

1. SI unit of radioactivity is:

March 2013 (c, f)

a) Rem

b) Rad

c) Becquerel

d) Curie

e) None

Correct Answer - C

Ans. C i.e. Becquerel

2. Dose rate in linear accelerator is measured as ?

a) Rads/minute

b) Rads/second

c) Roentgen/second

d) Curie/minute

e) None

Correct Answer - A

Ans. is'a.i.e., Rads/minute

[Ref, Innovation in radiation oncology p. 100)

- The dose rate in teletherapy (including linear accelerator) is measured in monitor unit or rad per minute,
- A monitor unit is a measure of machine output from a clinical accelerator for radiation therapy such as linear accelerator or an orthovoltage unit.

3. Teletherapy uses?

a) Electron

b) X-rays

c) Gamma rays

d) Beta rays

e) Protons/neutron

Correct Answer - A:B:C:E

Ans. is 'a' i.e., Electron, 'b' i.e., X-rays, 'c' i.e., Gamma rays & (e' i.e., Protons/neutrons

[Ref: Radiotherapy & brachyther-apy by Alessandra caner p. 19;
Radiation physics p. 210-217; Sumer Sethi &/e p. 177, 184]

- External beam radiotherapy (EBRT) or Teletherapy: -
In teletherapy the source of radiation is distant from the patient.
Teletherapy may be given by the following :
 1. X-rays beams (Linear acceleration)
 2. Gamma rays: - Cobalt - 60 beam or Cesium-137.
 3. Particulate beams

4. Radiological signs of NF-1 include?

a) Scoliosis

b) Widening of intercostal space

c) Posterior vertebral scalloping

d) Sphenoid wing dysplasia

e) Narrowing of neural foramina

Correct Answer - A:C:D

Ans. is 'a' i.e., Scoliosis, 'c' i.e., Posterior vertebral scalloping & 'd' i.e., Sphenoid wing dysplasia

[Ref: <https://radio-pedia.org/articles/neurofibromatosis-type-1>]

Radiographic features of NF 1

- Progressive sphenoid. wing dysplasia
- Kyphoscoliosis
- Posterior vestibular scalloping

5. Claw sign on radiography is seen in?

a) Ileocolic TB

b) Ischemic colitis

c) Crohn's disease

d) Ulcerative colitis

e) Intussusceptions

Correct Answer - E

Ans. is'e' i.e., Intussusceptions

[Ref www.ncbi.nlm.nih.gov/]

- Radiological signs of intussusceptions
- Claw sign
- Meniscus sign
- Empty right iliac fossa
- Coiled spring sign
- Pincer sign

6. Radiological tests which are used to see white matter of brain are?

a) Skull X-ray

b) CT

c) PET

d) MRI

e) Magnetic Resonance Spectroscopy

Correct Answer - A:B:C:D:E

Ans. is 'All' i.e., (a, b, c, d & e)

[Ref www.ncbi.nlm.nih.gov]

- 'Skull x-rays were historical useful and capable of identifying the gyriform calcification of the subcortical white matter although they no longer play a significant role in the diagnosis or management of this condition.
- The finding usually becomes evident between 2 and 7 years of age"
- White matter disease imaging
- Investigation of choice for white matter disease > MRI (CT is second choice).

7. Posterior urethral valves in children/infants are diagnosed by?

a) CT

b) HRCT

c) Prenatal ultrasound

d) Postnatal ultrasound

e) Micturating cystourethrography

Correct Answer - C:D:E

Ans. is 'c' i.e., Prenatal ultrasound, 'd' i.e., Postnatal ultrasound & 'e' i.e., Micturating cystourethrography

[Ref Clinical pediatric nephrology 3dlet p 94; Nekon 18th/e p. 2241]

- **Radiographic investigations for Posterior urethral valves (PUVs)**
Ultrasound
 - A. Antenatal ultrasound
 - B. Postnatal ultrasound
 - C. Voiding cystourethrogram (VCUG\ best imaging technique)

8. Natural radio-isotopes are?

a) Radium 226

b) Cesium 137

c) Strontium 90

d) Iridium 192

e) Cobalt 60

Correct Answer - A:B:C

Ans. is 'a' i.e., Radium 226,'b' i.e., Cesium 137 &'c'i.e., Strontium 90

[Rel <https://www.britannica.com/science/radioactive-isotope>; <https://www.chemicool.com/examples/natural-radioactive-elements.html>]

Natural sources of radiation (Background radiation)

- **Hydrogen (H-3), beryllium (Be- 10), carbon (C- 14) , radium (Ra-226). Radon (Rn-222),cesium (Cs-37), sodium(Na-22), silicon (Si-32), chlorine (Cl-36), argon (Ar-39), krypton (Kr-81, Kr-78), iodine (I-129, I-131), potassium (K-40), strontium (Sr 90). calcium (Ca-a8), germanium (Ge-76), zirconium- (2r-96), samarium, (Sm-147, 148)selenium (Se-82), rubidium (Ru-87), molybdenum (Mo-100), cadmium (Cd-113, Cd-116), xenon (Xe-136), barium (Ba-130), gadolinium (Gd-152), tungsten (Tn-180), platinum (Pt-190), bismuth (Bi-209), thorium (Th-232, Th-230) and uranium (u -23s,236, 237, 238)**

9. True about finding of pleural effusion:

- a) CT scan can distinguish between a pleural effusion and a pleural empyema
- b) USG can detect very small amount of fluid
- c) X-ray- homogenous opacity with obliteration of CP angle
- d) MRI cannot differentiate malignant from benign pleural disease
- e) MRI can differentiate malignant from benign pleural disease

