放射治療測驗

Radiotherapy

2018年8月26日星期日

1. 除題意不清楚或是圖片有問題，禁止詢問與試題有關的問題。

2. 應答時禁止使用任何文件。

3. 請在電腦答案卡上圈選作答

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| *作答方式* | 本測驗共有90題問題。請使用1到90作答欄位。  請將測驗卷Q1的答案填入答案卷的解答番號1。Q2 = 解答番號2，Q3 = 解答番號3…Q90 = 解答番號90。 |

1. Which of the following is true of daily QA list for a linear accelerator?

1) indicator of table position  
2) electron beam coincidence

3) photon beam coincidence  
4) indicator of collimator size

5) light and radiation field coincidence

1. Which of the following is true of monthly QA for a linear accelerator?

1) photon flatness change  
2) electron symmetry change

3) door operation check  
4) central axis change of gantry

5) coincidence of central cross hair-line axis for collimation rotation

1. Which of the following is true of annual QA for a linear accelerator?

1) accuracy of MLC position  
2) indicator of gantry position  
3) coincidence of light and radiation field size  
4) coincidence of an X-ray beam quality (PDD10 or TMR1020)  
5) optical distance indicator (ODI) check

1. Acceptable error of source position accuracy in daily QA of brachytherapy is:

1) 0.5 mm  
2) 1.0 mm  
3) 1.5 mm  
4) 2.0 mm  
5) 2.5 mm

1. Which of the following examination is true to be performed for QA when magnetron and target are replaced at the same time in tomotherapy?

1) beam quality check  
2) imaging noise check

3) MLC misplacement check  
4) imaging contrast check

5) geometrical distortion check

1. Which of the following statement is true of quality assurance (QA) ?

1) wedge transmission factor is a list of monthly QA as it can possibly change often  
2) the output for the change of an X-ray MU is not a list of QA as it is always consistent   
3) the output for the change of an X-ray dose rate is a list of an annual QA as it rarely alters  
4) the off-axis-ratio (OAR) does not need to perform a QA as it is always consistent  
5) the output for the change of an X-ray gantry angle does not need to perform as it is always consistent

1. Which best describes the unit and the quality of radiation?  
   1) kerma is used for the indirectly ionizing radiation  
   2) radiation exposure (R) is used for the directly ionizing radiation  
   3) dose equivalent is applied by the tissue weighting factor  
   4) radioactivity is a level of atomic decay  
   5) absorbed dose is applied for protecting tissue damage by radiation
2. Which of the following radiation is the case that dose equivalent is larger than absorbed dose?

1) electron beam  
2) neutron beam  
3) low-energy photon beam

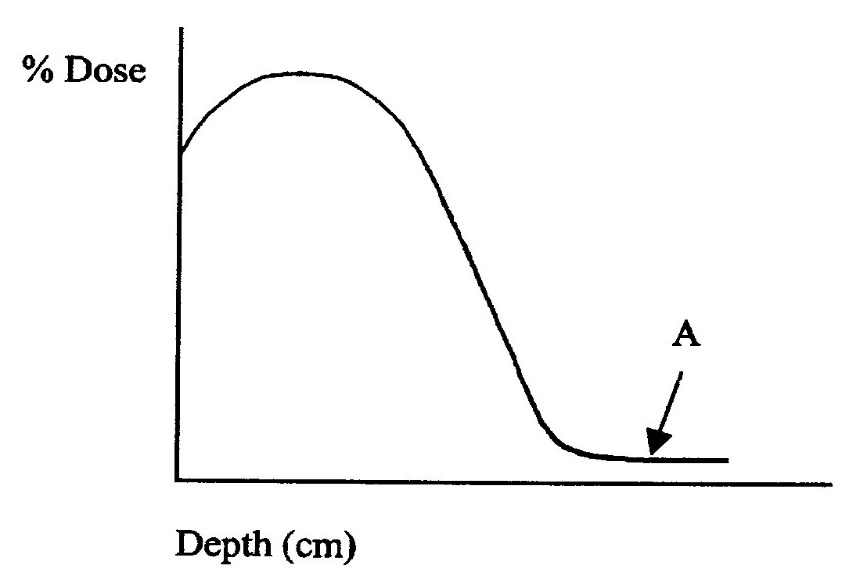
4) high-energy photon beam  
5) high-energy gamma ray

