

Specialized Topics in Areas of Radiologic Sciences
P.O. Box 2931 Toledo, Ohio 43606 419-471-1973
E-mail: info@xrayhomestudies.com
www.xrayhomestudies.com

Understanding Exposure Factors:

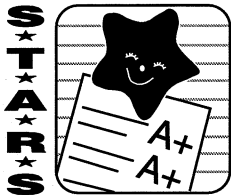
Density, Contrast, Detail,

Distortion and Accessories

Prepared by

Carolyn J. Frigmanski, M.A., B.S.R.T. ®
Founder, S.T.A.R.S.

**All post tests must be returned for the
designated and Ohio Department of Health
approved 4 continuing education credits.**



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Welcome to your S.T.A.R.S. self-learning product that has been approved by the Ohio Department of Health for continuing education credits for licensed gxmors and radiographers for license renewal.

Instructions:

- ❖ Please complete **both sides of this page** with your answer selections for all the units in this product! CE credit will **NOT** be provided for incomplete submissions.
- ❖ Do **NOT** send the question pages or return the booklet. It is yours to keep as a resource.
- ❖ You can use a standard envelope and postage when you return this page **ONLY** to the S.T.A.R.S. office at the address listed above.
- ❖ You will receive a signed certificate of completion from an official at S.T.A.R.S. upon successful evaluation of all your post test answers.
- ❖ Please **print the following information legibly** for record-keeping and accurate certificate completion.

Name _____

Address _____

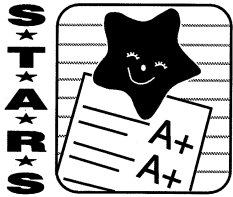
City, State and Zip Code _____

Desired Number for Certificate i.e. social security number/last 4 digits of social security # or License number:

Date of Submission _____

Thank you very much. I hope you enjoy this educational product!

Carolyn J. Frigmanski, M.A.,B.S.R.T. ®
Founder



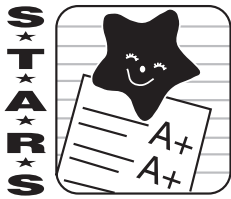
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Unit 3 Density	Unit 4 Contrast	Unit 5 Detail/Distortion	Unit 6 Accessory Devices
1.	1.	1.	1.
2.	2.	2.	2.
3.	3.	3.	3.
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20.	20.	20.	20.



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Dear GXMO/LSO/LSR participant,

Welcome to your selected S.T.A.R.S. developed continuing education home study!

In the spring of 2013, The Ohio Department of Health (ODH) approved ALL of them for GXMO license renewal. Please check with your state licensing agency if you are not a licensed GXMO in Ohio to be sure your state accepts these ce credits for your state license renewal requirement.

This product consists of a text on a desired topic and multiple question, short answer post test(s) pages. The number of Ohio Department of Health approved continuing education (ce) credits is listed on our order form. This home study product was originally developed for radiographers across the country who were registered with the American Registry of Radiologic Technologists (ARRT) and approved by the American Society of Radiologic Technologists (ASRT). Please disregard any reference to the ASRT/ARRT within this product, if any.

You must complete the reading and questions with a **75% or higher score** on the post test(s) to get your approved CE credit!

Please return all the post test pages to the **S.T.A.R.S.** address listed on our letterhead **BEFORE** your license expires. We will forward your certificate of completion on the same day your post test(s) were evaluated (except for holidays and Sundays). If you did NOT receive a 75%, we will send the pages back with the questions needing a new answer selection. Send them back for a **FREE** re-evaluation. No refund will be provided for unsatisfactory personal performance on any ce product.

Plan the return of your post test(s) pages in a timely manner. I cannot accept emailed or faxed copies since I need to retain my **ORIGINAL** records for the ODH for 3 years in case you may be audited.

Remember to get your envelope weighed at the post office whenever submitting more than 4 pages. The post office will return it to you if you have insufficient postage, thereby delaying it for my evaluation and your certificate of completion.

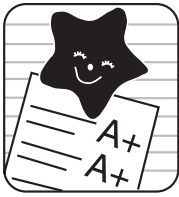
Feel free to contact me by email: info@xrayhomestudies.com or telephone: **419 471-1973** if you have any questions. Please share with others in the future.