Correct Answer - A:B:C:E

Ans., A,CT scan can distinguish between a pleural effusion and a pleural empyema B,USG can detect very small amount of fluid C X-ray- homogenous opacity with obliteration of CP angle& EMRI can differentiate malignant from benign pleural disease

Ref: Sumer Sethi 6th/49; Dahnert Radiology Manual 7th/ 446; WHO Manual of Radiographic Interpretation 2002/ 4 I _42

Imaging criteria are:

Homogenous density

- Density in dependent portion
- Upright: Costophrenic angle in pA view
- Lateral view: Anterior and posterior portions of gutter
- Lateral decubitus position: Along sides
- Supine position: Along posteriorly, giving diffuse haziness on the side of effusion

Silhouette of upper limit of density

- Upper margin high in axilla in pA view (yellow arrows)
- Upper margin high anteriorly and posteriorly in lateral view
- This is just an illusion

- Loss of silhouette: In the images below note lack of identifiable left diaphragm before and visible diaphragm after clearance of fluid (Silhouette sign principle)
- Mediastinal shift
- **Pleural Effusion- X-Ray**
- First 300 ml not visualized on PA view
- Lateral decubitus views may detect as little as 25 ml
- **Pleural effusion on CT scan:**
- CT scanning is excellent at detecting small amounts of fluid and is also often able to identify underlying intrathoracic causes (e.g. malignant pleural deposits or primary lung neoplasms) as well as subdiaphragmatic diseases (e.g. sub diaphragmatic abscess) .

10. True about USG:

- a) Uses most commonly frequency of 20-50 MHz for diagnostic ultrasound
- b) Work on principle of piezoelectric effect
- c) Ultrasonic waves only penetrates gas , not liquid
- d) Gas filled microbubbles are used as contrast media
- e) None

Correct Answer - B:D

Ans. B.Work on principle of piezoelectric effect & D.Gas filled microbubbles are used as contrast media

Ref Sumer Sethi 6th/9-10; Radiology & Imaging by Thayalan 334-40

Contrast-enhanced Ultrasound (CEUS):

- Application of ultrasound contrast medium to traditional medical sonography.
- Commercially available contrast media are gx-filled (air or perfluorocarbon) microbubbles that are administered intravenously to the systemic circulation.
- Microbubbles have a high degree of echogenicity (the ability of an object to reflect ultrasound waves)

11. Contrast agent which are not used for CT scan:

a) Water

b) CO₂

c) Barium compounds

d) Iodinated high-osmolality contrast media

e) Polyethylene glycol

Correct Answer - B

Ans. B. CO₂

Ref Sumer Sethi 6th/20; Radiology 6 Imaging by Thayalan159;
Dahnert Radiology Manual 7th/1147-48

- Radiocontrast agents are a type of medical contrast medium used to improve the visibility of internal bodily structures in X-ray-based imaging techniques such as computed tomography (CT), radiography & fluoroscopy.
- Radiocontrast agents are typically iodine or barium compounds.
- When an agent improves visibility of an area, it is called "contrast enhancing"
- Gadolinium is a key component of the contrast material most often used in magnetic resonance (MR) exams.
- Saline (salt water) and air are also used as contrast materials in imaging exams.
- Barium sulfate contrast media continue to be the preferred agents for opacification of the gastrointestinal tract for conventional fluoroscopic examinations
- The current use of iodinated water-soluble contrast media is

primarily limited to select situations

- Two commercial water-soluble iodinated high-osmolality contrast media (HOCMs) specifically designed for enteric opacification are in common use. Gastrografin and, Gastroview

12. True about signal characteristic of CSF on MRI & FLAIR:

a) Hyperintense on T1WI

b) Hypointense on T1 WI

c) Hyperintense on T2WI

d) FLAIR reduces CSF signal

e) FLAIR increases CSF signal

Correct Answer - B:C:D

Ans. B,Hypointense on T1 WI C,Hyperintense on T2WI & D,FLAIR reduces CSF signal

Ref: Sumer Sethi 6th/15; Radiology 6 Imagingby Thayalan Ist/386-89]

MRI Signal Characteristic

- CSF: Hypointense on T1WI, hyperintense on T2W1.
- Grey/White matter: Grey matter is grey & white matter is white on T1W1 & relationship is reversed on T2W1.
- The fluid,-attenuated inversion-recovery (FLAIR) uses longer T1 (2400ms) & TR (7000ms) to reduce the signal level of CSF & other tissue with long T1 relaxation constant.
- It reduces CSF signal & other water-bound anatomy in MR image by using a TI detected at or near the bounce point of CSF.
- FLAIR MRI techniques consist of an inversion recovery pulse to null the signal from CSF and a long echo time to produce a heavily T2-weighted sequence.

13. Precise FNAC can be obtained by using :

a) USG

b) CT

c) Endoscopic USG

d) MRI

e) Plain-Xray

Correct Answer - A

Ans. A. USG

Ref Dahnert Radiology Manual 7th/368;Harshmohan 7th/902-13;Robbins 9th/333

Radiological imaging Aids for FNAC:

- Non-palpable lesion require some form of localization by radiological aids for FNAC to be carried out.
- Plain X-ray films are usually adequate for lesions within bones & for some lesions within the chest
- FNAC of chest may also be attempted under image amplified fluoroscopy which allows visualization of needle placement on the television monitor
- CT guidance is also used for lesions within the chest dy Abdomen.
- The most versatile radiological aid is ultrasonographic guidance (USG) which allow direct visualization oF needle placement in real time & is free from radiation hazards.
- It is an extremely valuable aid for FNAC of thyroid nodules, soft tissue masses, intra-abdominal lesions dt for intrathoracic which about the chest wall, but no help in deep intrathoracic lesions or in bony lesions
- Precision of USG and CT scan is comparable for guidance in FNAC

from thoracic mass lesions

14. Gamma radiation is/are produced by:

a) Co-60

b) Caesium-137

c) P-32

d) Iridium-192

e) Strontium-90

Correct Answer - A:B:D

Ans. A,Co-60 B,Caesium-137 & D,Iridium-192

[Ref: Sumer Sethi 6th/177, 184; Radiology 6 Imaging by Thayalan Ist/17,278

Radiation emitted - Radionuclide

Gamma rays -

- Radium-226
- Caesium-137
- Cobalt-60
- Iridium-192
- Gold-198
- Samarium -153

Beta rays:

- Strontium-90
- Yttrium-90
- Phosphorus-32
- Rhenium-188

Combination of gamma and beta rays:

- Rhenium-186
- Iodine-131

15. All are true about gamma knife except:

- a) Focussed radiation is delivered to tumor
- b) Provide equal exposure to surrounding healthy tissue
- c) It is a type of stereotactic surgery
- d) Primarily used for small brain tumours
- e) Uses Co-60 as source of radiation

Correct Answer - B

Ans. B. Provide equal exposure to surrounding healthy tissue

Ref: Sumer Sethi 6th/196-97

Stereotactic Radiosurgery:

- Goal of stereotactic radiosurgery is to deliver enough radiation to destroy or stop the growth of a lesion previously defined by specialized imaging techniques without adversely affecting surrounding tissue.

Gamma Knife Radiosurgery:

- Gamma knife radiosurgery is a type of radiation therapy used to treat tumors and other abnormalities in the brain.
- Close to 200 tiny beams of radiation on a tumor.

Gamma knife:

- The Gamma Knife is an advanced radiation treatment for adults and children with small to medium brain tumors, abnormal blood vessel formations called arteriovenous malformations, epilepsy, trigeminal neuralgia, a nerve condition that causes chronic pain, and other neurological conditions.
- The "blades" of the Gamma Knife are the beams of gamma radiation programmed to target the lesion at the point where they intersect.
- Gamma Knife enables patients to undergo a non-invasive form of

brain surgery without surgical risks, a long hospital stay or subsequent rehabilitation.

16. Which of the following cell(s) are less radiosensitive:

a) Osteocyte

b) Erythroblasts

c) Chondrocyte

d) Spermatogonia

e) Lymphocyte

Correct Answer - A:C

Ans. A, Osteocyte & C, Chondrocyte

Ref: Sumer Sethi 6th/174; Radiology & Imaging by Thayalan Ist/310

- Most radiosensitive blood cell- Lymphocyte
- Least radiosensitive blood cell- platelet
- Most radiosensitive tissue of body- Bone marrow
- Least radiosensitive tissue of body -Nervous tissue/brain
- High Radiosensitive - Lymphoid organs, bone marrow blood, testes, ovaries, intestines
- Low Radiosensitive - Muscle, brain, spinal cord

17. True about photodynamic therapy of head & neck cancer:

a) Tumour sensitizer is used

b) Singlet oxygen is produced in tumour cell

c) After therapy, radiosensitizer may remain with tumour cell

d) Hemoporphyrin given as radiosensitizer

e) Photosensitivity is a side-effect after therapy

Correct Answer - A:B:C:E

Ans. A, Tumour sensitizer is used B, Singlet oxygen is produced in tumour cell C, After therapy, radiosensitizer may remain with tumour cell & E, Photosensitivity is a side-effect after therapy

- Ref Sabiston 236; Ballenger\ Otorhinolaryngology 16th/1324
- **Photodynamic therapy** is a new treatment that allows destruction of cancer cells and has recently been expanded to the eradication of metaplastic cells,
- It begins with the administration of a target specific photosensitizer that is eventually concentrated in the target tissue.
- The photosensitizing agent is then activated with a wavelength-specific light energy source, which leads to generation of free radicals cytotoxic to the target tissue.
- Applications reported in the literature include treating early radiographically detected, non-small cell lung cancer, pancreatic cancer squamous cell and basal cell carcinoma of the skin, recurrent superficial bladder cancer, Chest wall involvement from breast cancer and even chest wall recurrence of breast cancer.
- Given systemically, these drugs are preferentially taken up in tumor

cells, rendering them more sensitive to light-mediated cell killing than their surrounding tissues.

18. Chest roentgenogram feature (s) of stage-2 Sarcoidosis in Scadding scoring system

:

a) Bilateral hilar lymphadenopathy

b) Mediastinal lymphadenopathy

c) Upper lobe parenchymal infiltrates

d) Enlarged paratracheal nodes

e) Pulmonary fibrosis

Correct Answer - A:C

Ans. A,Bilateral hilar lymphadenopathy & C,Upper lobe parenchymal infiltrates

- Standard scoring system described by Scadding in 1961 for chest roentgenograms.
- Stage 1 - Hilar adenopathy alone, often with right paratracheal involvement.
- **Stage 2 - Combination of adenopathy plus infiltrates.**
- **BHL and parenchymal infiltrates.**
- **Patients may present with breathlessness or cough.**
- **The majority of cases resolve spontaneously.**
- Stage 3 reveals infiltrates alone.
- Stage 4 consists of fibrosis.
- Usually the infiltrates in sarcoidosis are predominantly an upper lobe process.
- Only in a few noninfectious diseases is an upper lobe predominance noted.