1. Which factor most influences at Dmax where high-energy photon electron equilibrium forms?

1) total does  
2) energy

3) field size  
4) tissue thickness

5) distance between the source and the surface

1. The graph below shows the PDD of an electron beam. The reason why the point A appears   
   on the PDD curve is:  
      
   1) due to an electron beam has lower energy penetration  
   2) due to no interaction with the target  
   3) due to electron has a tendency to spread out laterally  
   4) due to scattered dose from gantry head, dedicated cone, and transmission-typed ion chamber  
   5) due to neutrons are produced through electrons interaction with matters
2. Which of the following method is correct for reducing the geometric penumbra?  
   1) produces the block aperture perpendicularly   
   2) increases the source-to-skin distance  
   3) increases the source-to-collimator distance  
   4) increases the collimator-to-skin distance  
   5) uses MLC instead of customized block aperture
3. What is the correct reason why tissue-maximum ratio (TMR) is more commonly used than Tissue-Air Ratio (TAR) in a high-energy radiation treatment?  
   1) TMR is independent to Dmax  
   2) TMR is independent to field size  
   3) TMR is consistent regardless of energy  
   4) TAR is hard to measure at a high-energy radiation  
   5) TMR is easier to calculate the rotational treatment than TAR
4. Which statement is correct to describe the characteristic of a high-energy photon beam?  
   1) scatter radiation decreases with increasing field size  
   2) skin dose decreases with increasing energy  
   3) PDD decreases with increasing SSD  
   4) PDD decreases with increasing field size  
   5) PDD decreases with increasing energy
5. For the SSD treatment technique, the field size is defined to:  
   1) patient surface  
   2) central rotation point   
   3) Dmax  
   4) where the film/detector is placed  
   5) central point of patient thickness (Mid-sparation)
6. Which of the following is true of the Compton scatter?  
   1) mainly interacts with an atomic nucleus  
   2) attenuation changes according to an electron density of matter  
   3) occurrence probability increases with increasing energy  
   4) changes according to an atomic number of matter in a high-energy radiation  
   5) dominant phenomenon that interacts with matter within a 50 KeV
7. Which of the following is true of the quality assurance (QA) in radiation treatment?  
   1) optimizing uncertainties, which may occur during radiation treatment  
   2) management of radiation treatment machine that performs in special cases  
   3) patient safety is less related to radiation treatment QA  
   4) effective management for expensive radiation treatment machines in the economic point  
   5) wide range of works, complicated procedures, and management system supported by the staff are required
8. Which of the following is modified value as a form of square section from a rectangular section of 10 × 15 ㎠ using A/P method?

1) 8 × 8 ㎠  
2) 10 × 10 ㎠  
3) 12 × 12 ㎠

4) 13 × 13 ㎠s  
5) 15 × 15 ㎠

1. Which of the following is affected by changes in SSD?

1) %DD  
2) TMR  
3) TAR  
4) TPR  
5) OAR

1. What is true of the tissue-maximum ratio (TMR) measurement settings?  
   1) All measurements must be performed in air.  
   2) Measurement shall be made by placing a build-up cap on a chamber to form a second electronic equilibrium in the water.  
   3) It performs to measure the depth or the thickness from the surface to the phantom with fixing a chamber into a central axis of a treatment machine.  
   4) It is recommended to set a depth of 5cm or 10cm for the reference to mark TMR.  
   5) Field size needs to be identical to the surface since TMR is not affected by SSD.
2. When applying a 9 MeV electron beam to the field of 6 × 6 ㎠ and the result was obtained as the picture below. What action needs to be taken?  
     
   

1) Place a 1cm bolus on the surface  
2) Enlarge the field size to 10 × 10 ㎠

3) Change the electron energy as a 12 MeV  
4) Perform a normalization

5) generate treatment plan applying all four of the above.

1. The picture below shows an arc therapy with photon. Where do you think the maximum dose is formed when the central point is b?  
     