Thank you for selecting **S.T.A.R.S.** to meet your continuing education needs!

Sincerely,

Carolyn J. Frigmanski, M.A., B.S.R.T. ®, Founder

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How to renew your GXMO license in Ohio:

The Ohio Dept. of Health (ODH) requires a **minimum of 12 continuing education credits (ceus) to be completed every 2 years (your biennium) BEFORE your license expires.** You may do more than 12 ceus, but not less than 12 ceus, if you so choose. Ceus in excess of 12 cannot be carried over to the next biennium.

You will receive a hard copy renewal notice by mail from the ODH 60 days **BEFORE** your license expires. **It is your responsibility to amend your personal information to the ODH whenever you change your name, address or place of employment as soon as possible by using the ODH website or contacting the ODH by telephone at 614 752-4319 for assistance. Failure to receive an ODH notice is not an acceptable reason for failing to renew on time.** You can add completion of clinical modules to your GXMO license on the ODH web site.

Your ODH notice informs you that you may renew online or request a hard copy form from them. **You must have your S.T.A.R.S. certificate(s) of completion immediately available when you renew since your course title(s), number of ceus, and ODH accreditation number(s) and date(s) of completion are printed on it.**

You can renew immediately when you receive your notice or you have 30 days to complete the renewal process and payment to the ODH after your license expires. Online renewal requires your credit card for payment. If you chose hard copy renewal, you may submit a check or money order.

You and/or your employer can view and/or print your renewed license on line upon completion of the process. Problems that exist with renewal should be addressed to the ODH by calling for assistance.

S.T.A.R.S. personnel are NOT responsible for your renewal. Please direct any questions or needed assistance with renewal to the ODH personnel.

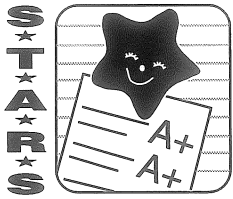
GXMOs must notify the ODH in writing within 30 days of any changes in the physician providing direct supervision. If your scope of practice changes (e.g. chiropractic to podiatric), a competency form must be completed and submitted to the ODH.

You may also want to check the ODH web site periodically for changes that may have occurred during your biennium and to share this information with your co-workers and/or administrative staff members.

The ODH website is: <http://www.odh.ohio.gov/odhPrograms/rp/rlic/ristatus.aspx>

Email is: BRadiation@odh.ohio.gov

Thank you very much.



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Instructions for Mailing your Continuing Education Post Tests

Complete ALL hard copy unit post tests for the products you purchased in legible printing BEFORE your license expires. Mail is processed the same day it is received.

You may want to copy them BEFORE you mail them to the S.T.A.R.S. office to minimize mail delivery complications. They will NOT be returned to you unless you get a 75% or less. If you do NOT get a 75% or better after evaluation, the post tests will be sent back to you with the questions needing a new answer selection. After completing the questions, send them ALL back to the S.T.A.R.S. office for re-evaluation.

Be sure to use the CORRECT postage by having it weighed at the post office if it consists of more than 5 pages. Envelopes with INSUFFICIENT POSTAGE will be sent back to the participant and delay your post test evaluation and certificate creation.

I do NOT accept faxes since faxes fade over time and I need to keep my records for 3 years in case you would get audited by the Ohio Dept. of Health for some reason.

I do NOT accept scanned pages because I do NOT want you putting your private, personal information on the internet. I do NOT open attachments due to the threat of virus contamination that may jeopardize my web site and computerized databases.

Do NOT send your study media i.e. CD, DVD, booklets and/or books back to me.

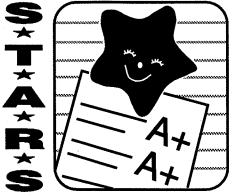
United States Postal Service (USPS):

If you are using USPS for priority or express mailing, please keep your receipt with the tracking number in case of a problem with the delivery. Please mark the section for NO SIGNATURE REQUIRED for express mail and send it to my home address: Carolyn J. Frigmanski, MA, BSRT (R) 3134 Aldringham Road Toledo, Ohio 43606. The USPS does NOT deliver to my P.O. Box address. Please call to let me know I should be expecting it at 419 471-1973.