19. Standard treatment of whole-brain radiotherapy (WBRT) for brain Metastasis

:

a) 20 grays (Gy) in 10 fractions

b) 30 grays (Gy) in 10 fractions

c) 30 grays (Gy) in 5 fractions

d) 15 grays (Gy) in 10 fractions

e) None

Correct Answer - B

Ans. B, 30 grays (Gy) in 10 fractions

- Whole-brain radiotherapy (WBRT) to 30 grays (Gy) in 10 fractions - Standard treatment in patients with multiple brain metastases.
- Current study investigated the potential benefit of dose escalation beyond 30 Gy.

20. Egg shell calcification is seen in ?

a) Silicosis

b) Sarcoidosis

c) Lymphoma after treatment

d) Aspergilloma

e) TB

Correct Answer - A:B:C:E

Ans. (A) Silicosis (B) Sarcoidosis (C) Lymphoma after treatment (E) TB

Calcification patterns on chest radiograph

Egg-shell calcification of lymph nodes:

- Defined as shell like calcifications up to 2 mm thick in periphery of at least two lymph nodes in at least one of which, the ring of calcification must be complete and one of the affected lymph nodes must be at least 1 cm in maximum diameter.

Important causes are : -

- Progressive massive fibrosis (PMF)
- Coccidioidomycosis
- Tuberculosis
- Silicosis (m.c. cause)
- Coal worker's Pneumoconiosis
- Sarcoidosis
- Blastomycosis
- Histoplasmosis
- Scleroderma
- Lymphoma following radiation
- Amyloidosis



21. Hilar lymph node calcification is seen in ?

a) Silicosis

b) Amyloidosis

c) Berylliosis

d) Asbestosis

e) Scleroderma

Correct Answer - A:B:E

Ans. (A) Silicosis (B) Amyloidosis (E) Scleroderma

Irregular central popcorn calcification:

- It is a cluster of sharply defined irregularly lobulated calcification usually in pulmonary nodule.
- It is characteristic of hamartoma.

Laminated or central pattern:

- Granuloma

Punctate Pattern:

- Tuberculoma or coccidioidomycosis

22. Radiological signs of intestinal perforation is/are -

a) Pneumoperitoneum

b) Regler's sign

c) Caterpillar sign

d) Bear sign

e) Football sign

Correct Answer - A:B:E

Ans. (A) Pneumoperitoneum (B) Regler's sign (E) Football sign
Perforation results in pneumoperitoneum:

- Best view to see PneumoPeritoneum is chest x-ray in erect position which detects air under the dome of the diaphragm.
- 1-2 ml of free air can be detected under the right dome (between the liver and right ilium of diaphragm) provided the patient is made to stand or sit at least 10 minutes prior to taking radiograph.
- Visualization of falciform ligament due to the presence of air on either side of the ligament - Falciform ligament sign.

Football sign:

- Presence of large quantities of air which form an interface with free intraperitoneal fluid.

Regler's sign or double wall sign:

- Visualization of both aspects of bowel wall due to the presence of intraluminal as well as extraluminal air.

Cupola sign:

- Large amount of gas under the diaphragm. It should be noted that air is visualized below the central tendon of diaphragm not below the

dome as occur in upright x-rays.

Inverted 'V' sign:

- Lateral umbilical ligament is visualized in lower abdomen.

Triangle sign (Doge's cap sign):

- Triangular (doge's cap), crescent shaped or semicircular collection of air in the Morison'spouch.

23. Unit(s) of absorbed radiation ?

a) Rad

b) Gray

c) Curie

d) Rem

e) Sievert

Correct Answer - A:B

Ans. (A) Rad (B) Gray

[Ref: Bhadhury 2d/e p. 197 & Internet source]

	SI unit	Conventional unit
Radioactivity	Becquerel (Bq)	Curie (Ci)
	1 Bq = 1 disintegration per second	
	1 Ci = 3.7×10^{10} disintegrations per second = 37 GBq	
Absorbed dose	Gray (Gy)	rad
	1 Gy = 1 J/kg = 100 rad	
Effective dose	Sievert (Sv)	rem
	1 Sv = 100 rem	
Linear energy transfer	Newton (N)	keV/ μ m
	1 N = 1 J/m	
	1 keV/ μ m = 1.6×10^{-13} N	

24. Isotope(s) used for brachytherapy is/are ?

a) Radon -222

b) Radium -226

c) Iodine-125

d) Cobalt - 60

e) Cesium -137

Correct Answer - A:B:C:D

Ans. (A) Radon -222 (B) Radium -226 (C) Iodine-125 (D) Cobalt - 60

[Ref: Prez & Brandy's Radiation Oncologist 5th/e p, 54]

- Three main types of radiotherapy depending upon the position of the source of radiation.

External beam radiotherapy (EBRT) or Teletherapy:

- X-rays beams (Linear acceleration).
- Gamma rays: - Cobalt - 60 beam or Cesium 137.
- Particulate beams

Internal radiotherapy or brachytherapy:

- In brachytherapy, the radiation source in close contact with tumor.
- The principle is to use an Intra or fuxta lesional radiation implant to irradiate the tumor in vicinity. Sealed source in placed within or near the tumor i.e., Short distance therapy.

Subtypes:

- **Interstitial**

Removable/Temporary sources or implants

Iridium - 192 (Ir - 192)

Permanent sources or implants

Cesium - 131 (Cs - 131)

Cesium - 137 (Cs - 137)

Cobalt - 60 (Co - 60)

Californium

Radium - 226 (Ra - 226)

Tantalum

Yttrium

Gold - 198 (Au - 198)

^{125}I

Radon - 222 (Rn - 222)

Palladium - 103 (Pd - 103)

Note : Co - 60 and Cs - 137 are used for both teletherapy and brachytherapy.