   EMB0000267c1712

1) a  
2) b  
3) c  
4) d  
5) surface

1. Which of the following is true of the characteristic of an electron beam?

1) absorbed dose is low on the surface  
2) evaluation of energy uses R80

3) better skin sparing effect than a photon  
4) dose drops rapidly after a depth of Dmax

5) contamination by some of photons does not occur

1. Which of the following definition is true as a reference by ICRU report 50?  
   1) IV - volume that is able to irradiate except the tolerance dose of the normal tissue  
   2) CTV – volume that takes account for patient’s motion and total volume of the target  
   3) TV – volume that the isodose of 90% passes by the selected isodose to be treated  
   4) PTV – volume that includes the CTV and the additional changes such as patient’s motion, anatomic change by breathing  
   5) GTV – volume that includes demonstrable extent of tumors and anatomic changes by breathing or motion
2. Which of the following is true of isodose curve?  
   1) not used for a prescription of treatment planning  
   2) no need to be consistent of beam quality when drawing the isodose curve  
   3) no information about the size of penumbra from the isodose curve  
   4) it is the curve by connecting points of the same PDD  
   5) Film isodose curve plotter mainly uses non-tissue-equivalent materials
3. What is the reason why a multi-field irradiation is more advantageous than a single field irradiation when tumors are located in depth?  
   1) It can increase the target dose while reducing normal tissue damage.  
   2) It aims accurately.  
   3) It decreases blood disorder.  
   4) It lessens the radiation-induced fatigue.  
   5) It can prescribe more dose to the skin.
4. Which of the following is true about medical linear accelerator?  
   1) The electrons are accelerated to positive charges with a bias energy of between 6 and 25 MeV.  
   2) Microwave amplification occurs in the klystron for low energy and in the magnetron for high energy.  
   3) If the acceleration is the same, the length of standing wave accelerating tube is shorter than that of traveling wave tube.  
   4) A frequency of approximately 1 GHz is transmitted through the wave guide to the tube.  
   5) All above are incorrect.
5. What is the frequency of medical linear accelerator?

1) 100 MHz   
2) 300 MHz  
3) 1000 MHz

4) 3000 MHz  
5) 5000 MHz

1. Which of the following is true of the wedge filter?  
   1) The wedge filter angle has the same thickness as the wedge filter angle when converting the water equivalent thickness.  
   2) The wedge filter angle is defined as the angle of the lateral dose distribution measured at the water of 10cm depth.  
   3) The physical wedge factor varies depending on the size, depth, and lateral distance.  
   4) The surface dose for the wedge filter increases the skin dose more than 50% of Dmax since an electron contamination occurs in the wedge filter.  
   5) The wedge filter angle is defined equally in the physical wedge and virtual wedge.
2. The half-value-layer(HVL) of 6M photon beam is a lead 13mm (p=13.5 g/cm2) What is the thickness of the low melting point lead alloy (Cerrobend) for reducing the primary beam to 5%? (However, the density of the low melting point lead is assumed to be 83% of lead.)

1) 5.2 cm  
2) 6.7 cm  
3) 7.8 cm  
4) 9.9 cm  
5) 11.5 cm

1. A 10 X 10 cm2 field and a 20 X 20 cm2 are adjacent to each other at SSD 100 ㎝. What shall be the skin gap required to join the two fields at a depth of 5 cm ?

1) 0.75 cm   
2) 0.89 cm  
3) 1.00 cm  
4) 1.21 cm  
5) 1.50 cm

1. Which of the following statement is true if an electron field is parallel to a photon field closely located?  
   1) The hot-spot occurs toward a photon field  
   2) The hot-spot occurs toward an electron field  
   3) The hot-spot is produced at the corner side of an electron and a photon field  
   4) The cold-spot is produced at the corner side of an electron and a photon field  
   5) No hot-spot and cold-spot are generated at the corner side of both fields.
2. What is the minimal thickness of lead to block a 15 MeV electron beam ?

