

## FINAL ANSWER KEY

Question 39/2024/OL

Paper Code:

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Code:

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Question1:-Coordination number of a metal ligand complex is

A:-the number of ligands in the complex

B:-the number of metal ions in the complex

C:-the number of unshared electron pairs

D:-the number of oxygen atoms in the complex

Correct Answer:- Option-A

Question2:-Nucleon numbers called magic numbers are

A:-2, 4, 20, 60, 82 or 126

B:-2, 10, 20, 50, 80 or 126

C:-2, 8, 20, 50, 82 or 126

D:-2, 10, 20, 50, 80 or 120

Correct Answer:- Option-C

Question3:-In alpha decay, the atomic number of the parent nuclide and the mass number is reduced by

A:-4 and 2

B:-2 and 4

C:-2 and 2

D:-4 and 4

Correct Answer:- Option-B

Question4:-In a Technetium radiopharmaceutical the number of states that Technetium can exist is

A:-1

B:-2

C:-3

D:-4

Correct Answer:- Option-C

Question5:-The radiopharmaceuticals requiring one solvent chromatography are all except

A:-Tc-99m DMSA

B:-Tc-99m MAA

C:-Tc-99m Sulphur Colloid

D:-Tc-99m DTPA

Correct Answer:- Option-D

Question6:-What instrument will you use if you have a spill of 2 mCi of I-131 in your lab?

A:-Cutie Pie

B:-Survey Meter

C:-Well Counter

D:-TLD

Correct Answer:- Option-B

Question7:-The type of collimator used in thyroid probe is

A:-Pinhole collimator

B:-Parallel hole collimator

C:-Converging collimator

D:-Flatfield collimator

Correct Answer:- Option-D

Question8:-Thermal neutrons are absorbed by

A:-Graphite

B:-Cadmium

C:-Beryllium

D:-Heavy water

Correct Answer:- Option-B

Question9:-For a radiopharmaceutical if  $T_p$  is  $<$   $T_b$ , then the  $T_e$  will be

A:-Less than  $T_p$

B:-Less than  $T_b$

C:-No relation

D:-Equal to  $T_p$

Correct Answer:- Option-A

Question10:-A kit preparation of Tc-99m which involves a transchelation reaction is

A:-Tc-99m DMSA

B:-Tc-99m DTPA

C:-Tc-99m Mebrofenin

D:-Tc-99m ECD

Correct Answer:- Option-D

Question11:-The precision of measured counts is indicated by

A:-Mean

B:-Standard deviation

C:-Median

D:-Confidence interval

Correct Answer:- Option-B

Question12:-For a count of 10,000, calculate the % uncertainty

A:-1%

B:-0.1%

C:-0.01%

D:-.02%

Correct Answer:- Option-A

Question13:-How closely a measurement agrees with the "True" value is called its?

A:-Precision

B:-Real value

C:-Accuracy

D:-Sensitivity

Correct Answer:- Option-C

Question14:-Radioactive disintegration follows a

A:-Gaussian distribution

B:-Poisson distribution

C:-Random distribution

D:-Log distribution

Correct Answer:- Option-B

Question15:-Interater agreement for categorical items is measured using

A:-Pearson correlation

B:-Mann Whitney U Test

C:-Wicoxon signed rank test

D:-Cohens Kappa

Correct Answer:- Option-D

Question16:-What statistical test will you apply to determine the significance of difference between the means of two sets of data obtained from the same set of patients following a normal distribution and whether positive or negative?

A:-One-sided Unpaired t test

B:-Two-sided Unpaired t test

C:-One-sided Paired t test

D:-Two-sided Paired t test

Correct Answer:- Option-D

Question17:-For a first order process rate constant  $k$  X concentration of substance in the compartment determines

A:-mean transit time

B:-flux

C:-turnover time

D:-steady state

Correct Answer:- Option-B

Question18:-The technique that averages local pixel values to reduce the effect of pixel-to-pixel variation is

A:-Normalizing

B:-Segmentation

C:-Smoothing

D:-Windowing

Correct Answer:- Option-C

Question19:-Nominal data from independent groups is analyzed using

A:-Mc Nemar Test

B:-Chi Square Test

C:-Wilcoxon signed rank test

D:-Friedman test

Correct Answer:- Option-B

Question20:-A useful approach to determine causes of artifacts in PET and SPECT images is