Intracavitary:

- Most important use of intracavitary radiation is in patients with cancer of the cervix after external radiation.
- It is also used in cancer of uterus, esophageal cancer and lung cancer.

Removable

Permanent

Radium

Colloidal radioactive gold

Cesium – 137

Yttrium

Cobalt – 60

Radioactive iodine (^{131}I)

Mould:

- **Used in penis carcinoma**

High dose radiation:

- Most common radioisotope used for HDR brachytherapy is iridium-192.
- Other isotopes which have been used are Cobalt-60 and cesium-137

25. Isotope(s) used for metastatic bone pain is/are ?

a) Strontium -89

b) Samarium-153

c) Phosphorus - 32

d) Thallium

e) Selenium

Correct Answer - A:B:C

Ans. (A) Strontium -89 (B) Samarium-153 (C) Phosphorus - 32

[Ref: Radiation oncology th/e P. 141]

- Radiopharmaceuticals (radioactive isotopes) used for metastatic bone pain are strontium (Sr - 89), Samarium (Sm - 153), rhenium (Re - 186), Phosphorus-32 and Tin- 117 (Sn- 117).

26. Drug(s) used for radiation protection is/are ?

a) Metronidazole

b) Amifostine

c) Actinomycin -D

d) Pentoxiphylline

e) Hydroxyurea

Correct Answer - A:D

Ans. (A) Metronidazole (D) Pentoxiphylline

[Ref: Orford oncologist 2nd/e p. 462]

Radiosensitizers:

- Radiosensitizers are compounds that apparently promote fixation of the free radicals produced by radiation damage at molecular level.

A) Hypoxic cell radiosensitizers:

- Nitroimidazoles: Metronidazole, Misonidazole, Etanidazole, Nimorazole, Pimonidazole
- Anticancers:- Actinomycin D (Dactinomycin), Bleomycin, Cisplatin, Doxorubicin, 5-FU,
- Fludarabine, Gemcitabine, Hydroxyurea, Paclitaxel, mitomycin- C, Topotecan, Vinorelbine.

Hyperbaric oxygen (most potent)

B) Non hypoxic cell radiosensitizers:

- Halogenated pyrimidines:- BUdR, IUdR.
- **Cisplatin and 5-FU are two of the most commonly used radiosensitizing agents.**

27. Feature(s) of crohn's disease is/are -

a) Pipestem colon

b) Pseudosacculation

c) Loss of haustrasion

d) Cobblestone appearance

e) String sign of kantor

Correct Answer - B:D:E

Ans. (B) Pseudosacculation (D) Cobblestone appearance

(E) String sign of kantor

Radiological findings of CD are : -

- Earliest changes are aphthous lesions or erosions (central flecks of barium surrounded by a translucent halo). These lesions are also known as Target lesions or Bull's eye.
- String sign of Kantor : - Greatly narrowed terminal ileum due to inflammation and fibrosis.
- 'Creeping-fat"sign (On CT) :- Inflammatory changes in the adjacent mesenteric fat.
- Comb sign: - Prominent vasa recta of mesenteric vessels.
- Discontinuous involvement (Skip areas are present).
- Cobblestone appearance
- Raspberry rose thorn appearance
- Pseudosacculation

28. Neoadjuvant chemotherapy stands for -

a) Chemotherapy along with surgery

b) Chemotherapy before surgery

c) Chemotherapy after surgery

d) Chemotherapy along with radiation therapy

e) Chemotherapy after radiation therapy

Correct Answer - B

Ans. B. Chemotherapy before surgery

[Ref: Katzung 13th/e p.919-20; chemoth.com/neoadjuvant-chemotherapy]

- Neoadjuvant chemotherapy refers to Combination of Chemotherapy and surgery/radiotherapy in which chemotherapy is given prior to surgery/radiotherapy.

29. True about concomitant chemoradiotherapy -

a) Chemotherapy and radiotherapy both given simultaneously

b) Radiotherapy acts locoregionally and chemotherapy acts against distant micrometastases

c) Radiotherapy acts as sensitizing agent

d) Chemotherapy may act as sensitizing agent

e) None

Correct Answer - A:B:D

Ans. (A) Chemotherapy and radiotherapy both given simultaneously (B) Radiotherapy acts locoregionally and chemotherapy acts against distant micrometastases

(D) Chemotherapy may act as sensitizing agent

Concomitant chemoradiotherapy

- Radiotherapy and chemotherapy are given simultaneously.
- Three clinical rationales support the use of chemotherapy delivered concurrently with radiation.
- First, concomitant chemoradiotherapy can be used with organ-preserving intent, resulting in improved cosmesis and function compared with surgical resection with or without adjuvant treatment.
- Second, chemotherapy can act as a radiosensitizer, improving the probability of local control and, in some cases, survival, by aiding the destruction of radioresistant clones.
- Third, chemotherapy given as part of concurrent chemoradiation may act systemically and potentially eradicate distant micrometastases.

30. Which of the following is/are true about brachytherapy than teletherapy -

a) More effective in carcinoma cervix

b) Same proportion of radiation is delivered to both-tumour & normal tissue

c) Better than teletherapy for large & bulky tumour

d) Deliver higher dose of radiation to tumour

e) Less damage to normal tissue

Correct Answer - A:D:E

Ans. (A) More effective in carcinoma cervix (D) Better than teletherapy for large & bulky tumour (E) Less damage to normal tissue

- Advantage of brachytherapy is that it delivers high radiation dose to tumor locally with high local control.
- Damage to normal tissue is less as there is rapid fall-off of radiation around the source.
- This technique is particularly useful in treating cancers of cervix, uterus, vagina and certain H and N cancers.
- It can also be used to treat breast, brain, skin, esophageal, soft tissue, lung, bladder and prostate cancer.

