° to 20°; 70° to 75°

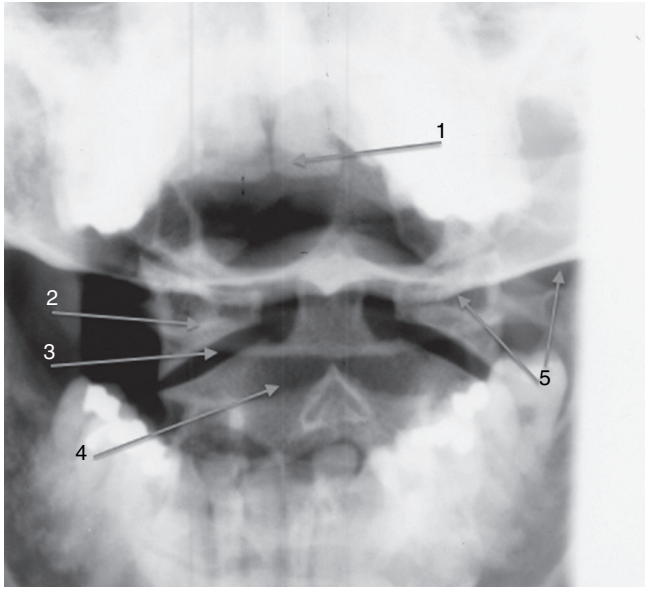
1. The articulation between C1 and C2 is termed _____ and is classified as a _____ joint.
2. Which cervical vertebra has no body and no spinous process? Which has an extra long spinous process?
3. Which positions will demonstrate cervical intervertebral foramina closest to the image receptor?
4. Which position will demonstrate cervical zygapophyseal joints to best advantage?
5. Which position(s) is/are recommended to demonstrate degree of cervical anterior/posterior movement?

1. the atlantoaxial joint/articulation; diarthrodial
2. C1/atlas; C7/vertebra prominens
3. RAO and LAO
4. Lateral
5. Lateral in flexion and extension

1. What type of vertebral fracture is commonly associated with osteoporosis?
2. Abnormal or exaggerated lateral curvature of the spine is termed _____.
3. Abnormal or exaggerated convex curvature of the spine is termed _____.
4. Inflammation of one or more vertebra is termed _____.
5. How should the radiographer adjust flexion of the head for the AP/open mouth projection?

1. Compression
2. scoliosis
3. kyphosis
4. spondylosis
5. A line from the lower margin of the upper incisors to the base of the skull/mastoid tip should be perpendicular to the IR.

1. If the base of the skull and odontoid process are superimposed in the open mouth projection, how should positioning be adjusted?
2. The AP axial projection of the cervical spine requires tube angulation in what direction and by how many degrees?
3. What should be the relationship between the MSP and the IR in the posterior oblique position of the cervical spine?
4. What should be the relationship between the MSP and the IR in the lateral position of the cervical spine?
5. The "swimmer's" position/Twining method of the cervical spine is used to demonstrate _____.
6. Referring to this image, what two positioning changes should be made? Identify the anatomy indicated in this image.



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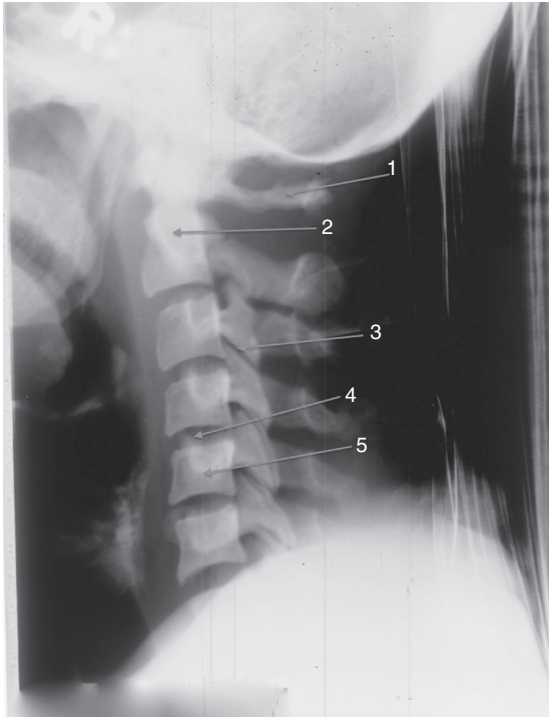
1. The chin should be depressed/more flexion is needed
2. Cephalad; 15° to 20°
3. 45°
4. Parallel
5. a lateral of the cervicothoracic area
6. Bring chin down enough to line up lower edge of maxillary incisors with base of skull/mastoid tip *and* rotate head to place MSP perpendicular to IR. 1: maxillary incisors, 2: lateral mass C1, 3: atlantoaxial articulation, 4: body C2, 5: base of skull.

1. The "swimmer's" position of the cervicothoracic area requires which arm to be elevated?
2. What is the "wagging jaw"/Ottonello method used to demonstrate?
3. If the teeth were obscuring the odontoid process in the open mouth position, how should skull positioning be adjusted?
4. A patient arriving in emergency x-ray has a cervical collar in place; what two images should be taken initially?
5. Forward displacement of one vertebra upon the one beneath it is termed _____.
6. In what position was this image most likely made? Identify the anatomic parts labeled in this image.



