

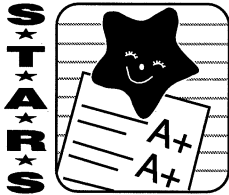
Specialized Topics in Areas of Radiologic Sciences
P.O. Box 2931 Toledo, Ohio 43606 419-471-1973
E-mail: info@xrayhomestudies.com
www.xrayhomestudies.com

Radiation Physics and Protection Series

Units 1 – 12

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 number
of Ohio Department of Health approved continuing
education credits.**



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Dear S.T.A.R.S. participant,

Welcome to your hard copy 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 for license renewal. These 12 units may be submitted for the full 12 ce hours required for radiologic license renewal. You may also divide them for partial credit hours and submit the remaining ce hours for your next biennium or renewal period. Partial credit can be in increments of 2, 3, 4, 6, 8, 9 or 10 ce hours.

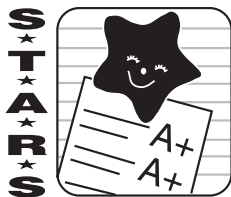
Instructions:

- ❖ Please complete **both sides of the answer page** with your selections for **all 12 units** in this product if you desire full credit! CE credit will **NOT** be provided for incomplete submissions.
- ❖ If you want **partial credit**, **only submit the page with the units you desire** for evaluation and certificate completion at this time.
- ❖ 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 with a 75% or better. If you are not successful, the post test answer sheet will be sent back to you for re-evaluation of the incorrect answers. You may return it for evaluation at no charge.
- ❖ Please **print the personal information legibly** on your submitted answer sheet for record-keeping and accurate certificate completion.
- ❖ Your desired number for certificate creation and record-keeping can be your full social security number; the last 4 digits of social security # or license number.

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

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

*****All references in these units to radiographers applies to general x-ray machine operators who are also called limited radiographers in other states.**



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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.

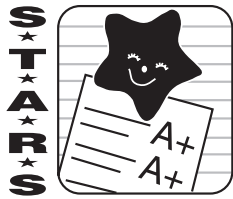
Remember to get your envelope weighed at the post office whenever submitting more than 4 pages. The post office will return it to you if you have insufficient postage, thereby delaying it for my evaluation and your certificate of completion.

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.

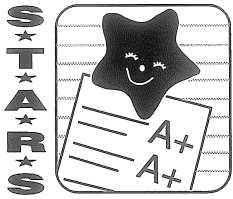
GXMOs must notify the ODH in writing within 30 days of any changes in the physician providing direct supervision. If your scope of practice changes (e.g. chiropractic to podiatric), a competency form must be completed and submitted to the ODH.

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.

Answer Sheet for: Units 1-7 Radiation Protection & Physics Series

**Please place your lettered selection for each question in the respective box and return
ONLY this post test sheet to S.T.A.R.S. office P.O. Box 2931 Toledo, Ohio 43606**

Name _____

Address _____

City _____ State _____ Zip Code _____

Desired Number for Certificate _____

Thank you for selecting our self-learning/home study products!

Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Unit 7
1.	1.	1.	1.	1.	1.	1.
2.	2.	2.	2.	2.	2.	2.
3.	3.	3.	3.	3.	3.	3.
4.	4.	4.	4.	4.	4.	4.
5.	5.	5.	5.	5.	5.	5.
6.	6.	6.	6.	6.	6.	6.
7.	7.	7.	7.	7.	7.	7.
8.	8.	8.	8.	8.	8.	8.
9.	9.	9.	9.	9.	9.	9.
10.	10.	10.	10.	10.	10.	10.
11.	11.	11.	11.	11.	11.	11.
12.	12.	12.	12.	12.	12.	12.
13.	13.	13.	13.	13.	13.	13.
14.	14.	14.	14.	14.	14.	14.
15.	15.	15.	15.	15.	15.	15.
16.	16.	16.	16.	16.	16.	16.
17.	17.	17.	17.	17.	17.	17.
18.	18.	18.	18.	18.	18.	18.
19.	19.	19.	19.	19.	19.	19.
20.	20.	20.	20.	20.	20.	20.

Answer Sheet for: Units 8-12 Radiation Protection & Physics Series

**Please place your lettered selection for each question in the respective box and return
ONLY this post test sheet to S.T.A.R.S. office P.O. Box 2931 Toledo, Ohio 43606**

Name _____

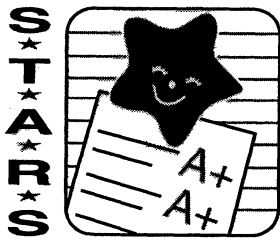
Address _____

City _____ State _____ Zip Code _____

Desired Number for Certificate _____

Thank you for selecting our self-learning/home study products!