A:-MIP image

B:-Cine image

C:-Sinogram

D:-Back projection image

Correct Answer:- Option-C



Question21:-

Identify this structure(arrow)

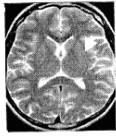
A:-Right lung upper lobe

B:-Right lung apex

C:-Azygous lobe

D:-Azygous vein

Correct Answer:- Option-C



Question22:-  
Identify this structure

- A:-Caudate
- B:-Putamen
- C:-Thalamus
- D:-Globus Pallidus

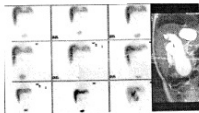
Correct Answer:- Option-B



Question23:-  
Identify the pathology on I-131 MIBG planar scan

- A:-Pheochromocytoma
- B:-Paraganglioma
- C:-NET
- D:-Normal Adrenal

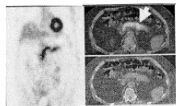
Correct Answer:- Option-A



Question24:-  
Identify the pathology on Tc-99m Mebrofenin scan

- A:-Gall bladder
- B:-Choledochal cyst
- C:-Bilioma
- D:-Hydatid cyst

Correct Answer:- Option-B



Question25:-  
Identify the structure with increased FDG uptake on PET/CT

- A:-None
- B:-Duodenum
- C:-Stomach
- D:-Pancreas

Correct Answer:- Option-D

Question26:-At the cellular level, the following components have been implicate in

promoting elevated FDG uptake in the malignant cells compared to host cells except

A:-Increased vascular flow-more tracer is available for the uptake

B:-Increased GLUT-1 on the cellular membrane-more FDG movement into the cell

C:-More HK 11-more FDG-6-P Production

D:-Increased dephosphorylation of FDG-6-P and less egress of FDG activity out of the malignant cell

Correct Answer:- Option-D

Question27:-An imaging radiopharmaceutical for tumor Apoptosis

A:-18 F-MISO

B:-11C-Co2

C:-99mTc-Annexin

D:-62Cu ATSM

Correct Answer:- Option-C

Question28:-Which of the following mechanism justifies the increased uptake of 11C methionine in cancer cells?

A:-Phosphorylation

B:-Decarboxylation

C:-Hexokinase activity

D:-Trans methylation

Correct Answer:- Option-D

Question29:-99 Tc RBC scintigraphy for the diagnosis of hepatic cavernous hemangioma

A:-Is the most sensitive noninvasive method

B:-Is the most specific noninvasive method

C:-Its sensitivity does not depend upon the size of the lesion

D:-It cannot differentiate hepatic cavernous hemangioma from metastasis

Correct Answer:- Option-B

Question30:-Critical organ for 201 Thallium is

A:-Gal bladder

B:-Kidneys

C:-Small intestine

D:-Large intestine

Correct Answer:- Option-B

Question31:-Which of the following radioisotope is recommended for the labeling of monoclonal antibodies for PET imaging?

A:-68 Ga

B:-124 I

C:-18 F

D:-11 C

Correct Answer:- Option-B

Question32:-On myocardial perfusion scan which of the following factors can be considered an advantage of  $^{99m}\text{Tc}$  tetrofosmin over  $^{99m}\text{Tc}$  Sestamibi?

A:-Higher myocardial uptake

B:-Rapid hepatic clearance

C:-Lower pulmonary uptake

D:-Lower price

Correct Answer:- Option-B

Question33:-What is the most appropriate radiopharmaceutical for myocardial perfusion with PET?

A:- $^{18}\text{F}$  FDG

B:- $^{13}\text{N}$  Ammonia

C:- $^{82}\text{Rb}$

D:- $^{11}\text{C}$  Palmitate

Correct Answer:- Option-B

Question34:-Which brain SPECT imaging has the poorest resolution quality?

A:- $^{99m}\text{Tc}$  HMPAO

B:- $^{99m}\text{Tc}$  ECD

C:- $^{123}\text{I}$  IMP

D:- $^{133}\text{Xe}$

Correct Answer:- Option-D

Question35:-Which among the following is radiochemical impurity?