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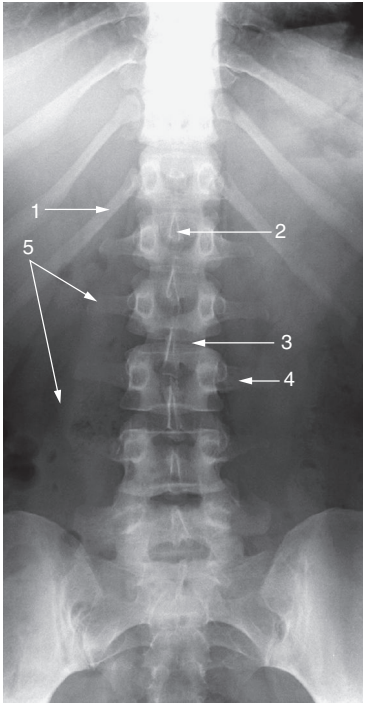
1. The arm adjacent to the IR
2. An AP of the entire cervical spine
3. More extension is needed/chin moved up.
4. Horizontal beam lateral and AP
5. spondylolisthesis
6. horizontal beam/“cross table” lateral. 1: posterior arch of C1, 2: body of C2, 3: C3-C4 zygapophyseal joint, 4: C4-C5 disc interspace, 5: body of C5

1. Why is "breathing technique" useful for the lateral projection of the thoracic spine?
2. The MSP should be _____ to the IR in the lateral position of the thoracic vertebrae. If this is not possible, the CR may be angled in which direction?
3. Anterior oblique positions of the thoracic vertebra require that the MSP _____ degrees to the IR and the MCP be _____ degrees to the IR.
4. RAO and LAO positions of the thoracic spine are performed to demonstrate the zygapophyseal articulations that are _____ to the IR.
5. Identify the anatomy indicated in this image. How can the interspace between L5-S1 be better visualized?



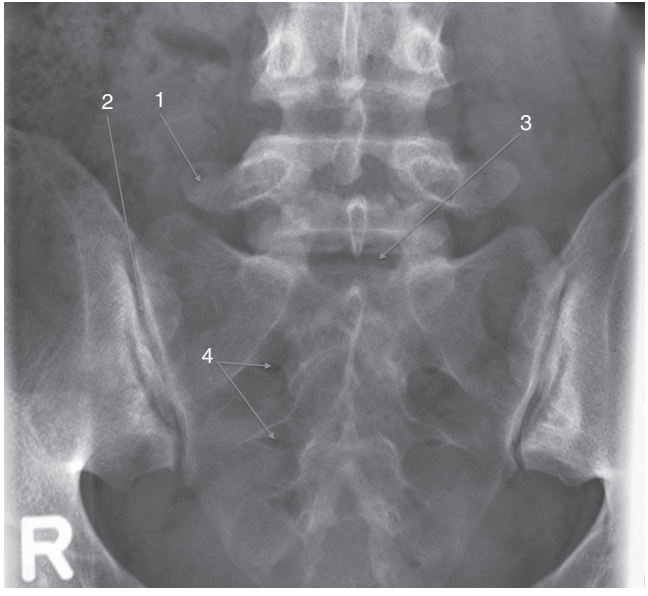
(Used with permission of Stamford Hospital, Department of Radiology.)

1. To blur out ribs and pulmonary vascular markings
2. Parallel; cephalad
3. 20°; 70°
4. closer
5. 1: 12 rib (right side), 2: spinous process, 3: L2-L3 intervertebral disc space, 4: L3 transverse process, 4: psoas muscle. Angle the x-ray tube 30° to 35° cephalad

1. The first through fourth lumbar zygapophyseal articulations are how many degrees to the MSP? The zygapophyseal articulation of L5-S1?
2. Which positions will demonstrate lumbar zygapophyseal articulations closest to the image receptor?
3. Which position will demonstrate lumbar intervertebral foramina?
4. That portion of each lumbar lamina lying between the superior and inferior articular processes is called the _____.
5. What maneuver is used for an AP projection of the lumbar spine in order to reduce the lordotic curve and make the intervertebral joints more visible?

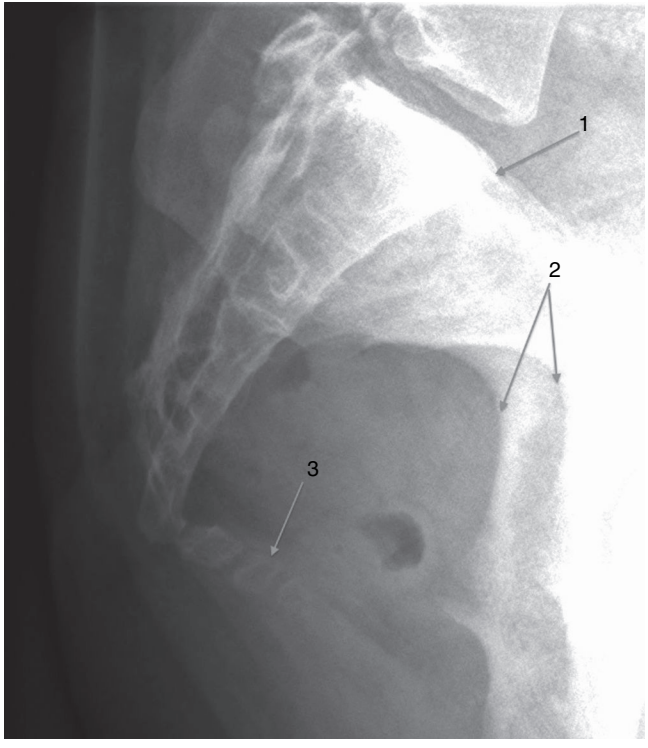
1. 45°; 30°
2. RPO and LPO
3. lateral
4. pars interarticularis
5. Flex the knees and hips, support knees with a sponge