Unit 8	Unit 9	Unit 10	Unit 11	Unit 12
1.	1.	1.	1.	1.
2.	2.	2.	2.	2.
3.	3.	3.	3.	3.
4.	4.	4.	4.	4.
5.	5.	5.	5.	5.
6.	6.	6.	6.	6.
7.	7.	7.	7.	7.
8.	8.	8.	8.	8.
9.	9.	9.	9.	9.
10.	10.	10.	10.	10.
11.	11.	11.	11.	11.
12.	12.	12.	12.	12.
13.	13.	13.	13.	13.
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15.	15.	15.	15.	15.
16.	16.	16.	16.	16.
17.	17.	17.	17.	17.
18.	18.	18.	18.	18.
19.	19.	19.	19.	19.
20.	20.	20.	20.	20.



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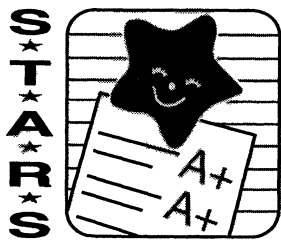
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Unit 1

Title: Introduction to Radiation Physics

1. The mass of an object in a gravitational field is called
 - a. density
 - b. weight
 - c. mass
 - d. mass gravity
2. The types of energy we use to produce our x-ray image before development are:
 - a. chemical and kinetic
 - b. nuclear and potential
 - c. electrical and electromagnetic
 - d. kinetic and potential
3. The types of energy we use to produce our x-ray image after development are:
 - a. electrical and chemical
 - b. nuclear and potential
 - c. chemical and thermal
 - d. kinetic and potential
4. The scientist who provided the information for the graphic representation of our elements in an orderly format was
 - a. Bohr
 - b. Einstein
 - c. Thomson
 - d. Mendeleev
5. The miniature solar system concept of the atom was provided by
 - a. Galileo
 - b. Bohr
 - c. Einstein
 - d. Dalton
6. The smallest part of an element that has all the properties of the element is called a
 - a. molecule
 - b. substance
 - c. ion
 - d. atom
7. The term used to describe silver and bromide atoms that combine to form the crystals in our film emulsion is a(n)
 - a. molecule
 - b. element
 - c. substance
 - d. covalent bond
8. The positively charged particle found in the nucleus is called the
 - a. ion
 - b. proton
 - c. neutron
 - d. electron
9. The smallest negatively charged particle of an atom is the
 - a. neutron
 - b. ion
 - c. electron
 - d. proton
10. Isotopes differ from ions because the atom has either gained or lost an(a)
 - a. proton
 - b. electron
 - c. beta particle
 - d. neutron
11. The shortest electromagnetic wavelength known to man is
 - a. x-ray
 - b. cosmic
 - c. ultraviolet
 - d. visible light

12. The EMR term which indicates the speed of light is
a. velocity
b. frequency
c. hertz
d. wavelength
13. An alpha particle is a form of particulate radiation consisting of a(n)
a. Hydrogen atom
b. Carbon cation
c. Oxygen molecule
d. Helium nucleus
14. The unit of radiation that can be measured in the primary x-ray beam is the
a. Curie or Becquerel
b. Rem or Sievert
c. Roentgen or Coulomb/Kilogram
d. Rad or Gray
15. The unit of radiation provided on your personnel monitoring report is the
a. RAD or Gray
b. mSievert or mRem
c. mCurie or Becquerel
d. mRoentgen
16. Radium become less radioactive over time because of a law called
a. law of conservation of energy
b. radioactive decay
c. Einstein's theory of relativity
d. inverse square law
17. The radiation that exits after passing through the patient to reach the image receptor is called
a. remnant
b. primary
c. scatter
d. particulate
18. The interaction of matter and radiation that produces a recoil electron is called
a. Compton effect
b. coherent scattering
c. pair production
d. photoelectronic effect
19. The interaction that does not occur in diagnostic x-ray is
a. photoelectric
b. Compton
c. pair production
d. classical scattering
20. The interaction that satisfies the law of conservation of energy and matter is called
a. pair production
b. photoelectric
c. Compton
d. coherent scattering