1) 0.2 cm  
2) 0.5 cm  
3) 0.8 cm  
4) 1.1 cm  
5) 1.3 cm

1. Which of the following is true of TBI (Total Body Irradiation)?  
   1) An uniform dose is set to be within +/- 5% along the central axis of the patient  
   2) The skin dose is set to deliver more than 80% of prescribe dose.  
   3) TBI is used for treating leukemia, lymphoma, immunodeficiency, and aplastic anemia.  
   4) The Beam spoiler is placed to reduce an average value of the beam energy  
   5) An eye shield with high Z material is used to save the lens impurity
2. Which of the following is true when TBI is performed with a Bi-lateral technique?  
   1) Only head and arm are required to have the tissue compensator  
   2) Arm should be placed on the chest region to reduce the dose to the lung.  
   3) An electron boost irradiation is needed for an additional treatment for the lung  
   4) Reference depth of compensator is the diameter of transverse direction near the umbilicus in the body which includes arm  
   5) It is set to be lower than 80% of prescription point dose to take account for the radiation pneumonitis
3. The advantage of a treatment method with a non-coplanar beam direction over a coplanar beam direction is:  
   1) reduces the irradiation field of the normal tissue  
   2) requires less of CT image data for treatment plan  
   3) provides wider choice to avoid irradiating critical organs  
   4) reduces a treatment time  
   5) no needs to concern about the collision
4. Which of the following statements is true about IMRT description?  
   1) IMRT is a technique that delivers non-uniform fluence to patient at a specific point to optimize the complex dose distribution.  
   2) IMRT is a technique that delivers uniform fluence to patient at a specific point to optimize the complex dose distribution.  
   3) Radiation used in IMRT forms the beam to be coincident with the tumor.  
   4) IMRT can produce the dose distribution of single or a few limited planes to the tumor volume  
   5) IMRT technique is superior to treat the whole body irradiation than 3D-CRT.
5. Which of the following is true regarding of deciding the PTV margin created from CTV?  
   1) IMRT applies the less margin on the PTV than 3D-CRT because it uses the optimized dose distribution.  
   2) PTV margin is the same for both IMRT and 3D-CRT because both techniques are working under the same image-guided technique.  
   3) The less PTV margin is needed for IMRT because IGRT technique can be used only for IMRT unlike 3D-CRT.  
   4) PTV margin depends on the accuracy of the fused CT image.  
   5) PTV margin applies the same regardless of the energy used (electron, photon, and proton)
6. Which of the following is true about MLC in IMRT?  
   1) Double focused MLC is used for IMRT of window sliding tech  
   2) few beams as possible should be used to minimize the tongue and groove effect.  
   3) The speed of MLC for optimal dose distribution is dependent on the direction and weight of the beam.  
   4) MLC materials use Brass to reduce unnecessary penumbra.   
   5) IMRT with dynamic MLC has the advantage of using less MU than static MLC.
7. Which of the following is true about the advantage of VMAT compare to Fixed-IMRT?  
   1) VMAT delivers a superior dose distribution in the target volume.  
   2) VMAT provides shorter treatment time while maintaining the same level of dose distribution  
   3) VMAT facilitates the process of dose optimization for tumors and normal tissues.  
   4) VMAT induces little movement of the patient’s position during treatment.   
   5) In term of dose distribution, low dose area can be effectively reduced by VMAT.
8. . What is true of the various methods using wedge filters when treating 3D-conformal radiation therapy?  
   1) Dynamic wedge is a method obtaining wedge filter effect by moving a jaw.  
   2) Dynamic wedge is mainly used.in a FIF treatment plan.  
   3) Because MU decreases by using wedge filter, it is effective to reduce treatment time.  
   4) When using a universal wedge, an improved dose distribution can be obtained in IMRT.  
   5) The use of wedge filter is essential when treating a curved area with an electron beam.
9. . What is true of stereotactic radiosurgery(SRS)?  
   1) SRS is a treatment, which delivers high dose at a time, results in higher treatment effect as the number of fractions increases.   
   2) SRS is primarily used for small tumors of 3 cm or less, and can be performed by Cyber Knife, Gamma Knife, and Linear Accelerator.  
   3) When using Cyber for SRS, the use of frames to make patient’s position fixed is essential.  
   4) The first SRS treatment was conducted using a proton beam.  
   5) Enough margin should be set for an adequate dose distribution around tumor when performing SRS treatment planning.
10. Which of the following is the equipment component of the Tomotherapy?