1. The correctly positioned oblique lumbar spine shows the "Scotty dog" appearance. What bony part does each of the following "Scottie dog" parts represent: leg, ear, eye, nose, neck.
2. If the lower lumbar spine is not supported so as to be parallel to the IR in the lateral position, the CR should be angled how much and in which direction?
3. The AP axial L5-S1 projection requires how much angulation and in what direction?
4. Why should a scoliosis series be performed in the PA rather than AP projection?
5. What positions are generally used to demonstrate/evaluate spinal fusion?
6. How many degrees, and in what direction, is the x-ray tube directed for this image? Identify the anatomy indicated in this image.



1. Inferior articular process, superior articular process, pedicle, transverse process, pars interarticularis
2. 5° caudad
3. 30° to 35° cephalad
4. To reduce dose to radiosensitive organs (breast, thyroid, reproductive organs)
5. laterals in flexion and extension
6. 30° to 35° cephalad 1: transverse process L5, 2: sacroiliac joint, 3: L5-S1 articulation, 4: sacral foramina

1. The AP axial projection of the sacrum requires tube angulation in what direction and how many degrees?
2. The AP axial projection of the coccyx requires tube angulation in what direction and how many degrees?
3. The LPO and RPO positions of the sacroiliac joints require which side to be elevated, and how many degrees?
4. Where should the CR be directed for the LPO and RPO positions of the sacroiliac joints?
5. Identify the numbered anatomic parts in the image here.



1. 15° cephalad
2. 10° caudad
3. The unaffected side should be elevated 25° to 30°
4. 1 inch medial to the elevated ASIS
5. 1: sacral promontory, 2: greater sciatic notches, 3: coccyx

1. Each innominate bone is made of three bones: the _____, _____, _____.
2. What bones make up the pelvis?
3. The posterior portion of the acetabulum is formed by the _____.
4. What portion of what bone extends from the anterior superior iliac spine to the posterior superior iliac spine?
5. That area posteroinferior to the pelvic brim/inlet is called the _____.

1. ilium, ischium, and pubis
2. Four bones: left and right innominate bones, the sacrum, the coccyx
3. ischium
4. Iliac crest
5. lesser, or true, pelvis

1. What bones make up the pelvic girdle?
2. The bones of the pelvis unite to form a socket for the femoral head called the _____.
3. Select the features that are typical of the normal male/android pelvis:
   - shallow from anterior to posterior
   - narrow pelvic inlet
   - pubic angle less than 90°
   - wider and more horizontal
4. The superior and inferior rami of the ilium and ischium unite to form the _____.

1. The two hip/innominate bones
2. acetabulum
3. Narrow pelvic inlet, pubic angle less than 90°
4. obturator foramen

1. The neck of the femur forms a ____ degree angle with its body/shaft. In what direction the femoral neck also projects 15° to 20°?
2. Whenever possible, what maneuver is performed to place the femoral neck parallel to the IR for the AP projection of the hip?
3. The AP projection of the pelvis requires that the CR be directed to the midline midway between the _____ and _____.
4. The bilateral AP oblique/frog-leg projection/modified Cleaves method of the pelvis requires that the CR be directed to the midline 1 inch superior to what bony structure?

1. 120°; anteriorly
2. Legs are internally rotated 15° to 20°
3. ASIS; pubic symphysis
4. Pubic symphysis

1. The RPO position for the acetabulum requires what degree of obliquity?
2. To demonstrate the rami of the pubis and ischium in the AP axial outlet projection, the CR should be directed _____ degrees, in what direction?
3. When the body is in the seated upright position, the body's weight rests on what pelvic structures?
4. The centering point "2.5 in distal and perpendicular to the midpoint of a line between the ASIS and pubic symphysis" identifies correct centering for _____ projection of the _____.

1. 45°
2. 30° to 45° for females and 20° to 35° for males; caudad
3. Ischial tuberosities
4. AP, hip