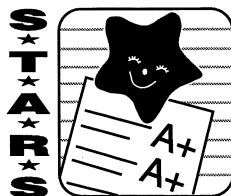
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Unit 2

Title: Basic X-ray Circuitry

1. Materials that allow electrons to flow easily are called
 - a. semi conductors
 - b. insulators
 - c. conductors
 - d. semi insulators
2. The electrification process using the electrical field of a charged object to confer a charge on an uncharged object is
 - a. traction
 - b. induction
 - c. contact
 - d. friction
3. The law of electrostatics which is similar to one of the laws of magnetism is
 - a. unlike charges attract, like charges repel
 - b. force is inversely proportional to the product of the charges
 - c. charges are located on the exterior
 - d. unlike charges repel, like charges attract
4. Electromotive force is a synonym for
 - a. amp
 - b. watt
 - c. ohm
 - d. volt
5. The scientist who established the relationship of volts = amps x ohms is
 - a. Georges Ohm
 - b. Michael Faraday
 - c. Albert Einstein
 - d. Benjamin Franklin
6. The type of current in which electrons oscillate back and forth every 1/120 second is called
 - a. direct
 - b. rectified
 - c. alternating
 - d. direct pulsating
7. In the three-wire system, the wire that does not carry electricity is called
 - a. hot
 - b. ground
 - c. cold
 - d. warm
8. The type of circuit used in older style Christmas tree lights where one bulb went out, they all went out is
 - a. parallel
 - b. alternating
 - c. direct
 - d. series
9. When current is on, the electromagnet will
 - a. possess a magnetic field
 - b. not possess a magnetic field
 - c. not operate at all
 - d. attract all materials
10. Transformers use the form of induction called
 - a. self
 - b. back emf
 - c. mutual
 - d. magnetic
11. The device that consists of an armature with current flowing in it within a magnetic field is a(n)
 - a. generator
 - b. motor
 - c. transformer
 - d. electromagnetic

12. An electrical device that operates on self induction and allows us to preselect kVp is called a
- a. transformer
 - b. solenoid
 - c. electromagnet
 - d. autotransformer
13. The most efficient and expensive transformer on the market today is the
- a. shell type
 - b. closed core
 - c. air core
 - d. open core
14. The process of converting A.C. to direct pulsating current is called
- a. inversion
 - b. transformation
 - c. rectification
 - d. induction
15. Tungsten is used in x-ray tubes because it has a
- a. low atomic number
 - b. low melting point
 - c. exceptional density
 - d. high thermal conductivity property
16. The process of using heat to "boil off" electrons at the cathode is called
- a. rectification
 - b. thermionic emission
 - c. space charge
 - d. mutual induction
17. The portion of the primary beam that originates from ionizing tungsten atoms at the anode is
- a. characteristic
 - b. brems
 - c. secondary
 - d. remnant
18. Calculating heat units for a three phase 12 pulse unit requires mA X seconds X kVp and
- a. X 1.35
 - b. X .5
 - c. X 1.41
 - d. X 2
19. The manufacturer's chart that provides details about the maximum technical factors that can be used for an exposure is
- a. technique
 - b. tube rating
 - c. anode cooling
 - d. cathode heating
20. One of the responsibilities for radiographers is to prolong x-ray tube life by
- a. disregarding unusual sounds
 - b. utilizing low exposures all the time
 - c. maximizing rotor time
 - d. following recommended warming procedures



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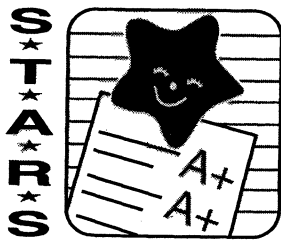
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Unit #3

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



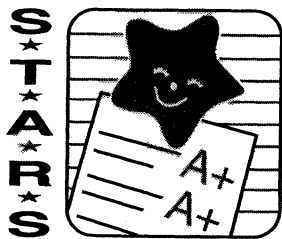
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Unit 4

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



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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

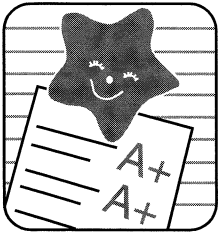
- a. mottle
- b. graininess

- 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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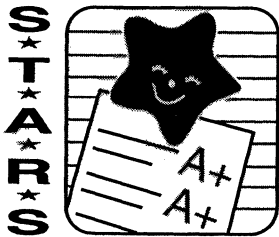
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Unit 6