1) Flattening Filter  
2) Bending Magnet  
3) Magnetron  
4) Scattering Foil  
5) Motor-based MLC (120 leaf)

1. Which of the following is true of considering for 4D-CT?  
   1) Correction for target irregularity  
   2) Correction for non-uniformity of tumor  
   3) Modulation of beam intensity  
   4) respiratory gating  
   5) Treatment time reduction
2. . Which of the following is true about Tomotherapy?  
   1) With the couch fixed, it rotates 360 degrees to treat.  
   2) IGRT can be performed using MVCT.  
   3) MLC operation method that is used to treat IMRT is window sliding method.  
   4) Tomotherapy uses a helical treatment technique in the form of cone beam.  
   5) It treats using a 10 MV X-ray.
3. Which of the following is true about proton therapy?  
   1) The closer the tumor is to the surface, the greater benefits of proton treatment can be achieved.  
   2) A proton with an RBE of 3 has a greater biological effect than a photon.  
   3) It is possible to treat without using a compensator and a block aperture in a pencil beam scanning mode (IMPT)  
   4) Block aperture materials are Tungsten and lead-alloy.  
   5) The Bragg peak of proton is equal to each energy and provides a great benefit of saving the normal tissues.
4. Which of the following is true of the Klystron and the Magnetron?  
   1) they are the components to bend an electron  
   2) they are the components to control the focal spot in the beam  
   3) they are equipped inside the gantry head  
   4) they produce microwave  
   5) they generate a high energy of radiation by accelerating an electron
5. Which of the following material can be used to modify the dose of irregular surface region of patient while maintaining the skin sparing effect?

1) bolus  
2) lead block  
3) wedge filter

4) compensator  
5) front pointer

1. Which of the following is related to intensity-modulated radiation therapy (IMRT) ?  
   1) radiation treatment with respiratory gating  
   2) treatment using bolus and wedge filter  
   3) forward radiation treatment planning  
   4) single field exposure using a block aperture  
   5) radiation treatment using MLC with sliding-window technique
2. Which of the following statement is true of radiation treatment technique with wedge filter?  
   1) increases the output when wedge filters are used  
   2) dynamic wedges can be generated using a multi-leaf collimator (MLC)  
   3) wedge filter is used to provide a uniform dose distribution within target  
   4) use of wedge filter is more beneficial to the superficial tumor than the deep-seated tumor in the body  
   5) wedge filter should be used near the skin region as possible
3. Which of the following dose calculation algorithm is the method that tracks the beam path by calculating photon interactions in a statistical way?

1) Monte Carlo  
2) Pencil beam  
3) IMRT optimizer

4) Clarkson scatter  
5) Collapsed Cone Convolution

1. What is correct statement about the surface dose of an electron beam?  
   1) lower surface dose than photon  
   2) PDD increases with increasing energy  
   3) increases the skin sparing effect with increasing energy  
   4) despite linac changed, the surface dose value is the same if the energy is still identical  
   5) plane-parallel chamber is mainly used for dose measurement
2. Which of the following is a correctly match for the list of linear accelerator QA/QC and its acceptable error?  
   1) symmetry of an X-ray - +/- 3%  
   2) flatness of an X-ray - +/- 3 %  
   3) laser beam coincidence – within 3 mm  
   4) rotational beam central axis check – within the spherical diameter of 3 mm  
   5) coincidence of light-field and radiation-field – within +/- 3 mm
3. The energy range of the plane-parallel chamber application recommended by AAPT TG-51 for an electron beam is:

1) 6 MeV or less  
2) 7 - 9 MeV  
3) 10 - 12 MeV

4) 13 - 15 MeV  
5) 16 MeV or more

1. Which of the following measurement device does not need a correction through other measurement device?

1) TLD  
2) Diode  
3) Farmer chamber

4) Radiochromic film  
5) Free-air ionization chamber

1. For high dose rate brachytherapy, what is the advantage of 192Ir over 60Co and 137Cs?

1) greater Half-lilfe  
2) greater Half-value-layer

3) greater specific activity  
4) higher average energy

5) all of the above

1. Which of the followings are true for the list of DICOM data transfer?  
   1) Beam data, RT structure sets  
   2) RT images, RT structure sets, RT dose  
   3) Beam data, RT structure sets, RT images  
   4) RT optimization parameters, RT structure sets  
   5) RT optimization parameters, RT structure sets, RT dose
2. Which of the following is correct for the list of monthly QA?

1) Door interlock  
2) Table top sag

3) Audiovisual monitor  
4) Emergency off switches

5) Optical distance indicator (ODI)

1. Which best describes Dose Volume Histogram (DVH)?  
   1) optimizes radiation treatment during a given time  
   2) one of the method analyzing the quality of treatment plan  
   3) can be used for the representative dose to normal tissue  
   4) provides dose for the target in the form of circular graph  
   5) provides the point where the hot-spot occurs in the target
2. If the depth of an electron R50 is 3.8 cm that has a wide field size, what is the average energy of the surface?