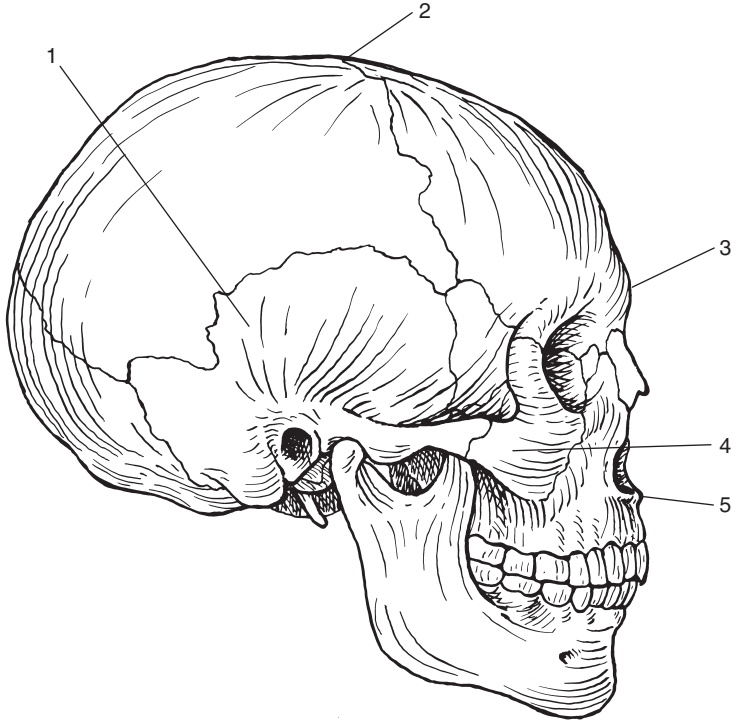
1. Identify the item(s) below that must be parallel to each other when performing an axiolateral projection (horizontal beam lateral) of the hip:
   - femoral neck
   - IR
   - CR
2. Mediolateral "frog-leg" projections of the hip require femur _____ of 40° to 45°.
3. When performing an axiolateral projection (horizontal beam lateral) of the hip, the CR must be perpendicular to the _____ and _____.
4. The greater trochanters are in the same horizontal plane as what pelvic structure?

1. Femoral neck; IR
2. abduction
3. femoral neck; IR
4. Pubic symphysis

1. Name the paired cranial bones. Name the unpaired facial bones.
2. What is the name of the suture separating the frontal bone from the parietal bones?
3. Name the three processes of the temporal bone.
4. The pituitary/hypophyseal gland is seated in which cranial bone?
5. What is the name of the prominence on the squamous portion of the frontal bone that may be used as a positioning landmark?

1. Two parietal bones, two temporal bones; one mandible, one vomer
2. Coronal suture
3. Mastoid process, zygomatic process, styloid process
4. Sphenoid bone
5. Glabella

1. Label the anatomic structures/ features seen in this illustration.
2. The parietal bones meet midline to form what suture?
3. A large opening in the base of the occipital bone through which the spinal cord passes is the _____.
4. The paranasal sinuses lie in which cranial bones? Which is the most posterior paranasal sinus?
5. Unossified points at the junction of sutures on an infant's skull are called _____.

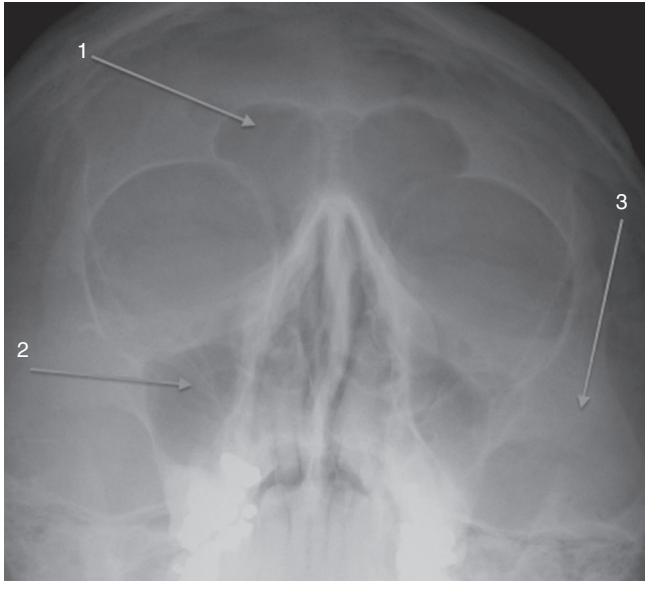


1. 1: temporal bone, 2: bregma, 3: glabella, 4: zygomatic bone, 5: anterior nasal spine
2. sagittal
3. foramen magnum
4. Frontal bone, ethmoid bone, maxillae, sphenoid bone; sphenoid
5. fontanels

1. What is the name of the point formed at the junction of the parietal bone, temporal bone, and greater wing of the sphenoid bone?
2. What two bones form the nasal septum?
3. The suture formed by the temporal and parietal bone is the _____.
4. Name the bony structures of the middle ear from lateral to medial.
5. The auditory/Eustachian tube connects the _____ with the _____.

1. Pterion
2. The perpendicular plate of the ethmoid bone, and the vomer
3. squamosal suture
4. Malleus, incus, stapes
5. middle ear; nasopharynx

1. What bone(s) separate the oral and nasal cavities?
2. What external landmark corresponds to the nasofrontal suture?
3. What are the names of the processes found on the mandible and maxilla that serve to provide anchors for the roots of the teeth?
4. The process extending superiorly and anteriorly from the ramus of the mandible is the _____.
5. What facial bone is quadrilateral in shape and has four processes: frontosphenoidal, orbital, temporal, and maxillary?
6. What structures are indicated by the numbers 1, 2, and 3 in this figure? In what position/projection was the image made?



1. The two maxillae
2. Nasion
3. Alveolar processes
4. coronoid process
5. Zygoma/malar
6. 1: frontal sinus, 2: maxillary sinus, 3: zygoma/malar; Waters position/ parietoacanthial projection

1. The process extending superiorly and posteriorly from the ramus of the mandible is the _____.
2. Which is the largest and only movable facial bone?
3. The sutures of the skull are the _____ type of joint/articulation – provide all three terms that can be used to describe this articulation
4. Radiographic positioning of the paranasal sinuses should be performed in what body position and why?
5. What degree angle is formed by the petrous ridges and MSP in the mesocephalic shaped skull?