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



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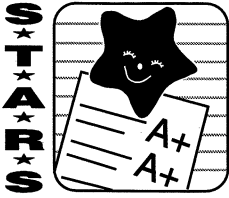
Unit 7

Title: Radiographic Film, Darkroom Processing and Intensifying Screens

1. Historically, the first radiographic film base was
 - a. glass
 - b. plastic
 - c. cellulose nitrate
 - d. tinted
2. The most important layer of film construction that actually creates the latent image is
 - a. supercoating
 - b. adhesive layer
 - c. emulsion
 - d. base
3. The ability of the radiographic film to respond to light or radiation is called
 - a. latitude
 - b. sensitivity
 - c. crossover
 - d. contrast
4. — 10. Match the chemical with its function.

___ sodium sulfate	a. reducing agent in manual developer
___ glutaraldehyde	b. accelerator/activator in manual processing
___ phenidone	c. a preservative common in both fixer and developer
___ metal/elon	d. neutralizes the alkalinity of carried over developing solutions
___ ammonium thiosulfate	e. hardener found in automatic developer
___ sodium carbonate	f. reducing agent in automatic developer
___ acetic acid	g. cleaning agent found in the fixer
11. Radiographic film storage conditions include
 - a. 80°F at 50% humidity
 - b. 70°F at 30% humidity
 - c. 50°F at 68% humidity
 - d. 68°F with 40-60% humidity
12. An exposure of 10 mAs was used with Par film. The new mAs using fast film would be
 - a. 5 mAs
 - b. 20 mAs
 - c. 30 mAs
 - d. 2 mAs
13. 50 mAs was used with Par film. The new mAs using slow film would be
 - a. 15 mAs
 - b. 90 mAs
 - c. 150 mAs
 - d. 300 mAs

14. The term that describes the invisible changes occurring in the silver halide crystals after exposure to x-ray is
- a. manifest
 - b. latent
 - c. duplitized
 - d. non-manifest
15. A processing artifact that occurs every 3.14" on the film surface is
- a. sludge marks
 - b. guide shoe marks
 - c. kink marks
 - d. Pi lines
16. The type of light emission which occurs from the screens inside the cassette is
- a. fluorescence
 - b. luminescence
 - c. phosphorescence
 - d. screen lag
17. The most important layer in screen construction which provides light photons is
- a. protective coating
 - b. base
 - c. phosphor layer
 - d. reflective backing
18. The crystal used in the construction of rare earth screens is
- a. calcium tungstate
 - b. lanthanum/gadolinium oxysulfide
 - c. zinc cadmium sulfide
 - d. calcium sulfide
19. Screens constructed with big crystals in thick active layers are considered
- a. par
 - b. average
 - c. slow
 - d. fast
20. The greatest reduction in radiation dose to the patient will occur with screens made of
- a. large crystals in thick layers
 - b. small crystals in thick layers
 - c. small crystals in thin layers
 - d. large crystals in thin layers



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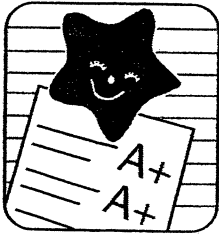
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Unit 8

Title: Cellular and Molecular Biology

1. The portion of the cell that contains DNA is called the
 - a. cytoplasm
 - b. nucleus
 - c. nucleolus
 - d. macromolecule
2. The organelle which digests macromolecules for energy production is called the
 - a. ribosome
 - b. nucleolus
 - c. mitochondria
 - d. lysosome
3. The process of cellular division for genetic cells in both sexes is called
 - a. meiosis
 - b. mitosis
 - c. cell cycle
 - d. cell generation
4. The pre-DNA synthesis stage in a cell cycle is identified as
 - a. M phase
 - b. G₁
 - c. G₂
 - d. S
5. The phase of mitosis in which the chromosomes line up at the equator of the parent cell is
 - a. anaphase
 - b. prophase
 - c. telophase
 - d. metaphase
6. The most abundant macromolecule in the human body is
 - a. saccharides
 - b. lipids
 - c. water
 - d. protein
7. The macromolecule that controls cell function and heredity is
 - a. DNA
 - b. lipids
 - c. RNA
 - d. carbohydrates
8. Radiation biologists have determined that ionizing radiation can produce
 - a. no effects in living tissue
 - b. observable effects in dead tissue
 - c. no change in chromosomes
 - d. genetic change
9. The physical factor which uses a formula to compare biologic effects of various forms of radiation is called
 - a. OER
 - b. RBE
 - c. LET
 - d. REM
10. The biological factor which indicates cell radiosensitivity increases with oxygen saturation is called
 - a. LET
 - b. RBE
 - c. OER
 - d. REM

