



श्री चित्रा तिरुनाल आयुर्विज्ञान और प्रौद्योगिकी संस्थान, त्रिवेंद्रम, केरल- 695 011  
(एक राष्ट्रीय महत्व का संस्थान, विज्ञान एवं प्रौद्योगिकी विभाग, भारत सरकार)  
SREE CHITRA TIRUNAL INSTITUTE FOR MEDICAL SCIENCES AND TECHNOLOGY, TRIVANDRUM  
KERALA – 695 011

(An Institution of National Importance, Department of Science and Technology, Govt. of India)

टेलीफोन नं. Telephone No. 0471- 2443152 -फाक्स /Fax- 2550728 , 0471- 2446433

ई-मेल/E-mail :sct@sctimst.ac.in वेबसाइट/ Website : [www.sctimst.ac.in](http://www.sctimst.ac.in)

## ENTRANCE EXAMINATION - ACADEMIC SESSION JANUARY 2025

### Program: PhD [BIOMATERIALS SCIENCES AND TECHNOLOGY]

Time:90 Minutes

Max. Marks: 100

(Select the most appropriate answer)

(There are **no negative** marks for wrong answers)

1	Chemical formula of the calcium phosphate mineral brushite is _____
a	$\text{CaHPO}_4$
b	$\text{CaHPO}_4 \cdot 2\text{H}_2\text{O}$
c	$\text{Ca}_{10}(\text{PO}_4)_6(\text{OH})_2$
d	$\text{Ca}_{10}(\text{HPO}_4)(\text{PO}_4)_6$
2	Identify the technique to study the ultrstructure of the cells and their organelles and environment
a	Scanning electron microscopy
b	Energy dispersive X ray analysis
c	Light microscopy
d	Transmission electron microscopy
3	Which of the following is NOT a unit by which energy is measured?
a	Joule
b	Calorie
c	Electron volt
d	Newton
4	Ultraviolet and x-ray radiation can damage human cells. Which of the following is a property of these two forms of radiation?
a	low wave speed
b	short wavelength
c	low wave frequency
d	small wave amplitude
5	Which one of the following techniques relies on the spin angular momentum of a photon?
a	CD spectroscopy
b	Fluorescence spectroscopy
c	IR spectroscopy
d	Raman spectroscopy
6	Of the following colligative properties, which is most practical for determining the extent of protein aggregation?
a	Freezing point depression



	b	Osmotic pressure
	c	Boiling point elevation
	d	Solute vapor pressure
7	Which of the following is(are) the characteristics of mass spectroscopy? I. Analyte molecules are converted to gaseous ions II. The ions are separated according to their mass to charge ratio III. In addition to compound identification, mass spectra can be utilized to determine precise isotopic masses and isotopic ratios	
	a	II only
	b	I and III only
	c	II and III only
	d	I, II and III
8	A catalyst increases rate of reaction by _____	
	a	Decreasing enthalpy
	b	Decreasing internal energy
	c	Decreasing activation energy
	d	Increasing activation energy
9	Migration of a protein in an SDS polyacrylamide gel is inversely proportional to?	
	a	Molecular weight
	b	log of molecular weight
	c	negative charge
	d	isoelectric point
10	Which of the following forms extracellular cross-linked fibrils of great tensile strength	
	a	Integrins
	b	Laminins
	c	Collagen
	d	Fibronectin
11	In animal cell culture, a CO <sub>2</sub> enriched atmosphere in the incubator chamber is used to maintain the culture pH between 6.9 and 7.4. Which one of the following statements is CORRECT?	
	a	higher the bicarbonate concentration in the medium, higher should be the requirement of gaseous CO <sub>2</sub>
	b	lower the bicarbonate concentration in the medium, higher should be the requirement of gaseous CO <sub>2</sub>
	c	higher the bicarbonate concentration in the medium, lower should be the requirement of gaseous CO <sub>2</sub>
	d	CO <sub>2</sub> requirement is independent of bicarbonate concentration in the medium
12	Analysis of a hexapeptide using enzymatic cleavage reveals the following result: <ul style="list-style-type: none"> <li>Amino acid composition of the peptide is: 2R, A, V, S, Y</li> <li>Trypsin digestion yields two fragments and the compositions are: (R, A, V) and (R, S, Y)</li> <li>Chymotrypsin digestion yields two fragments and the compositions are: (A, R, V, Y) and (R, S)</li> <li>Digestion with carboxypeptidase A yields no cleavage product.</li> </ul> <p>Given: Trypsin cleaves at carboxyl side of R.</p>	