A:-Presence of free  $^{99m}\text{Tc}$  in radiopharmaceutical preparation

B:-The presence of  $^{99}\text{Mo}$  in  $^{99m}\text{TcO}_4$ -Solution

C:-The presence of alumina in  $^{99m}\text{TcO}_4$ -Solution

D:-None of the above

Correct Answer:- Option-A

Question36:-Argon is the choice of gas filled in dose calibrator due to

A:-It being non-radioactive in most physical conditions

B:-It being the cheapest among all noble gases

C:-It has relatively higher Z and lower first ionization potential

D:-All of the above

Correct Answer:- Option-D

Question37:-The major interactions in soft tissues for 100 Kev to 10 Mev energy range is

- A:-Photoelectric effect
- B:-Compton Scattering
- C:-Pair production
- D:-Both 2 and 3

Correct Answer:- Option-B

Question38:-It is called for an investigation of Over Exposure if a person is receiving exposure more than 10 mSv during

- A:-One month
- B:-One year
- C:-Monitoring period
- D:-None of the above

Correct Answer:- Option-C

Question39:-Organ absorbed dose is

- A:-Directly proportional to the effective half-life of the radionuclide
- B:-Inversely proportional to the effective half-life of the radionuclide
- C:-Not related to the effective half-life of the radionuclide
- D:-Four times less than the effective half-life of the radionuclide

Correct Answer:- Option-A

Question40:-<sup>131</sup>Iodine sealed in the capsule for the treatment of thyroid disorder is termed as

- A:-Normal form of radioactive material
- B:-Special form of radioactive material
- C:-Depends on the activity of <sup>131</sup>I in the capsule
- D:-None of the above

Correct Answer:- Option-B

Question41:-In case of spillage of very high radionuclide activity, the steps taken are

- i. Information to RSO
- ii. Decontaminate the area
- iii. Inform others about the incidence
- iv. Control the spread of contamination

A:-i, ii, iii, iv

B:-ii, iii, iv, i

C:-iii, iv, i, ii

D:-iv, ii, iii

Correct Answer:- Option-D



Question42:-Sensitivity to radiation carcinogenesis is maximum for

A:-Senior Citizen > 60 yrs

B:-Children < 20 yrs

C:-Adult females

D:-Adult males in the age group of 20-60yrs

Correct Answer:- Option-B

Question43:-If the physical half-life of a radionuclide is 2 days and the biological half-life is 4 days, the effective half life of the radionuclide is

A:-6 days

B:-13 days

C:-1.33 days

D:-4 days

Correct Answer:- Option-C

Question44:-Basic principle of radiation protection is to

A:-Completely avoid deterministic effects and minimize stochastic effects well below the detectable levels

B:-Only avoid deterministic effects

C:-Set dose limits based on actual epidemiological observations of occupational workers

D:-None of the above

Correct Answer:- Option-A

Question45:-Doubling dose for genetic effects is

A:-Dose needed to achieve double the mutation rate compared to the natural mutation rate

B:-The dose needed to double the total mutations

C:-The dose needed to observe double the frequency of recessive disorders in a human population

D:-The dose needed to achieve half the mutation rate compared to the natural mutation rate

Correct Answer:- Option-A

Question46:-Tissue weighting factor is based on

A:-Fractional contribution of a tissue based on relative detriment towards stochastic risk

B:-Total weight of the concerned tissue

C:-Related to the total surface area of the patient

D:-Threshold of the deterministic effect associated with the tissue

Correct Answer:- Option-A

Question47:-Which of the following is the principle of medical ethics?

A:-Autonomy

B:-Beneficence

C:-Confidentiality

D:-All of the above

Correct Answer:- Option-D

Question48:-Which of the following are types of consent?

A:-Informed consent

B:-Express consent

C:-Proxy consent

D:-All of the above

Correct Answer:- Option-D

Question49:-Which instrument is used for locating radioactive contamination?

A:-Well Counter

B:-Gas Ion Chamber

C:-Geiger Counter

D:-Proportional Counter

Correct Answer:- Option-C

Question50:-True incidence counts in PET imaging correspond to the number of \_\_\_\_\_ that occur between a pair of PET detector crystals.