11. In the target theory, one initial ionizing event may "hit" a critical target and the cell will
- a. die
 - b. recover
 - c. multiply
 - d. sustain no effect
12. The radiolysis of water is considered to be a (an)
- a. critical target
 - b. direct effect
 - c. indirect effect
 - d. minimal effect
13. The term "radiation sickness" refers to the conversion of water into a toxic compound called
- a. tritium
 - b. hydrogen peroxide
 - c. carbon monoxide
 - d. hydrochloric acid
14. Dose-response relationships are graphic mathematical displays of
- a. how radiation affects radiation workers
 - b. how the percentage of death is calculated to an exposed group
 - c. how different doses of radiation affect mice and flies
 - d. how different cells are affected by radiation exposure
15. The law which describes the fundamental principles of cell radiosensitivity was developed by
- a. Marie and Pierre Curie
 - b. Bergonie and Tribondeau
 - c. Albert Einstein
 - d. Wilhelm Roentgen
16. One explanation for high fetal radiosensitivity is
- a. the small number of reproducing cells
 - b. the dependence on maternal blood flow
 - c. the type and rate at which cells mature
 - d. the amount of amniotic fluid
17. The human cell type **most** sensitive to radiation insult is
- a. brain and spinal cord
 - b. lymphocytes
 - c. bone
 - d. erythroblasts
18. The human cell type **least** sensitive to radiation insult is
- a. brain and spinal cord
 - b. lymphocytes
 - c. bone
 - d. erythroblasts
19. The term used to identify the loss or change in the sequence of nitrogenous bases in DNA is
- a. point lesion
 - b. cross-linking
 - c. point mutation
 - d. main-chain scission
20. The **most** radiosensitive period in the aging process of human beings occurs during
- a. childhood
 - b. adolescence
 - c. adulthood
 - d. fetal development in utero



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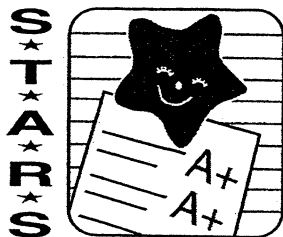
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Unit 9

Title: Biological Effects of Radiation Exposure - Acute

1. In diagnostic radiographic installations, the probability of an accident involving acute radiation lethality is
 - a. 80%
 - b. less than 50%
 - c. 60%
 - d. impossible
2. Thirty people died from acute radiation exposure at
 - a. Three Mile Island
 - b. Chernobyl
 - c. Davis Besse
 - d. Nagasaki
3. "Immediate radiation sickness" occurs in the
 - a. prodromal stage
 - b. latent stage
 - c. G.I. stage
 - d. CNS stage
4. Manifest illnesses occur in a specific order based on increasing dose as
 - a. prodromal, GI and hematologic
 - b. CNS, G.I. hematologic
 - c. hematologic, G.I., CNS
 - d. latent, hematologic, CNS
5. The stage of acute radiation lethality in which the victim feels he is "recovering" is
 - a. prodromal
 - b. latent
 - c. hematologic
 - d. G.I.
6. The manifest illness that is produced by radiation doses of 200-1,000 Grays is
 - a. G.I.
 - b. prodromal
 - c. CNS
 - d. hematologic
7. The manifest illness, which occurs within 4 to 10 days after a radiation dose of 5000 Grays, is
 - a. G.I.
 - b. hematologic
 - c. CNS
 - d. G.U.
8. The chart containing information about the percent of deaths in a certain time frame is
 - a. acuity chart
 - b. survival curve
 - c. latent dose
 - d. lethal dose chart
9. The unit of radiation measured for acute radiation lethality is
 - a. Roentgen
 - b. Rads
 - c. REM
 - d. Becquerel
10. The shortest survival period for victims of radiation doses in excess of 5,000 Grays is
 - a. CNS
 - b. G.I.
 - c. hematologic
 - d. G. U.
11. The most notorious nuclear power plant accident in the United States was
 - a. Davis Besse
 - b. Enrico Fermi
 - c. Three Mile Island
 - d. San Francisco