1. condyloid process
2. Mandible
3. synarthrodial/immovable/fibrous
4. erect; to demonstrate air/fluid levels
5. Approximately 47°

1. The vertical portion on the mandible is the _____.
2. What skull projection is most commonly used to demonstrate the occipital bone?
3. The lateral projection of the skull utilizes the _____ baseline and requires that the MSP be _____ to the IR.
4. When viewing a lateral skull radiograph, incorrect positioning caused by *tilt* is evidenced by what structures not being superimposed?
5. Where should the petrous pyramids be projected in the PA axial projection (Caldwell method) of the skull using a 15° caudal tube angle?

1. ramus
2. AP axial/Towne method
3. IOML; parallel
4. Supraorbital margins/orbital plates, mandibular body
5. In the lower one-third of the orbits

1. When viewing a lateral skull radiograph, incorrect positioning caused by *rotation* is evidenced by what structures not being superimposed?
2. Where should the petrous pyramids be projected in the PA projection of the skull with the OML perpendicular to the IR?
3. What projection(s) will demonstrate the dorsum sella and posterior clinoid processes within the foramen magnum?
4. What is the single best projection to demonstrate the facial bones?
5. Where should the CR enter for a lateral projection of the nasal bones? For a lateral projection of the facial bones?

1. Mandibular rami, EAMs, sella turcica
2. Within the orbits
3. AP axial projection (Towne method), PA axial projection (Haas method)
4. Parietoacanthial projection (Waters method)
5. 0.5 in distal to the nasion; perpendicular to mid-zygoma

1. In a correctly positioned parietoacanthial projection (Waters method), where should the petrous pyramids be seen with respect to the maxillary sinuses?
2. The oblique inferosuperior (tangential) projection of the zygomatic arches requires that the IOML be _____ to the IR, and that the head be rotated _____ degrees toward the _____ side.
3. The PA axial projection of the mandible requires _____ angulation in order to demonstrate condyles and TMJ area.
4. What comparison images are often obtained to demonstrate range of anterior movement of the mandibular condyle in relationship to the mandibular fossa?
5. A *blowout* fracture affects what portion of the bony orbit?

1. The petrous pyramids should be projected below the maxillary sinuses.
2. Parallel; 15°; affected (side being examined)
3. cephalad
4. Open and closed mouth projections of the TMJ
5. The floor of the orbit

1. If the petrous pyramids are seen superimposed on the inferior aspect of the maxillary sinuses in the parietoacanthial projection, what change in position is necessary?
2. What projection demonstrates all the paranasal sinuses?
3. The PA projection, utilizing 15° OML adjustment from the horizontal, is used to demonstrate which sinus group(s)?
4. The SMV projection requires that the _____ baseline be parallel to the IR, and demonstrates the _____, _____, and _____ sinuses.
5. The parietoacanthial transoral projection (open mouth Waters method) demonstrates the _____ sinuses through the open mouth.

1. The chin should be extended/elevated further.
2. Lateral
3. Frontal and ethmoid
4. IOML; sphenoid, ethmoid, and maxillary
5. sphenoid

1. Patient consent can be _____, _____, or _____.
2. What does the acronym HIPAA stand for?
3. What is the name of a personal document naming the individual who is authorized to make all health care decisions?
4. What is the term used to describe the ethical principle of *goodness*?
5. What is the term used to describe the ethical principle of truthfulness?

1. verbal (oral), written, or implied
2. Health Insurance Portability and Accountability Act
3. Advance Healthcare Directive/Living Will (health care proxy)
4. Beneficence
5. Veracity

1. What is the ethical term used to describe no evil, that is, our obligation not to inflict harm?
2. What is the ethical term used to describe faithfulness or loyalty?
3. What is the ethical term used to describe self-determination; our respect of the independence of others?
4. What is the term used to describe patient protection concerning release of their private information?

1. Nonmaleficence
2. Veracity
3. Autonomy
4. Confidentiality

1. What are the four conditions required for valid patient consent?
2. What AHA document identifies and lists the requirements for open and honest communication, respect for differences, and for personal and professional values required for optimal patient care?
3. What do the abbreviations DNR and DNI stand for?

1. Legal age, sound mind, consent freely, adequately informed
2. AHA's: "A Patient's Bill of Rights"
3. Do not resuscitate and do not intubate

1. The terms *libel* and *slander* refer to the spreading of information that causes loss of reputation and/or defamation of character; what is the difference between the two terms?
2. What is the difference between *assault* and *battery*?
3. The omission or failure to take reasonable care or caution is termed _____.

1. *Libel* is written defamation; *slander* is verbal defamation
2. *Assault* is the threat to touch another in an injurious way; *battery* is unlawful touching of another without consent
3. negligence

1. What is the literal meaning of the doctrine of *res ipsa loquitur*? The doctrine of *respondeat superior*?
2. Another name for professional negligence is _____.
3. Which part of the ARRT Standards of Ethics is aspirational? Which part is enforceable?
4. Select the violations of ARRT Rules of Ethics from the following:
   - Submitting misleading educational history
   - Revealing privileged patient communication
   - Failure to obtain pertinent information for the radiologist
   - Violating state/federal narcotics laws
5. What could a radiographer be sued for if a patient falls off a stretcher, whose side rails are down, while waiting outside the x-ray room after their examination?