31. Features of strontium 89 in comparison to phosphorus-32 -

a) Longer t-1/2

b) Deeper penetration

c) Emits beta rays while P-32 emits alpha rays

d) Lesser toxicity

e) None

Correct Answer - A:D

Ans. (A) Longer t-1/2 (D) Lesser toxicity

[ReJ: Review of Radiology by Sumer Sethi Ch/e p. 184; Harrison 19h/e p. 363e-3; Bonica's Management of Pain by Scott Fishman p' 655]

- Half-life of P-32 is 14.3 days and strontium-89 is 50.5 days.
- Soft tissue penetration of P-32 is 8 mm and strontium-89 is 2.4 mm.
- Both P-32 and Strontium-89 emit B-rays.
- P-32 is moderately toxic where as strontium has low toxicity.

32. Which of the following is/are used in neuroendocrine tumor evaluation:

a) 68Ga-DOTA-TOC

b) MIBG

c) 68Ga-DOTA-NOC

d) F-18 Fluorodopa

e) 68Ga-DOTA-TATE

Correct Answer - A:B:C:D:E

Ans. (A) 68Ga-DOTA-TOC (B) MIBG (C) 68Ga-DOTA-NOC (D) F-18 Fluorodopa (E) 68Ga-DOTA-TATE

Gallium 68 DOTATOC/DOTANOC:

- For imaging of neuroendocrine tumors.
- Higher sensitivity for GI neuroendocrine tumors

F- 18 Fluorodopa: Dopamine analogue:

- The most specific & sensitive agent for imaging of neuroendocrine tumors especially pheochromocytoma (adrenal & extra-adrenal) & neuroblastoma

Scintigraphy of neuroendocrine Tumors:

- I - 131 Metaiodobenzylguanidine (MIBG) Sensitivity - 77 - 100%.
- I - 123 Metaiodobenzylguanidine (MIBG).
- Glucose Analogs 2- (fluorine-r8) fluoro-2-deoxy-D-glucose (FDG) Uptake

33. USG is/are based on:

a) Piezoelectric effect

b) Diamagnetic effect

c) Paramagnetic effect

d) Ferromagnetic effect

e) Electromagnetic effect

Correct Answer - A

Ans. A. Piezoelectric effect

[Ref: Review Radiology by Sumer Sethi 6th/ 9-11]

Ultrasonography:

- Ultrasonic image(sonographic/echographic) is based on mechanical oscillations of the crystal excited by electrical pulses (Piezoelectric effect).

34. X-ray feature (s) of Left Atrial Hypertrophy:

a) Boot shaped heart

b) Widened carina

c) Straightened left border

d) Double atrial shadow

e) Money bag appearance

Correct Answer - B:C:D

Ans. (B) Widened carina (C) Straightened left border (D) Double atrial shadow

[Ref: PJM 20th/228; Dahnert Radiology manual 5th/ 57 5,636-637; Review radiology by Sumer Sethi 6th/76-77,80]

X-ray feature of left Atrial Hypertrophy:

- Double atrial shadow (Double density seen through right upper border)
- Straightened left border
- Left bronchus lifted up with widened carina
- Esophagus curving around the dilated Left atrium.
- Splaying of mainstem bronchi (i.e. Increased carinal angle)
- Small aorta (due to increase of forward cardiac output)
- Normal/Undersized LV

35. Which of the following is/are common radiation induced cancers:

a) Breast cancer

b) Gonadal cancer

c) Leukaemia

d) Renal cell carcinoma

e) Prostate cancer

Correct Answer - A:B:C

Ans. (A) Breast cancer (B) Gonadal cancer (C) Leukaemia

[Ref: Dahnert Radiology manual 7th/ 574,154,408,313.]

- Most commonly occurring radiation-induced cancer is Leukemia.
- Cancer induction is the largest risk of radiation exposure encountered in radiology.
- Bone marrow, gastrointestinal tract & mucosa, breast tissue, gonads & lymphatic tissue are most susceptible to radiation induced malignancy.
- Cancer risk is higher for children than for adults

36. Water lily sign is seen in:

a) Hydatid cyst of lung

b) Aspergilloma lung

c) T. B

d) Silicosis

e) Hamartoma lung

Correct Answer - A

Ans. (A) Hydatid cyst of lung

[Ref Review of Radiology by Sumer Sethi 6th/59; Dahnert Radiology manual 5th/493]

Hydatid Lung

- No or rare calcification in lung
- Water lily sign or Camalote sign (in chest X-ray)

Lung Echinococcosis:

Water lily sign:

- Completely collapsed crumpled cyst membrane floating on the cyst fluid
- Sign of Camelot
- Serpent sign
- Cumbo sign
- Meniscus sign
- Crescent sign
- **Hamartoma lung.**
- Carney's triad & calcification
- **Silicosis:** Eggshell calcification.

37. Which of the following do not use radiation:

a) MRI

b) CT

c) USG

d) SPECT

e) PET

Correct Answer - A:C

Ans. (A) MRI (C) USG

[R4 L 6 B 26th/174; Review of Radiology by Sumer Sethi 6th/5' 9; Dahnert Radiology manual sth/ 1070-71]

Ultrasound:

- Second commonest method of imaging.
- It relies on high-frequency sound waves generated by a transducer containing piezoelectric material.

MRI:

- MRI relies on the fact that nuclei containing an odd number of protons or neutrons have a characteristic motion in a magnetic field (precession) and produce a magnetic moment as a result of this motion.
- A brief radiofrequency pulse is then applied to alter the motion of the nuclei.