12. The city of Hiroshima was selected for the first atomic bombing because it
- a. had no military armament factories
 - b. was the home of all military officials
 - c. was located in the mountains
 - d. had not been previously bombed
13. The temperature at the central core of the atomic bomb's fireball was
- a. 100,000 °F
 - b. 300,000 °C
 - c. 1 million °C
 - d. less than 100,000 °C
14. The rationale in dropping the Atomic Bomb was to
- a. spare further American lives
 - b. gain another Presidential term for H. Truman
 - c. maintain confidence with U.S. allies
 - d. demonstrate Albert Einstein's research
15. The atomic bomb is often described and pictured as a
- a. red fireball
 - b. black fireball
 - c. "mushroom" cloud
 - d. cumulus cloud
16. The second Japanese city to be bombed on August 9, 1945 was
- a. Hiroshima
 - b. Tokyo
 - c. Nagano
 - d. Nagasaki
17. The manifest illness in which a full recovery can occur within six months is
- a. CNS
 - b. hematologic
 - c. G.I.
 - d. G.U.
18. The element(s) first used for fission in the atomic bomb production was
- a. uranium
 - b. radium and uranium
 - c. radon and plutonium
 - d. plutonium and uranium
19. The most notorious nuclear power plant accident in the World was
- a. Davis Besse
 - b. Enrico Fermi
 - c. Three Mile Island
 - d. Chernobyl
20. Cities that began the world wide ban of nuclear weapons after World War II were
- a. Hiroshima and Nagasaki
 - b. Washington, D.C. and Tokyo
 - c. Hiroshima and Washington, D.C.
 - d. Berlin and Tokyo



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Unit 10

Title: Biological Effects of Radiation Exposure — Chronic

1. The consequence of local tissue damage to high doses of radiation is
 - a. no recovery
 - b. cell proliferation
 - c. sterility
 - d. total non-function of the tissue or organ
2. Radiation effects on the skin include
 - a. erythema & birth marks
 - b. premature aging
 - c. excessive wrinkles & creases
 - d. desquamation & erythema
3. Wilhelm Konrad Roentgen died in 1921 from
 - a. colon cancer
 - b. melanoma
 - c. leukemia
 - d. pernicious anemia
4. The only woman to have won two Nobel prizes in the entire history of the award is
 - a. Amelia Earhart
 - b. Florence Nightingale
 - c. Marie Curie
 - d. Sarah Bernhart
5. The individual who is considered the first fatality from the effects of prolonged exposure to man-made radiation is
 - a. Pierre Curie
 - b. Clarence Dally
 - c. Bertha Roentgen
 - d. Thomas Edison
6. The dose-response relationship characteristic that demonstrates a directly proportional effect to dose is
 - a. linear
 - b. semi-log
 - c. non-linear
 - d. quadratic
7. The dose-response relationship characteristic that demonstrates any amount of radiation will produce an effect is
 - a. threshold
 - b. non-linear
 - c. non-threshold
 - d. linear
8. Current radiation protection guidelines support the dose-response relationship identified as
 - a. threshold, non-linear
 - b. non-threshold, linear
 - c. non-linear, non-threshold
 - d. linear, threshold
9. The population of scientists who experienced and reported Cataracts were
 - a. cyclotron physicists
 - b. Atomic Bomb survivors
 - c. German mine workers
 - d. radium watch painters
10. Elevated incidence of radiation-induced leukemia was demonstrated in
 - a. nuclear power plant accident survivors
 - b. British radiologists
 - c. pregnant women
 - d. children irradiated in utero
11. Liver cancer was induced by a contrast medium used in angiography called
 - a. Pantopaque
 - b. Dionosil oily
 - c. Thoratrast
 - d. Ethiodol

12. Radium salts were used in the early half of this century to treat patients with
- a. TB and arthritis
 - b. pneumonia and meningitis
 - c. black lung disease and polio
 - d. smallpox and TB
13. In the U.S., we historically treated children with enlarged thymus glands who later manifested
- a. bone cancer
 - b. thyroid cancer
 - c. brain cancer
 - d. melanoma
14. Historically occupationally-induced malignancies have been documented in the
- a. brain and kidney
 - b. skin and bowel
 - c. liver and lymph
 - d. bone and lung
15. After prolonged high-dose fluoroscopic procedures, chromosomal alterations have been identified such as
- a. rung addition
 - b. chromatid addition
 - c. reciprocal relocation
 - d. ring formation
16. Irradiation to the gonads in adults of 200 Rads (2 Gy) produces
- a. suspension of menses
 - b. permanent sterility
 - c. temporary sterility
 - d. impotence
17. The most sensitive period for fetal radiation is
- a. 1st 2 weeks of 1st trimester
 - b. 1st 2 weeks of 2nd trimester
 - c. 1st 2 weeks of last trimester
 - d. anytime
18. Life-span shortening based on chronic doses of low level radiation is
- a. considerable
 - b. controversial
 - c. well-documented
 - d. definitely well established
19. The most difficult risk estimate to calculate is
- a. relative
 - b. statistical
 - c. excess
 - d. absolute
20. A current study involving thousands of U.S. Medical Radiographers who have been employed under low level radiation risks indicates
- a. an excess risk for leukemia
 - b. an excess risk for all cancers
 - c. no effects have been identified at this time
 - d. an absolute risk for melanoma