FedEx or United Parcel Service UPS:

If you are using these delivery services, please keep your receipts with the tracking number in case of a problem with the delivery. Please mark the section for NO SIGNATURE REQUIRED for express mail and send it to my home address: Carolyn J. Frigmanski, MA, BSRT(R) 3134 Aldringham Road Toledo, Ohio 43606. Please call to let me know I should be expecting it at 419 471-1973.

Thank you very much.



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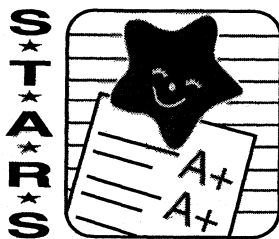
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Unit #3

Title Factors Affecting the Radiographic Image — Density

1. Quality radiographs can be consistently produced with a thorough knowledge of
 - a. manual processing of film
 - b. the Joint Commission requirements
 - c. budgetary considerations
 - d. visibility & sharpness of detail
2. The sharpness of detail as recorded information is controlled predominately by
 - a. exposure factors
 - b. darkroom conditions
 - c. geometric factors
 - d. equipment operation
3. Radiographic images that possess low noise have
 - a. maximum optical densities
 - b. minimal unwanted optical densities
 - c. less detail
 - d. high grain
4. The prime factor of exposure which determines the number of x-rays produced is
 - a. mA
 - b. kVp
 - c. time
 - d. mA and kVp
5. The prime factor of exposure which determines the penetration of the beam is
 - a. kVp
 - b. mA
 - c. time
 - d. mA and kVp
6. The degree of blackening on the film is the result of a combination of prime factors such as
 - a. mA
 - b. time
 - c. kVp
 - d. mA, kVp and time
7. The law that allows radiographers to manipulate mA and time to achieve the same density is
 - a. inverse square
 - b. compensation
 - c. reciprocity
 - d. half life
8. The law that provides radiographers the greatest degree of radiation protection is
 - a. reciprocity
 - b. inverse square
 - c. compensation
 - d. half life
9. The law that allows radiographers to produce equally diagnostic images when distance is altered is
 - a. compensation
 - b. inverse square
 - c. reciprocity
 - d. half life
10. As kVp is increased, the degree of blackening on the resultant image
 - a. decreases
 - b. remains the same
 - c. increases
 - d. becomes inconsistent
11. Disease processes that require an increase in the prime factors of exposure are called
 - a. destructive
 - b. multiplying
 - c. subtractive
 - d. additive

12. The resultant density on a finished image will increase as
a. time of exposure decrease c. screen speed decreases
b. processing temperature rises d. kVp decreases
13. Beam restriction affects density because the amount of scatter radiation
a. decreases as collimation decreases c. remains unchanged
b. increases as collimation decreases d. increases with the collimator's dimensions
14. Unwanted and non-diagnostic density on a finished radiograph is considered
a. reciprocity density c. fog
b. positive density d. background
15. As added filtration increases in thickness, the resultant effect on density will
a. increase c. remain the same
b. decrease d. increases as the atomic number increases
16. The useful diagnostic range of densities on a finished radiograph is
a. .25-2.0 c. .25-4.0
b. 0.5-3.0 d. .1-2.5
17. The speed factor refers to the step on the sensitometric curve that has a numeric value of
a. 2.0 c. .1.5
b. 0.5 d. 1.0
18. When utilizing the anode heel effect properly, the thinnest anatomical portion of the body parts
a. should be placed at the cathode end c. should be placed at the anode end
b. should be placed transversely to the tube d. should be placed longitudinally to the tube
19. The compensatory filter designed specifically for chest radiography is the
a. wedge c. boomerang
b. trough d. added
20. Select the new exposure mAs to be used to produce an equally diagnostic film if 120 mAs was used at 36" and the new distance is 60".
a. 333 mAs c. 90 mAs
b. 475 mAs d. 200 mAs