38. Which of the following is non-ionising radiation:

a) X-ray

b) 13 -rays

c) a -rays

d) Microwave

e) y rays

Correct Answer - D

Ans. (D) Microwave

[Ref Robbins 9th/428; Review of Radiology by Sumer Sethi 6th/166; L 6.8 26th/172]

- The energy of nonionizing radiation such as UV and infrared light, microwave & sound waves, can move atoms in a molecule or cause them to vibrate.

39. On x-ray, small bowel can be differentiated by large bowel by having:

a) String of beads sign

b) Haustarions

c) Peripherally placed concave coil of intestine

d) Air fluid level

e) Valvulae conniventes

Correct Answer - A:D:E

Ans. (A) String of beads sign (D) Air fluid level (E) Valvulae conniventes

[Ref. BDC 6th/Vol. II 438; Review Radiology by Sumer Sethi 6th/123; Grainger & Allisoni Diagnostic Radiology 6th/598, 602; Dahnert Radiology manual 5th/767; L 6 B 26th/ I 143-44]

- Dilated loops of small intestine are readily identified if they are gas filled on supine radiographs.
- The strings of beads sign, caused by a line of gas bubbles trapped b/w the valvulas contents, is seen only when very dilated small bowel is almost completely filled with fluid & is virtually diagnostic of small bowel obstruction.

40. For radiotherapy an isotope is paced in or around canecr site. It is called as:

a) Brachytherapy

b) Teletherapy

c) External beam therapy

d) Intensity Medulated radiotherapy

e) None

Correct Answer - A

Ans. (A) Brachytherapy

[Ref. Radiology by Sumer Sethi 6th/176; Grainger & Allison\
Diagnostic Radiology 6th/1737]

Brachytherapy:

- It refers to situations in which a radioisotope is placed onto or inside the patient.
- The source can be placed into the target tissues or tumour itself such as prostate or breast (interstitial brachytherapy, into a body cavity such as the uterine cavity, oesophagus or bronchus (intracavity/ intraluminal brachytherapy) ot onto the skin surface to treat a cutaneous malignancy

41. Normal brain calcification is /are present in:

a) Pineal gland

b) Choroids plexus

c) Thalamus

d) Duramater

e) Hypothalamus

Correct Answer - A:B:D

Ans.(A) Pineal gland (B) Choroids plexus (D) Duramater

[Review of Radiology by Sumer Sethi 6th/ 137]

Normal Intracranial Calcification:

- Pineal,habenulae
- Choroid Plexus
- Dura (falx, tentorium, over vault)
- Ligaments (petroclinoid & interclinoid)
- Pacchionianbodies
- Basal Ganglia dentate nucleus
- Pituitary
- Lens

42. Which of the following is true regarding MRI:

a) MRI is better than CT scan for bony lesion

b) Grey matter is grey on T1WI

c) Uses dye gadolinium

d) Gadolinium is safer than iodine based contrast agent

e) Can be used in multiple plain

Correct Answer - B:C:D:E

Ans. (B) Grey matter is grey on T1WI (C) Uses dye gadolinium (D) Gadolinium is safer than iodine based contrast agent (E) Can be used in multiple plain

[Ref Sumer Sethi 2nd/9-10; mriscans.cliniccompare.co.uk/mri-scan-with-contrast-dye; Dahnert radiology Review Manual 5th/1079; Bhadury 2nd/ 177; blog.radiolog.ucsf.edu; [www.difren.com/difference / CT-Scan-r,s-MRI](http://www.difren.com/difference/CT-Scan-r,s-MRI)]

MRI:

- The contrast dye used in these MRI Scans is generally gadolinium at complications are rarer in comparison to the Iodine origin dye used for X-rays and CT scan
- In spine & for musculoskeletal problems, MRI is the preferred option.
- MR imaging has traditionally been used for neurologic indications, including brain tumors, acute ischemia, infection, and congenital abnormalities.
- Grey matter is grey & white matter is white on T1W1 & relationship is reversed on T2W1.

43. All are true regarding PET scan except:

- a) Help in assessment of both anatomical & functional status of tissue
- b) Do not pose any radiation exposure to patient
- c) Superior to CT for anatomical detail
- d) FDG is used
- e) None

Correct Answer - B:C

Ans. (B) Do not pose any radiation exposure to patient (C) Superior to CT for anatomical detail

[Ref L e B 25th/136-37; Dahnert Radiology manual 5th/1085; L & B 25th/136, Basic Radiology by Lange 2004; [raiegtaphics.rsna.org / content/23/2/ 315full](http://raiegtaphics.rsna.org/content/23/2/315full)]

Positron Emission Tomography (PET):

- The most commonly used radiolabeled tracer is ¹⁸F-2- fluoro-2- deoxy-D-glucose (FDG), although other tracers can also be used in order to assess metabolic functions such as oxygen and glucose consumption and blood flow.
- Areas of high metabolic activity (i.e., cerebral cortex, deep gray nuclei) demonstrate greater radiopharmaceutical uptake than ilo arcas of low metabolic activity, such as white matter or cerebrospinal fluid. The bones of the skull and scalp soft tissues are, for the most part, invisible.
- Anatomic resolution, although not as good as with CT or MRI imaging.

Strengths:

- Allows/functional imaging

- Allows imaging of the whole body
 - Bone scan has a high sensitivity for metastatic bone disease, fractures and infection
- Drawbacks:**
- High cost, very limited availability and relatively low spatial resolution.