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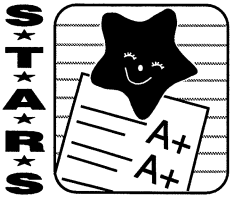
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Conversion Table for the Units of Radiation Measurement

Traditional Name	Current Name	Measurement
Roentgen	Coulomb/kilogram	In air exposure
Rad	Gray	Radiation absorbed dose
REM	Sievert	Dose equivalent
Curie	Becquerel	Radioactivity



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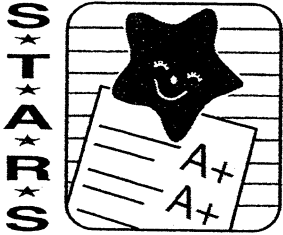
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Unit 11

Title: Common Methods used to Control Radiation Exposure to the Patient

1. United States medical physicists and radiation biologists are concerned about radiation amounts received by the general public because
 - a. the frequency of x-ray examinations is decreasing
 - b. the frequency of erythema is increasing from diagnostic procedures
 - c. multiple modalities are not available for diagnosis confirmation
 - d. physicians order more x-rays to protect themselves from litigation
2. With the increasing sophistication of angio-interventional procedures, the radiation exposures during fluoroscopy is
 - a. increasing
 - b. remaining the same
 - c. decreasing
 - d. insignificant
3. Quality control is different than quality assurance because it involves
 - a. only the x ray film processors
 - b. only the x ray generating equipment
 - c. only physicists and biomedical engineers
 - d. acceptance and performance evaluation radiographic equipment
4. The national program of accreditation utilized by hospital facilities receiving Medicare/ Medicaid funding is known as
 - a. IRS and NRC
 - b. IRS and FDA
 - c. JRCRT and ACS
 - d. The Joint Commission
5. The reason commonly used by radiographers for not using a gonad shield is
 - a. placing it incorrectly on the body
 - b. not important for use
 - c. diagnostic x rays have little dose
 - d. the radiologist/physician doesn't insist on it
6. A gonad shield that attaches to the collimator is called
 - a. shadow
 - b. contact
 - c. shaped
 - d. portable
7. Appropriate gonad shielding can reduce dose as great as ____% in males and ____% in females
 - a. 60:40
 - b. 95:50
 - c. 75:25
 - d. 50:95
8. The population(s) who need gonadal shielding include
 - a. children only
 - b. women in childbearing age
 - c. children and adults with reproductive potential
 - d. males up to age 65
9. To enhance communication with the patient, radiographers should always
 - a. hurry the procedure without explanation
 - b. disregard patient comprehension
 - c. be sympathetic
 - d. be empathetic
10. To minimize repeats due to respiratory activity, radiographers should always
 - a. consider sedation
 - b. select any exposure time
 - c. use the same time
 - d. watch the patient carefully

11. The movement of the stomach, small bowel and colon after ingesting a big lunch is a type of
 - a. involuntary motion
 - b. voluntary motion
 - c. self-conscious motion
 - d. automatic motion
12. The type of technique chart which reduces patient dose the best is called a
 - a. variable kVp, fixed mAs
 - b. high kVp
 - c. variable mAs, fixed kVp
 - d. phototiming chart
13. The biggest detriment to detail on a finished radiograph is created by
 - a. long S.I.D.
 - b. short O.I.D.
 - c. patient motion
 - d. slow film-screen combination
14. A radiographer interested in minimizing positioning errors will develop conscientious habits involving
 - a. fast positioning skills regardless of patient's physical challenges
 - b. allowance of just enough time regardless of patient comprehension or capabilities
 - c. student practice without supervision
 - d. periodically review of personal film quality and patient skills
15. If a x-ray examination is absolutely necessary on a pregnant patient, the radiographer should always
 - a. precisely collimate & carefully position protective shields
 - b. use longer times of exposure
 - c. do the routine number of views
 - d. take repeats as needed
16. When a fetal dose of 30 Rads (300 mGy) has been calculated by a medical physicist, the recommendation for a pregnant woman is to
 - a. continue the pregnancy
 - b. terminate the pregnancy.
 - c. not have additional pregnancies in the future
 - d. continue the pregnancy without any concern
17. — 20. Identify four technical choices in the list below to minimize patient dose:
 - ___ a. use high kVp
 - ___ b. skip gonad shielding
 - ___ c. hurry patients so you can go home on time
 - ___ d. use shortest time possible
 - ___ e. use long S.I.D.
 - ___ f. be careful while positioning
 - ___ g. take as many views as you can throw out repeats
 - ___ h. use ALARA concept