A:-Positron - electron annihilation

B:-Annihilation gamma rays

C:-Nuclear decays

D:-Positrons emitted

Correct Answer:- Option-A

Question51:-What is the minimum volume of gastrointestinal (GI) bleed that can be detected by RBC scintigraphy?

A:-0.1 mL

B:-0.5 mL

C:-1 mL

D:-5 mL

Correct Answer:- Option-B

Question52:-PSMA therapy most common side effects is

A:-Drop in GFR

B:-Drop in Blood parameters

C:-Sialadenitis

D:-Diarrhea

Correct Answer:- Option-C

Question53:-What is the mechanism of choline uptake in parathyroid adenoma on Choline PET/CT?

A:-Chief cells

B:-Oxyphil cells

C:-Both Chief cells and Oxyphil cells

D:-None of the above

Correct Answer:- Option-C

Question54:-Therasphere/Sirsphere is contraindicated if right to left shunt is more than

A:-5%

B:-10%

C:-20%

D:-30%

Correct Answer:- Option-C

Question55:-PET/MR is best indicated in

A:-Lung metastasis

B:-Lymph metastasis

C:-Bone metastasis

D:-Liver metastasis

Correct Answer:- Option-D

Question56:-Radiotherapy is indicated in patients with thyroid cancer

A:-Brain metastasis

B:-Lung metastasis

C:-Spinal metastasis

D:-Lymph node metastasis

Correct Answer:- Option-C

Question57:-Dose limiting factor in pediatric thyroid cancer patients is with following site of metastasis

A:-Brain metastasis

B:-Lung metastasis

C:-Spinal metastasis

D:-Lymph node metastasis

Correct Answer:- Option-B

Question58:-During a lung perfusion study, activity is noted in the head and in the area of the kidneys. This represents

A:-Incorrect particle size

B:-Right to left shunt

C:-Probable metastasis

D:-Free technetium in the MAA

Correct Answer:- Option-B

Question59:-When activity is noted in the head and in the area of the kidneys, minimum right to left shunt is

A:-4

B:-8

C:-16

D:-20

Correct Answer:- Option-B

Question60:-FAPI PET/CT has advantage over FDG PET/CT in patients with

A:-GI malignancy

B:-Lymphoma

C:-Breast Cancer

D:-Genital malignancies

Correct Answer:- Option-A

Question61:-In TENIS patients of thyroid cancer FDF PRY/CT is indicated when minimum Tg level is

A:-More than 5

B:-More than 80

C:-More than 120

D:-More than 20

Correct Answer:- Option-D

Question62:-Sandwich protocol in neuroendocrine tumor therapy is

A:-Chemotherapy followed by Radiotherapy followed by Chemotherapy

B:-DOTATATE therapy followed by chemotherapy followed by DOTATATE therapy

C:-DOTATATE therapy followed by radiotherapy followed by DOTATATE therapy

D:-DOTATATE therapy followed by surgery followed by DOTATATE therapy

Correct Answer:- Option-B

Question63:-CXCR for PET/CT is based on

A:-Chemokine receptors

B:-SS receptors

C:-Estrogen receptors

D:-Progesterone receptors

Correct Answer:- Option-A

Question64:-Ga-68 trivhexine PET/CT imaging is based on

- A:-Integrin expression receptor
- B:-Chemokine expression receptor
- C:-Somatostatin receptor
- D:-HER2 receptor

Correct Answer:- Option-A

Question65:-F-18 Tetrafluoroborate PET/CT imaging is based on

- A:-Integrin expression receptor
- B:-HER2 receptor
- C:-Chemokine expression receptor
- D:-Sodium/iodide symporter

Correct Answer:- Option-D

Question66:-In 3D PET acquisition, what determines the optimum amount of administered activity?

- A:-True count rate
- B:-Noise equivalent count rate
- C:-External radiation exposure
- D:-Internal radiation exposure

Correct Answer:- Option-B

Question67:-What is the recommended approach to optimize radiation dose to patients in PET examinations?

- A:-Administer the maximum possible radioactivity to ensure clear images
- B:-Administer an amount of radioactivity sufficient for good images of diagnostic information
- C:-Administer radioactivity beyond the required levels for better count rates
- D:-Administer a fixed amount of radioactivity regardless of imaging requirements

Correct Answer:- Option-B

Question68:-What is the half-value thickness of lead material for 511 keV photons compared to 140 keV photons?