1. “The thing speaks for itself”; “let the master answer/respond”
2. malpractice
3. Code of Ethics; Rules of Ethics
4.
   - Submitting misleading educational history
   - Revealing privileged patient communication
   - Violating state/federal narcotics laws
5. Negligence

1. Eye contact, facial expression, personal appearance, touch, etc are all types of _____ communication.
2. What is the term used to describe restriction of patient movement to ensure safety?
3. What is the term used to describe the use of various devices to help prevent patient movement during imaging procedures?
4. What are the three types of communication?

1. nonverbal
2. Restraint
3. Immobilization
4. Verbal/oral, written, and nonverbal

1. What is the term used to describe loss of language function; inability to speak?
2. Select the ways in which interpersonal communication can be improved:
   - Explaining the examination to the patient
   - Speaking to toddlers at eye level
   - Moving quickly with the elderly
   - Using a family member to translate for language-challenged patient
   - Providing privacy and modesty for adolescents
3. Socially shared characteristics attitudes, beliefs, language, customs, etc of a group of people that are passed from one generation to the next defines _____.

1. Aphasia
2.
   - Explaining the examination to the patient
   - Speaking to toddlers at eye level
   - Providing privacy and modesty for adolescents
3. culture

1. How should the radiographer explain the examination to the patient?
2. Why is it important to clearly explain the procedure to the patient?
3. How is the patient likely to respond to a complicated explanation laden with technical jargon?

1. In a simple, clear, and direct manner, without the use of elaborate medical terminology
2. It reduces patient anxiety, increases cooperation, and results in a better examination.
3. Feelings of intimidation and increased anxiety

1. The use of physical restraints on adult patients requires a/an _____ order.
2. The Joint Commission (TJC) requires that health care personnel to use at least _____ patient identifiers to validate identity before proceeding with the health care services.
3. Select who should be used as interpreter for patients having language barriers:
   - Parent, child, or spouse of the patient
   - Any immediate family member
   - A trained interpreter
4. What is the term used to describe a discriminatory attitude toward the elderly?

1. physician's
2. two
3. A trained interpreter
4. Ageism

1. _____ technique is used to prevent the spread of pathogens and protect the patient from infection.
2. The destruction of pathogens through the use of chemical materials is termed _____.
3. Another name for surgical asepsis is _____.

1. Aseptic
2. disinfection
3. sterilization

1. To reduce the probability of infectious organism's transmission to a susceptible individual is the function of _____.
2. Probably the easiest and most effective method of controlling the transmission of infections is _____.
3. Microorganisms capable of causing disease are called _____.
4. An area that is free of viable microorganisms is considered to be _____.

1. medical asepsis
2. handwashing
3. pathogens/pathogenic organisms
4. sterile/a sterile field

1. Arrange the following steps for opening a sterile package in their correct order:
   - Opening the side flaps
   - Opening the flap located furthest from you
   - Opening the flap located closest to you
2. If in doubt about the sterility of an object, it should be considered _____.
3. How must OR persons in sterile gown and gloves pass each other?
4. What is the term used to describe the principal habitat where a particular infectious agent lives and multiplies, and from which it can spread to cause disease?

1.
   - Opening the flap located farthest from you
   - Opening the side flaps
   - Opening the flap located closest to you
2. unsterile
3. Back-to-back
4. Reservoir of infection

1. Arrange the cycle of infection components in their correct order following the recognized *reservoir of infection*:
   - transmission of disease
   - susceptible host
   - portal of exit
   - portal of entry.
2. Animals, food, water, and the soil are all examples of what part of the cycle of infection?
3. An object that transmits infectious material/pathogenic organisms is termed _____.
4. Tuberculosis, varicella, and rubeola are examples of infections transmitted via _____.
5. Name some examples of *vehicles* of infection.

1.
   - Portal of exit
   - Susceptible host
   - Portal of entry
   - Transmission of disease
2. They are all reservoirs of infection.
3. a fomite
4. air/airborne transmission
5. Contaminated water, food, blood, drugs

1. Any medium that transports microorganisms is termed _____.
2. Give some examples of arthropod-borne infectious diseases.
3. An arthropod in whose body an infectious organism develops/multiplies before infecting a host is termed _____.
4. What type of transmission can occur when an infectious individual, sneezes, coughs, speaks, etc in the vicinity of a susceptible host?

1. a vehicle
2. Lyme disease, West Nile virus, malaria, bubonic plague, Rocky Mountains spotted fever
3. a vector
4. Droplet contamination/transmission

1. List at least three conditions that require the use of contact precautions.
2. What is the name of the route of transmission in which the infected person touches a susceptible host's tissue?
3. Nosocomial, or HAI, refers to what kind of infection?
4. When skin is being prepared for a surgical procedure, it is first cleansed in what direction and motion?