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Unit 12

Title: Common Methods Used to Control Radiation Exposure to the Operator

1. Time, distance and shielding are considered the
 - a. ACR recommendations
 - b. cardinal principles of radiation protection
 - c. IRS guidelines
 - d. NCRP recommendations
2. The ALARA concept includes stipulation(s) such as
 - a. risks of radiation exposure must outweigh the benefits
 - b. specific dose limits can be exceeded
 - c. repeats are justified to get a good examination
 - d. all exposures should be kept as low as reasonably achievable
3. The maximum permissible dose is now called the
 - a. ALARA unit
 - b. maximum limit
 - c. dose limit
 - d. maximum dose limit
4. A 30 year old radiation worker could have a cumulative whole body dose limit of
 - a. 300 mSv
 - b. 30 Sv
 - c. 150 mSv
 - d. 15 Sv
5. A 26 year old radiation worker could have a dose limit of _____ or less during her pregnancy.
 - a. 26 mSv
 - b. 2.6 mSv
 - c. 5 mSv
 - d. 10 Sv
6. Declaring a pregnancy to your supervisor is important because
 - a. your dose limit becomes 1.5 mSv/month
 - b. it will determine the need to change your scheduled rotations in fluoroscopy
 - c. it requires the use of two personal monitoring devices
 - d. your supervisor should review your previous radiation records with you
7. Managers following good radiation protection principles for their personnel should
 - a. provide annual in-services on radiation protection
 - b. provide counseling opportunities during pregnancy
 - c. provide new employees with policies and procedures about radiation protection
 - d. all of the above
8. The most practical and inexpensive personnel monitoring device in existence today is a
 - a. TLD
 - b. Film badge
 - c. pocket dosimeter
 - d. Geiger counter
9. Lithium fluoride chips/powders are found in the
 - a. TLD
 - b. pocket dosimeter
 - c. film badge
 - d. Geiger counter
10. The personnel monitoring device that provides immediate results is the
 - a. film badge
 - b. TLD
 - c. pocket dosimeter
 - d. Geiger counter

11. Personnel monitoring device reports should contain
- a. current exposure only
 - b. cumulative monthly exposure
 - c. last year's exposure results
 - d. year-to-date exposure
12. If you lose your film badge, you should
- a. use the control badge
 - b. report it immediately and get a replacement from the commercial vendor
 - c. wait for the next shipment
 - d. use someone else's during their absence
13. Since the film badge is your "personal" monitor, you may
- a. not wear it during personal medical exams
 - b. wear it to the beach
 - c. wear it during your dental x-rays
 - d. share it with others who lose theirs
14. Exposure switches on the operator console should be
- a. 6 feet or longer for mobility
 - b. located within a secondary barrier
 - c. fixed permanently to the console
 - d. removable
15. When an x-ray tube is replaced, the medical physicist should check for
- a. accurate billing
 - b. leakage radiation
 - c. delivery date
 - d. remnant radiation
16. A protective barrier which requires 1/16" Pb or 4" of masonry is called
- a. secondary
 - b. tertiary
 - c. control booth
 - d. primary
17. The control booth is considered a
- a. primary barrier
 - b. tertiary barrier
 - c. secondary barrier
 - d. controlled work space
18. — 20. Match 3 of the following items that will reduce your risk of radiation exposure
- _____ a. stay as close as possible to the patient or volunteer to hold patients
 - _____ b. collimate the beam to the anatomy under investigation
 - _____ c. use ALARA concepts all the time
 - _____ d. give your Pb apron and gloves to the physician
 - _____ e. use intensifying screens at all times