- A:-4.1 mm vs 0.3 mm
- B:-0.3 mm vs 4.1 mm
- C:-2.5 mm vs 1.0 mm
- D:-0.5 mm vs 2.0 mm

Correct Answer:- Option-A

Question69:-What is the primary concern regarding radiation exposure for staff in nuclear medicine compared to radiology and teletherapy?

- A:-Internal contamination from unsealed sources

B:-External irradiation during procedures

C:-Exposure to radioactive aerosols

D:-Handling of volatile radiopharmaceuticals

Correct Answer:- Option-A

Question70:-Which areas in nuclear medicine facility are typically classified as controlled areas?

A:-Patients waiting rooms

B:-Examination rooms

C:-Storage and preparation rooms for radiopharmaceuticals

D:-Counting and imaging departments

Correct Answer:- Option-C

Question71:-What is the purpose of the Annual Limit on Intake (ALI)?

A:-To determine the maximum amount of radiation a person can receive in a year

B:-To calculate the amount radiation required for medical imaging

C:-To estimate the dose resulting from internal contamination

D:-To regulate the disposal of radioactive materials

Correct Answer:- Option-C

Question72:-Which method is typically used to remove loose contamination from surfaces in nuclear medicine facilities?

A:-Dry wiping

B:-Acid treatment

C:-Wet swabbing

D:-Air blowing

Correct Answer:- Option-C

Question73:-What action should be taken if fixed contamination emits high-energy gamma radiation and has a long half-life?

A:-Dispose of the contaminated object

B:-Use mild acids for cleaning

C:-Apply a thick coat of paint

D:-Use soap-EDTA mixture

Correct Answer:- Option-A

Question74:-Which of the following factors is NOT typically considered when planning the layout of a Nuclear Medicine department?

A:-Accessibility for patients with disabilities

B:-Proximity to the emergency room

C:-Adequate shielding for radiation safety

D:-Workflow efficiency for staff

Correct Answer:- Option-B

Question75:-How does the gamma ray constant of PET radionuclides compare to that of Tc-99m?

A:-The same

B:-7 times more

C:-Half as much

D:-One tenth as much

Correct Answer:- Option-B

Question76:-Which of the following radionuclides used for pain palliation works by Auger electron emission?

A:-Sr89

B:-117mSn

C:-153Sm

D:-186Re

Correct Answer:- Option-B

Question77:-Most common toxicity of  $^{131}\text{I}$ -MIBG therapy is

A:-Thrombocytopenia

B:-Deterioration of renal function

C:-Hypothyroidism

D:-Hypertension

Correct Answer:- Option-A

Question78:-Physiological sites for  $^{99\text{m}}\text{Tc}(V)$  DMSA concentration are all of the following except

A:-Kidney

B:-Nasal mucosa

C:-Female breasts

D:-Skull bones

Correct Answer:- Option-D

Question79:-All of the following are PET agents except

A:-F18

B:-Ga-68

C:-Rb-82

D:-N-14

Correct Answer:- Option-D

Question80:-Octreotide is preferred over Somatostatin because

A:-It has a shorter half-life than the latter

B:-It has a longer half-life than the latter

C:-It shows greater tumour uptake than the latter

D:-It is less expensive

Correct Answer:- Option-B

Question81:-All of the following tumors take up Octreotide except

A:-Medullary Carcinoma

B:-Neuroblastoma

C:-Pheochromocytoma

D:-Glioblastoma multiforme

Correct Answer:- Option-D

Question82:-The T1/2 of Carbon-11, Fluorine-18, Oxygen-15 and Nitrogen-13 are respectively

A:-20 min, 110 mins, 2 mins and 10 mins

B:-10 min, 110 mins, 2 mins and 20 mins

C:-110 min, 10 mins, 20 mins and 2 mins

D:-2 min, 110 mins, 20 mins and 10 mins

Correct Answer:- Option-A

Question83:-Which among the following drugs with not interfere with MIB uptake?

A:-Tricyclic antidepressants

B:-Dipyridine

C:-Reserpine

D:-Dopamine

Correct Answer:- Option-B

Question84:-The best radionuclide used for large joint synovectomy is

A:-Re 186

B:-Ib 169

C:-Y-90

D:-None of the above

Correct Answer:- Option-C

Question85:-Which among the following radio isotope is not used for palliation of bone pain?