1. MRSA (methicillin-resistant *Staphylococcus aureus*), hepatitis A, varicella, impetigo, varicella zoster
2. Direct contact
3. Nosocomial and HAI (health care–associated infection) infections are those acquired in health care facilities
4. Starting at the center, using a circular motion in widening circles (ie, working from center outward)

1. Disposable materials wet with contaminated blood or body fluids should be placed _____.
2. When should mobile equipment be cleaned for mobile studies of compromised patients?
3. Regarding sterile technique, where are gowns considered sterile?
4. What are the three types of transmission-based precautions?

1. in a red bag or special container marked with biohazard symbol
2. Before entering the patient's room
3. In the front from waist up and the sleeves
4. Airborne, droplet, contact

1. What type of transmission-based precaution requires a negative-pressure isolation room?
2. What type of transmission-based precaution is required for influenza, mumps, and rubella?
3. What type of transmission-based precaution is required for MRSA and varicella?
4. What part of a sterile glove is *not* considered sterile when donning it with a nonsterile hand?

1. Airborne
2. Droplet
3. Contact
4. The inside of the cuff

1. What care should be given to the mobile equipment used for imaging a patient with contact precautions?
2. What type of transmission-based precaution requires the health care worker to wear a respiratory protection mask?
3. What type of transmission-based precaution requires the health care worker to wear gloves and gown?

1. Must be cleaned/decontaminated with an antiseptic solution
2. Airborne
3. Contact

1. What type of transmission-based precaution requires the health-care worker to wear a particulate protection/surgical string mask?
2. All vascular access procedures require that the health care worker wear _____.
3. In what ways are needlestick injuries avoided?

1. Droplet
2. gloves
3. Needle recapping must be avoided; if recapping is required, “one-handed scoop” technique should be used.

1. Special puncture-proof containers are provided for _____.
2. List some appropriate actions to take if a patient feels faint.
3. A pulse oximeter measures _____ and _____.

1. discarding used sharps (needles, etc)
2. If seated, bend forward and place head between knees; if recumbent, place in Trendelenburg position; if upright, place in recumbent position.
3. oxygen saturation level of blood; pulse rate

1. Arrange the following structures in order as they fill with air upon inspiration: trachea, pharynx, lungs, nose, bronchi, larynx.
2. What patient movement precaution should be taken when performing mobile chest x-rays within the first 24 hours following pacemaker insertion?
3. What are the vital signs?

1. Nose, pharynx, larynx, trachea, bronchi, lungs
2. Avoid elevating the left arm
3. Body temperature, pulse rate, respiratory rate, arterial blood pressure

1. A febrile condition is usually caused by _____.
2. What measurement site generally records the highest body temperature? What time of day is body temperature usually highest?
3. The term used to describe difficulty in breathing is _____; the term used to describe abnormally rapid breathing is _____.

1. some kind of infection
2. Rectal; night
3. dyspnea; tachypnea

1. What is the normal adult respiratory rate? How does that compare with the normal respiratory rate of children?
2. Blood pressure in vessels is highest during what phase of the heart cycle?
3. When blood pressure measurements are recorded, what number is placed on top?
4. A sphygmomanometer and a stethoscope are needed to assess _____.

1. 12 to 18 breaths/min; children have higher rate up to 30 breaths/min.
2. Ventricular systole
3. Systolic
4. blood pressure

1. What is the normal adult systolic range? What is the normal diastolic range?
2. Blood pressure reading consistently above 140/90 are termed _____.
3. During blood pressure measurement, the cuff needs to be inflated enough to collapse the _____ artery.

1. 100 to 140; 60 to 90
2. hypertension
3. brachial

1. During blood pressure measurement, the first sound heard upon very slow opening of the bulb pump valve is the _____ pressure.
2. The body's center of gravity in the upright position is the _____; the body's stability is increased, and muscle strain decreased, with a _____ center of gravity and _____ base of support.
3. Body stability is maintained when its center of gravity is _____ its base of support.

1. systolic
2. center of the pelvis (sacral level); lower; broader/wider
3. over/in line with

1. When helping a patient into/out of a wheelchair, the wheelchair should be_____ to the x-ray table/bed and locked.
2. When transferring a patient from the wheelchair to the x-ray table/bed, the patient's _____ side should approach the x-ray table/bed first.
3. What is the most common device used to deliver low concentrations and low flow of oxygen?

1. 45°
2. stronger
3. Nasal cannula

1. When an IV infusion is in place, the IV standard/bag should be _____ inch(es) above the level of the vein.
2. The term *diaphoresis* refers to profuse _____.
3. An endotracheal tube is used for _____ ventilation.

1. 18 to 24
2. sweating/perspiration
3. mechanical

1. What kind of tube is likely to be used in cases of pleural effusion, pneumothorax or hemothorax?
2. Larger gauge needles have a _____ bore; the part of the needle attached to the syringe is the _____.
3. The term that refers to medication or contrast medium leaked from a vein, or inadvertently introduced into tissue outside a vein, is _____; the term referring to the diffusion of injected material into adjacent tissues is _____.
4. How many dose(s) of injectable medication are contained in an ampoule?

1. Chest/thoracostomy tube
2. smaller; hub
3. extravasation; infiltration
4. One

1. What veins are most commonly used venipuncture sites? What is the recommended angle for intravenous needle insertion?
2. The Cantor and Harris tubes are examples of _____; the Miller-Abbott tube is an example of _____.
3. What is the most common type of urinary catheter?
4. A surgically formed passage from the large bowel to the exterior is termed a _____, and the external opening of the bowel is termed a _____.