1) 6 MeV  
2) 9 MeV  
3) 12 MeV  
4) 16 MeV  
5) 20 MeV

1. Which of the following is related to the cell cycle in 4R which explains the characteristics of fractionated irradiation in radiotherapy?

1) Repair  
2) Repopulation  
3) Redistribution

4) Reoxygenation  
5) Reconstruction

1. Which phase is the most resistant to radiation in the cell cycle?

1) G0  
2) G1  
3) M  
4) late S  
5) G2

1. Which of the following is true of proton therapy?  
   1) can treat TBI using proton treatment plan  
   2) can expect a higher biological effect as the RBE of proton is 2.5 times larger than an X-ray  
   3) uses the same concept of the PTV provided by ICRT report 62 in proton therapy  
   4) not affected by patient setup since proton has the unique characteristic called the Bragg peak  
   5) important to select the appropriate beam direction with fixed patient setup because proton is largely dependent on the change of the tissue density in the beam path.
2. What factors changes the TMR?

1) energy, SAD, depth  
2) SAD, depth, field size  
3) energy, depth, field size

4) energy, dose rate, field size  
5) SAD, energy, field size

1. Which of the following matches is correct for radiation protection?

1) shorter time, distance / thicker blocking wall  
2) longer time, distance / thicker blocking wall  
3) shorter time / longer distance / blocking wall of 5 HVL  
4) shorter time / longer distance / blocking wall of 8 HVL  
5) shorter time / longer distance / blocking wall of 10 HVL

1. Which of the following is true of the respiratory gating radiation treatment (RGRT) ?  
   1) only possible to treat where is related to breathing such as the chest, abdominal area  
   2) manage the pattern of breathing by placing a sensor near the air way of patient  
   3) reduces normal tissue complications by holding the tumor movement  
   4) available for the adults only and patient’s family take a breath instead of the pediatrics  
   5) can be applied when tumor movement is greater than 10mm and the normal tissue saving effect is highly expected
2. Which test needs to be done to measure the movement and the position of a MLC?

1) split-field test  
2) leaf-end effect  
3) picket fence technique

4) tongue and groove test  
5) round edge position test

1. Which is the biggest cause resulting in an X-ray contamination in an electron beam therapy?

1) patient body  
2) electron cone  
3) scattering foil

4) collimator jaw  
5) monitor ion chamber

1. Which of the following matches are correct order of increasing size of the treating volumes recommended by ICRU?

1) GTV – CTV – PTV – ITV – TV – IV  
2) GTV – CTV – TV – PTV – ITV – IV

3) CTV – PTV – GTV – ITV – IV – TV  
4) GTV – CTV – ITV – PTV – TV – IV

5) CTV – GTV – PTV – ITV – IV – TIV

1. Which is most influenced by the atomic number for an X-ray interaction with matters?

1) photoelectric effect  
2) photonuclear reaction  
3) Compton scatter

4) pair production  
5) Rayleigh scattering

1. Which of the following results in the greatest difference of absorbed dose and kerma on the skin surface

1) 6 MeV electron  
2) 10 MV X-ray  
3) 10 MeV electron

4) 15 MV X-ray  
5) 15 MeV electron

1. What is the acceptable error of IMRT QA recommended by AAPM TG-142?

1) electron beam energy constancy: 5 %  
2) cross-hair centering: 1 mm

3) gantry/collimator angle indicator: 20  
4) light/radiation field coincidence: 3 mm

5) output constancy: 1.5%

1. Which of the following is true of a systemic error?  
   1) includes inter-treatment error  
   2) includes changes of shape and location of the target  
   3) checkable error after treatment  
   4) occasional error that may occur during whole course of treatment  
   5) error that occurs toward the same direction with similar pattern in every treatment
2. Which of the following is true of the oligometastasis?  
   1) possible to treat with chemo therapy  
   2) especially for lung, liver, and brain are only available to treat with radiation  
   3) can be diagnosed through blood test but invisible in imaging  
   4) can be treated with radiation as it only metastasizes a loco-regionally region  
   5) radiotherapy is not available to apply as it spreads out to multiple regions at once
3. Choose the answer for the blank A, B of the sentence below.  
     