A:-P-32

B:-Sr 89

C:-Re 186

D:-Re 188

Correct Answer:- Option-D



Question86:-Which among the following radio isotope is not used for imaging medullary carcinoma thyroid?

A:- $^{68}\text{Ga-DOTA}$

B:- $^{99\text{m}}\text{Tc(V)DMSA}$

C:- $^{131}\text{I NaI}$

D:- $^{18}\text{F-FDG}$

Correct Answer:- Option-C

Question87:- $^{131}\text{I}$  therapy is not indicated in

A:-Papillary carcinoma thyroid

B:-Follicular carcinoma thyroid

C:-Insular carcinoma thyroid

D:-Anaplastic carcinoma thyroid

Correct Answer:- Option-D

Question88:-Among neuroendocrine tumors which has the good prognosis?

A:- $^{68}\text{Ga DOTA}$  negative and 18 FDG scan positive

B:- $^{68}\text{Ga DOTA}$  positive and 18 FDG scan positive

C:- $^{68}\text{Ga DOTA}$  positive and 18 FDG scan negative

D:- $^{68}\text{Ga DOTA}$  scan negative and 18 FDG scan negative

Correct Answer:- Option-C

Question89:-Which radioisotope is ideal for whole body imaging in well differentiated thyroid tumor after thyroidectomy?

A:- $^{131}\text{I}$

B:- $^{123}\text{I}$

C:- $^{124}\text{I}$

D:- $^{125}\text{I}$

Correct Answer:- Option-B

Question90:-Which one of the following drugs interfere with the uptake of  $^{131}\text{I}$  in the thyroid gland/metastasis?

A:-Alpha blockers

B:-Beta-blockers

C:-Verapamil

D:-Amiodarone

Correct Answer:- Option-D

Question91:-Which one of the following is the proper way of validating the data?

A:-Repetition of full data collection in the same population

B:-Data collection in new population

C:-Repetition of data collection in a randomly selected subset in the same

population

D:-Repeat data collection is not required

Correct Answer:- Option-C

Question92:-To describe the study population characteristics we need to

A:-Calculate the frequency of distribution

B:-Calculate measures of association

C:-Look for correlation between variables

D:-Perform multivariable regression

Correct Answer:- Option-A

Question93:-Which of the following is TRUE for a "Descriptive Research Question"?

A:-Involves observation to measure a quantity

B:-Involves comparison groups

C:-Tests the efficacy of interventions

D:-Require hypothesis testing

Correct Answer:- Option-A

Question94:-The ability to apply the principles of analysis to identify those studies which are unbiased and valid is called as

A:-Critical appraisal

B:-Information seeking

C:-Information management

D:-Systematic review

Correct Answer:- Option-A

Question95:-The purpose of a double-blinding in a clinical trial is to

A:-Achieve comparability of all arms of a clinical trial

B:-Avoid observer and participant bias

C:-Avoid observer bias and sampling variation

D:-Avoid subject bias and sampling variation

Correct Answer:- Option-B

Question96:-In a clinical trial, what is the main purpose of randomization?

A:-To get more power for data analysis

B:-To reduce investigator bias

C:-To get groups with comparable baseline characteristics

D:-To ensure optimum number of participants in each trial arm

Correct Answer:- Option-C

Question97:-Statistical power is defined as the probability of

A:-Accepting a null hypothesis when it is false

B:-Rejecting a null hypothesis when it is true

C:-Rejecting a null hypothesis when it is false

D:-Failing to reject a null hypothesis when it is false

Correct Answer:- Option-C

Question98:-Ability of a study to detect correctly the presence of an association is known as

A:-Precision

B:-Power

C:-Confidence

D:-Significance

Correct Answer:- Option-B

Question99:-A study design that randomly assigns participation into an experimental group or control group is called as

A:-Cohort Study

B:-Case - Control Study

C:-Randomized Controlled Trials

D:-Cross Sectional Study

Correct Answer:- Option-C

Question100:-Difference between the minimum value and the maximum value of the observations

A:-Variance

B:-Inter-quartile range

C:-Range

D:-Standard deviation

Correct Answer:- Option-C