1. Cephalic and basilic; 15°
2. single-lumen nasoenteric tubes; double-lumen nasoenteric tube
3. The Foley catheter
4. colostomy; stoma

1. At what level should urinary collection bags be kept?
2. An audible alarm from an infusion/medication pump usually signals that _____.
3. What is the name of the catheter frequently used to measure cardiac output and right heart pressures?
4. Anticholinergic drugs _____ the blood pressure and _____ the heart rate.

1. Below the level of the urinary bladder
2. fluid is running low or its flow has been interrupted.
3. Swan-Ganz (a type of pulmonary artery flow–directed catheter)
4. increase; increase

1. A vasovagal response is characterized by _____ heart rate and _____ blood pressure.
2. What visual signs can the radiographer use to continually assess patient condition?
3. Elevated creatinine levels are most often seen in patients with compromised _____ function.
4. The normal ECG waveform is termed _____.
5. The abnormal quivering of cardiac muscle fibers, instead of contraction, is termed _____.

1. decreased; decreased
2. Changes in skin color, changes in skin temperature, level of consciousness (LOC), breathing rate, motor control
3. renal
4. sinus rhythm
5. fibrillation

1. A drug specifically used to treat a toxic effect is termed a/an _____.
2. Which of these drugs have adrenergic/vasoconstrictor effects:
   - epinephrine/Adrenalin
   - ephedrine/Isuprel
   - hydrocodone/Vicodin
   - norepinephrine bitartrate/Levophed
   - meperidine/Demerol
3. What should be the angle between the needle and skin for intramuscular injections?
4. Intrathecal injections are made into the _____ space.

1. antidote
2. epinephrine/adrenalin; ephedrine/isuprel; norepinephrine bitartrate/levophed
3. 90°
4. subarachnoid

1. Treatment or medication introduced into the body, other than through the digestive system/orally, is termed_____.
2. Especially during a disaster, the process of identifying victims, performing initial examinations, and assigning priorities for further care is called _____.
3. In the standardized emergency code communication, to what do the following color codenames refer? Red; silver; blue
4. A pulmonary embolism (PE) is most often a complication of thrombus formation in one or both _____.
5. Episodes of chest pain occurring when coronary arteries are unable to supply the heart with sufficient oxygenated blood is termed _____.

1. parenteral
2. triage
3. Red: fire; Silver: weapon or hostage situation; Blue: cardiac or respiratory arrest
4. lower extremities
5. angina pectoris

1. The device that is used to administer electric shock to correct ineffectual cardiac rhythm is termed _____.
2. A severe blow to the head often results in injury on the opposite side. This is called a _____ injury.
3. An incision into the chest, with insertion of tube to relieve pneumothorax or hemothorax is termed _____.
4. CPR compressions should be delivered at a rate of about _____.
5. A nonambulatory nauseous patient should be helped to the _____ position to avoid _____ of vomitus.

1. defibrillator
2. contrecoup
3. thoracotomy
4. 100 compressions per minute
5. lateral decubitus; aspiration

1. What is the radiographer's most important task if the patient experiences a seizure?
2. Urticaria is the medical term for _____, and its most common treatment is administration of _____.
3. The most serious type of contrast media reaction is _____ shock.
4. Shock caused by loss of blood or tissue fluid is termed _____ shock.

1. To protect the patient from injury
2. hives; antihistamine
3. anaphylactic
4. hypovolemic

1. Nonionic contrast agents have a _____ osmolality than ionic contrast agents.
2. Heating water-soluble iodinated contrast agents to _____ temperature reduces its viscosity and makes it easier to inject.
3. What drug is most often used to treat non–insulin-dependent diabetes?
4. What term is used to describe a symptom or circumstance that makes a particular treatment unsafe or inappropriate?

1. lower
2. body
3. Metformin/glucophage
4. Contraindication

1. What is the current recommendation for patients taking the medication metformin (Glucophage) who also require a radiologic examination using iodinated contrast media?
2. Latex allergy can be manifested with *mild* reactions such as _____ or more *severe* reactions such as _____.
3. Diaphoresis, hypotension, and bradycardia are symptoms of a _____ type of allergic reaction to contrast media.
4. A diabetic patient who has taken insulin, but no food, may develop _____; some symptoms are _____; examples of quick treatment while the patient is still alert are _____.
5. Epistaxis is the medical term for _____. How should epistaxis be treated?

1. Discontinue the medication for 48 hours before and 48 hours following use of the contrast agent.
2. Mild: skin redness, hives, itching; Severe: itchy eyes, running nose, sneezing, difficulty breathing, wheezing.
3. vasovagal
4. hypoglycemia; tremor, perspiration, weakness and hunger; providing sweetened fruit juice, candy, or a prepackaged dose of glucose gel
5. nosebleed; breath through mouth, keeping head level and pressing firmly against nasal septum for about 10 minutes

1. Bisacodyl and citrate of magnesia are examples of _____.
2. What is the usual patient preparation for an upper GI series?
3. Glucagon can be useful in radiologic examination of the GI tract because it slows _____.
4. Radiologic examination of the small intestine via Bilbao or Sellink tube through which barium sulfate is injected is termed _____.

1. cathartics
2. NPO for about 8 hours prior to the examination
3. peristalsis
4. enteroclysis

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