    % (A) with therapy A versus therapy B  
   therapeutic gain factor = -----------------------------------------------  
    % (B) with therapy B versus therapy B

1) A: tumor control / B: complication  
2) A: oxygenation / B: tumor growth

3) A: complication / B: tumor control  
4) A: tumor growth / B: oxygenation

5) A: complication / B: oxygenation

1. Which factor is true causing the normal tissue changes by radiation?

1) TD 5/5  
2) TD 50/50  
3) Daily dose

4) Treatment time  
5) Treatment fraction

1. In general, what value is considered as an alpha/beta ratio of normal tissue?

1) 2  
2) 3  
3) 5  
4) 10  
5) 15

1. Which of the following is true of the breast cancer treatment?  
   1) in brachytherapy, surface skin molds technique is mainly used  
   2) use of breast board is more effective to treat the patient underwent the radical mastectomy surgery  
   3) chemotherapy is a primary option for those underwent an operation, not applying for radiotherapy  
   4) one of the prognostic factor of treatment is the positive number of internal mammary lymphnode  
   5) Treatment for the internal mammary lymphnode can be done with an electron beam therapy alone and/or including tangential treatment technique
2. Where is the most frequent area of cancer development in the segment of the breast tissue divided with the central nipple and other 4 parts?

1) nipple upper  
2) nipple lower

3) UOQ (Upper Outer Quadrant)  
4) LIQ (Lower Inner Quadrant)

5) LOQ (Lower Outer Quadrant)

1. Which of the following matches is true of the serial organ and parallel organ?

1) liver - serial  
2) lung - serial  
3) spinal cord - parallel

4) small bowel - serial  
5) kidneys – serial

1. Which of the following is true of a Field-in-Field technique?  
   1) provides high dose gradient  
   2) gives an effect to improve the conformity  
   3) fluence optimization is performed with an inverse planning  
   4) Hot-spot appears toward the chest wall as MU increases  
   5) gives an effect to elevate the dose homogeneity without using wedge filter
2. Which of the following factor is able to make an effect of VMAT?

1) electron beam settings  
2) number of leaf (MLC)  
3) dose rate

4) use of a bolus  
5) couch rotation

1. MVCT is more advantageous than KVCT because:  
   1) shows a better contrast in MVCT  
   2) uses the same machine as an X-ray imaging machine  
   3) provides a better imaging quality for an artificial implant  
   4) less exposure than KVCT  
   5) MVCT is able to provide a real time patient’s motion during treatment
2. Which of the following is true of the multi-leaf collimator and the gantry head?

1) linac head: 1% / MLC: within 1%  
2) linac head: 1% / MLC: within 1%

3) linac head: 1% / MLC: within 5%  
4) linac head: 1% / MLC: within 2%

5) linac head: 2% / MLC: within 5%

1. Which of the following is a method for an evaluation of a 3DCRT?

1) CT scan  
2) EPID- port film  
3) TLD dosimetry

4) MV-cone beam CT  
5) Point dose dosimetry

1. Choose the answer below.  
   A high dose rate brachytherapy is classified as a brachytherapy technique as ( ) of prescribed dose rate recommended by the ICRU.

1) 2 cGy/min or more  
2) 10 cGy/min or more  
3) 20 cGy/min or more

4) 30 cGy/min or more  
5) 40 cGy/min or more

1. ICRT recommends the acceptable error of dose coverage within the target of:

1) – 3 % to +5%  
2) – 3 % to +7 %  
3) – 5 % to + 7 %

4) – 5 % to + 10 %  
5) – 10 % to + 10%

1. Which of the following material can be used as a scattering absorber for reducing the skin dose?

1) Al  
2) Cu  
3) Sn  
4) Pb  
5) Cd

1. Which of the following is true of IMRT optimization and segmentation?  
   1) less dose reproducibility than a 3DCRT  
   2) intensity of All beamlet is equal  
   3) field size is determined by a number of segments  
   4) field size is determined by a custom block  
   5) optimization is processed using a collimator
2. Which of the following is true of a Flattening-Filter-Free (FFF)?  
   1) hard to provide an accurate dose distribution  
   2) dose distribution is not flat  
   3) high energy electron beam is produced  
   4) longer treatment time than a conventional treatment  
   5) able to create a similar dose distribution like wedge filters
3. Which of the following technique can make the least effect of an intra-fraction motion?

1) SRS  
2) SBRT  
3) IMRT  
4) VMAT  
5) RGRT