44. False increase in size of heart on chest x-ray PA view is/are seen in:

a) Rotation of patient

b) Supine view

c) Film taken in expiration

d) Pneumonia

e) None

Correct Answer - A:B

Ans. (A) Rotation of patient (B) Supine view

[Ref: WHO Radiographic Manual 2002/32-33; Basic Radiology (Lange) 2004/Heart imaging]

Causes of pseudo increased size of heart:

- Chest X-ray should be taken in full inspiration & correctly centered:
- A film taken in expiration can cause confusion.
- It may simulate diseases e.g., pulmonary congestion, cardiomegaly or a wide mediastinum'

In Supine chest view:

- The Heart appears enlarged & mediastinum may appear wide perhaps 10cm.

Mediastinal Widening:

- Widening of the mediastinum is most often due to technical factors such as Patient positioning or the projection used.
- Rotation, incomplete inspiration, or an AP view, may all exaggerate the width of the mediastinum, as well as heart size.

45. Side-effects (s) of Pituitary irradiation:

a) Hypopituitarism

b) Decrease risk of secondary tumor

c) Optic nerve damage

d) Increased risk of cerebrovascular accident

e) None

Correct Answer - A:C:D

Ans. (A) Hypopituitarism (C) Optic nerve damage (D) Increased risk of cerebrovascular accident

[Ref Harrison 19th/2263-64, 18th/2886, 2829;CMDT 2016/1087, 06/1115; Devita 7th/1844; Leibel Philip 2nd/489]

S/E of Pituitary irradiation:

- Hypopituitarism, some degree of memory impairment, increased long term risk of second tumor & small vessel ischemic episode.

46. True statement regarding Iodine-131:

a) It is the only isotope of iodine used for thyroid

b) Contraindicated in pregnancy

c) Emits a rays

d) Emits 13 rays

e) Emits γ rays

Correct Answer - B:D:E

**Ans. (B) Contraindicated in pregnancy (D) Emits 13 rays
(E) Emits γ rays**

[Ref: Dahnert Radiology manual 5th/1087:88; Review of Radiology by Sumer Sethi 2nd/101; Harrison 18th/2932, 17th/1360; Dutta Gynaecology 5th/484, 4th /465; Meredith Radiation Physics & Nuclear Medicine/28]

(Iodine) I-131:

- Emits beta & gamma rays.
- Contraindicated during pregnancy.
- Foetal thyroid will be destroyed resulting in cretinism, other abnormalities if given during the first trimester.
- **I-127** - Stable isotope of iodine.
- **I-131** - Radioactive isotope of medical importance.
- **I-123** - Agent of choice for thyroid imaging.
- For radioactive iodine scanning I-131 & I-123 are used.
- For treatment hypothyroidism & thyroid cancer I-131 is used.

47. 18-FDG stands for:

a) 18-Fluorodeoxy glucose

b) 18-Fluorodioxy glucose

c) 18-Fluorodeoxy galactose

d) 18-Fluorodioxy galactose

e) 18-Fluorodeoxy glycogen

Correct Answer - A

Ans. (A) 18-Fluorodeoxy glucose

[Ref Sumer Sethi 2nd/16; Grainger & Allison Radiology 6th/141]

- 18F-2- Fluoro-2-deoxy-D-glucose (FDG)
- Dye used in PET scans.
- The most commonly used radiolabeled tracer is 18F-2- Fluoro-2-deoxy-D-glucose (FDG).
- In PET helps assess metabolic functions such as oxygen and glucose consumption and blood flow.

48. Half-life of radium is:

a) 14 day

b) 27 day

c) 1626 years

d) 5.25 yr

e) None

Correct Answer - C

Ans. (C) 1626 years

[Ref: Harrison 19the/p263e-3]

- Half-life of Ra-226: 1626 years

49. 1 curie is equivalent to:

a) 1.7×10^{10} disintegration/second

b) 2.7×10^{10} disintegration/second

c) 3.7×10^{10} disintegration/second

d) 4.7×10^{10} disintegration/second

e) 5.7×10^{10} disintegration/second

Correct Answer - C

Ans. (C) 3.7×10^{10} disintegration/second

[Ref: Sumer Sethi 2nd/94-95; Grainger & Allison Radiology 6th/118; Radiology by S. Bhailury 2nd/197; Harrison 19th/263 e-1, 18th/1788; <http://www.nrc.gov/reading-rm/doc-collections/cfr>]

Radiology by S. Bhadury 2nd/197:Writes:

- 1 Bq= 1 disintegration/second
- 1 Curie (Ci)= 3.7×10^{10} disintegration/second
- 1 Ci is equal to 37 gigabecquerel
- 1 gray (Gy) = 100 rads 10 mGy = 1 rad 1 mGy = 100 mrad Gray (Gy) is the SI unit of absorbed dose.
- One gray is equal to an absorbed dose of 1 rads/kilogram (100 rads).

50. Radiation not emitted by Co-60:

a) a rays

b) 13 rays

c) y rays

d) Positron

e) 6 rays

Correct Answer - A:D:E

Ans. A,a rays D, Positron & E, 6 rays

[Ref: Harrison 19th/263e3, 18th/1790; Sumer Sethi 2nd/88; Grainger (t Allison Radiology 6th/118]

- Cobalt (Co-60) - beta,gamma rays emitted.

51. Which of the following areas are not examined in FAST:

a) Perisplenic

b) Perihepatic

c) Suprapubic

d) Chest

e) None

Correct Answer - E

Ans. (E) NONE

[Ref: L 6 B 26th/ 1 87; Manipal 4th/886]

- FAST: 4 acoustic window- pericardial, perihepatic, perisplenic or pelvic.
- The four classic areas that are examined for free fluid are the perihepatic space (also called Morison's pouch or the hepatorenal recess), perisplenic space, pericardium & pelvis.