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Unit 4

Title: Factors Affecting the Radiographic Image - Contrast

1. Long scale contrast describes a finished radiograph possessing
 - a. black and white shades only
 - b. many shades of gray
 - c. no valuable diagnostic information
 - d. fog
2. When a physician requests an image with high contrast, he usually means
 - a. long scale
 - b. medium scale
 - c. short scale
 - d. a image with lots of gray shades
3. Contrast on the finished radiograph that was produced by the patient's inherent size, shape, and tissue densities is called
 - a. subject
 - b. film
 - c. subject and film
 - d. long scale
4. The exposure factor which contributes the most to radiographic contrast is
 - a. mAs
 - b. mA
 - c. time
 - d. kVp
5. As patient thickness and tissue density increases, the scale of contrast
 - a. increases
 - b. decreases
 - c. remains the same
 - d. gets shorter
6. Subject contrast may be altered when
 - a. pathological process exists
 - b. processing changes
 - c. film type changes
 - d. technique changes
7. Contrast scales which are provided by the commercial manufacturer are referred to as
 - a. subject
 - b. short
 - c. film
 - d. long
8. Increasing development temperature provides resultant images with
 - a. more contrast
 - b. short scale contrast
 - c. excellent contrast
 - d. less contrast
9. "Hardness" of the beam refers to the function of the filter in removing
 - a. short wavelengths
 - b. long wavelengths
 - c. average wavelengths
 - d. remnant wavelengths
10. The glass window of the x-ray tube acts as a filter and is called
 - a. inherent
 - b. added
 - c. total
 - d. compensatory
11. Total filtration is a combination of
 - a. added and compensatory
 - b. inherent and compensatory
 - c. inherent and added
 - d. wedge and trough

12. Every body part has the recommended kVp to utilize and is referred to as
 - a. maximum
 - b. average
 - c. acceptable
 - d. optimum
13. If the mAs is going to be halved, 90 kVp would have to be changed to
 - a. 87
 - b. approximately 103
 - c. 80
 - d. 110
14. If the mAs is going to be decreased 50%, 74 kVp would have to be changed to
 - a. 63
 - b. 100
 - c. 85
 - d. 94
15. Thicker, denser body parts produce
 - a. less scatter
 - b. the same scatter
 - c. optimum scatter
 - d. greater scatter
16. Methods to control scatter include
 - a. increasing collimation
 - b. increasing time
 - c. increasing kVp
 - d. decreasing kVp
17. Most departments that employ many radiographers doing a variety of radiographic exams will purchase
 - a. wide latitude film
 - b. narrow latitude film
 - c. non-screen film
 - d. single emulsion film
18. The inherent film product characteristic affecting the resultant scale of contrast is called
 - a. latitude
 - b. sensitivity
 - c. film response
 - d. film fog
19. When increasing a grid ratio, the scale of contrast will
 - a. demonstrate no change
 - b. improve by reducing scatter
 - c. deteriorate radiographic quality
 - d. only be determined by the patient
20. The total filtration of aluminum equivalent for diagnostic imaging tubes is approximately
 - a. 1.5 mm
 - b. 2.0 mm
 - c. 2.5 mm
 - d. 3.0 mm

**Unit 5****Title: Factors Affecting the Radiographic Image —Detail and Distortion**

1. The term umbra refers to the
 - a. fuzzy border surrounding the image
 - b. magnification factor
 - c. image proper
 - d. location of the central ray

- 2-7. Match the geometric factor with its corresponding effect on sharpness of detail
(You may use these items more than once.)

___ closest object-image distance possible	a. increasing sharpness
___ largest focal spot size	
___ longest source-image distance	b. decreases sharpness
___ fastest film-screen combination possible	
___ patient capable of holding still	c. no change in detail
___ shortest exposure time possible	

8. Using a tube tilt in error on a projection that does not usually require it will produce
 - a. productive distortion
 - b. no distortion
 - c. identical distortion
 - d. non-productive distortion

- 9-11. Calculate the magnification factor for these situations.

___ magnification factor when image size is 2" and object size is 1.5".
___ magnification factor when image size is 4" and object size is 3".
___ magnification factor when image size is 3" and object size is 2".

12. —14. Calculate the image size for these situations.

_____ object size is 3"; the S.I.D. is 72"; the S.O.D. is 36".

_____ object size is 6"; the S.I.D. is 40"; the S.O.D. is 20".

_____ object size is 2"; the S.I.D. is 36"; the S.O.D. is 24".

15-17. Calculate the % of magnification for these situations

_____ % image width is 4"; object width is 2".

_____ % image width is 6"; object width is 4".

_____ % image width is 3"; object width is 1.5".

18. The test device which can be used to evaluate spatial resolution in screens is

- a. parallel line type
- b. densitometer

- c. wire mesh
- d. sensitometer

19. The "speckled" appearance created from the distribution of silver halide crystals in the film emulsion is called

- a. mottle
- b. graininess

- c. noise
- d. edge gradient

20. The random interaction of x-rays and intensifying screen crystals is called

- a. noise
- b. graininess

- c. quantum mottle
- d. quantum mechanics



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Unit 6

Title: Accessory Devices Used in Radiographic Techniques

1. Grids are recommended for use when
 - a. scatter radiation is minimal
 - b. clean up is not important
 - c. body parts measure over 10–12 cm.
 - d. scatter radiation may become extreme
2. Grids will
 - a. improve contrast
 - b. reduce dose to patient
 - c. be helpful for all examinations
 - d. reduce contrast
3. The height of the lead strip to the distance between them is
 - a. selectivity
 - b. grid radius
 - c. grid ratio
 - d. contrast improvement factor
4. Contrast improvement factor compares radiographs with a grid to those
 - a. of higher grid ratios
 - b. without a grid
 - c. using higher grid frequencies
 - d. using lower grid ratios
5. A finished radiograph with density in the middle and no density on the periphery of each side indicates
 - a. an upside down grid
 - b. off-center grid
 - c. grid not moving
 - d. incorrect grid ratio
6. An 8:1 grid ratio is used with 100 mAs. The corrected mAs for a 16:1 grid ratio is
 - a. 25 mAs
 - b. remains the same
 - c. 75 mAs
 - d. 150 mAs
7. A non-grid technique is 60 mAs. A 12:1 grid is used with a corrected mAs of
 - a. 90 mAs
 - b. 60 mAs
 - c. 300 mAs
 - d. 200 mAs
8. A beam-restricting device which requires the use of micro-switches is
 - a. aperture
 - b. P.B.L. device
 - c. manual collimator
 - d. cone
9. The radiographic projection that could best utilize the anode heel effect to advantage is
 - a. AP dorsal spine
 - b. PA colon
 - c. lateral skull
 - d. PA hand
10. The beam-restricting device that operates similarly to the lens of a camera is
 - a. cone
 - b. collimator
 - c. aperture
 - d. P.B.L. device
11. One of the disadvantages in utilizing a cylinder cone is
 - a. decreased patient dose
 - b. increased patient dose
 - c. less penetration
 - d. more density

12. A metallic wedge that can be inserted into the x-ray tube housing to improve the quality of the finished radiograph is a
- a. total filter
 - b. inherent filter
 - c. triangle filter
 - d. compensatory filter
13. To utilize the anode heel effect properly, the anatomical part should be placed on the table with the thicker portion aligned to the
- a. anode portion of the tube
 - b. cathode portion of the tube
 - c. transversely to the tube
 - d. longitudinally to the tube
14. Collimating the x-ray beam closely to the anatomical part warrants a/an
- a. decrease in primary radiation
 - b. increase in secondary radiation
 - c. increase in primary radiation
 - d. increase in remnant radiation
15. The major function of any filter is to
- a. harden the beam
 - b. soften the beam
 - c. allow all x-rays through
 - d. decrease patient dose
16. Restricting the primary beam with any device will result in images with
- a. less detail
 - b. more fog
 - c. more density
 - d. greater detail
17. The grid ratio recommended for diagnostic exams using 90 kVp or less is
- a. 16:1
 - b. 8:1
 - c. 6:1
 - d. 12:1
18. Manufacturers of grids must specify the following detail on the grid itself.
- a. composition of materials
 - b. per cent of lead content
 - c. thickness of grid
 - d. grid ratio
19. The old technique of inserting a black sheet of paper inside a cassette was to
- a. cut exposure dose
 - b. increase the density on resultant image
 - c. reduce the density on the resultant image
 - d. reduce detail
20. When using grids, compensatory filters and beam restricting devices, patient dose will be
- a. increased
 - b. decreased
 - c. remain the same
 - d. fluctuate