		<p>Chymotrypsin cleaves at carboxyl side of Y. Carboxypeptidase A cleaves at amino side of the C-terminal amino acid (except R and K) of the peptide.</p> <p>The correct amino acid sequence of the peptide is:</p>
	a	RSYRVA
	b	AVRYSR
	c	SRYVAR
	d	SVRRYA
13		Which of the following is incorrect with respect to the property indicated?
	a	Electronegativity: $F_2 > Cl_2 > Br_2$
	b	Electron affinity: $Cl_2 > F_2 > Br_2$
	c	Oxidising power: $F_2 > Cl_2 > Br_2$
	d	Bond energy: $F_2 > Cl_2 > Br_2$
14		<p>The normal modes of a <math>CO_2</math> molecule that is IR active include which of the following?</p> <p>I. Bending II. Symmetric stretching III. Asymmetric stretching</p>
	a	I and II only
	b	II and III only
	c	I and III only
	d	I, II and III
15		A colloidal solution exhibits _____
	a	Low osmotic pressure
	b	High osmotic pressure
	c	No osmotic pressure
	d	Very high osmotic pressure
16		An emulsifier _____
	a	Homogenises an emulsion
	b	Accelerates dispersion
	c	Stabilises an emulsion
	d	Helps in the flocculation of an emulsion
17		<p>The most definitive method for determining if actin is a component of an isolated membrane preparation would be to analyze the membrane proteins by</p>
	a	Polyacrylamide gel electrophoresis
	b	Column chromatography
	c	Western blotting
	d	2-D electrophoresis
18		Which of the following is an n-type semiconductor?
	a	Silicon
	b	Arsenic doped silicon
	c	Gallium doped silicon
	d	Silicon carbide
19		Which of the following is lower for argon than for neon?
	a	First ionization energy
	b	Melting point
	c	Boiling point



	d	Heat of vaporization
20		Nitrogen is comparatively an inert element since _____
	a	Its atom has stable electronic configuration
	b	It has low atomic radius
	c	Its electronegativity is sufficiently high
	d	Its molecule has high dissociation energy
21		Which of the following type of spectroscopy is a light scattering technique?
	a	Nuclear magnetic resonance
	b	Infra red spectroscopy
	c	Raman Spectroscopy
	d	UV-Vis
22		The average life of a radioactive substance is given by the expression
	a	Total no. of atoms/ atoms which disintegrate
	b	The sum of the lives of all the atoms/total no. of atoms
	c	Total no. of atoms/the sum of the lives of all the atoms
	d	None of the above
23		The Mark-Houwink equation for a polymer solution is
	a	$[\eta] = KM^{1/n}$
	b	$[\eta r] = KM^n$
	c	$[\eta] = KM^a$
	d	$[\eta] = aM^k$
24		If one mole of an ideal gas doubles its volume as it undergoes an isothermal expansion, its pressure is?
	a	quadrupled
	b	doubled
	c	unchanged
	d	halved
25		Electromagnetic radiation emitted from a nucleus is most likely to be in the form of
	a	Gamma rays
	b	Ultraviolet radiation
	c	Infrared radiation
	d	Microwaves
26		Which one of the following techniques relies on the spin angular momentum of a photon?
	a	Fluorescence spectroscopy
	b	CD spectroscopy
	c	IR spectroscopy
	d	Raman spectroscopy
27		At isoelectric pH, an amino acid exists as
	a	Cation
	b	Anion
	c	Zwitterion
	d	None
28		How many grams of NaBr do we need in order to prepare one liter of a 10-milimolar NaBr solution? (Atomic mass of Na = 23 g/mol; atomic mass of Br = 80 g/mol.)
	a	103
	b	10.3
	c	1.03



	d	0.103
29	What is the pH of a $10^{-2}$ N NaOH solution?	
	a	8
	b	12
	c	10
	d	11
30	Why is it generally preferable to use absorbance as a measure of quantification rather than % transmittance in UV-Vis spectrophotometry?	
	a	%T cannot be measured as accurately as absorbance
	b	%T is dependent on the power of incident radiation
	c	Absorption is proportional to concentration of the analyte whereas %T is not
	d	None of the above
31	Which of the following equipment can be used to measure the glass transition temperature?	
	a	Spectrophotometer
	b	DSC
	c	TGA
	d	Viscometer
32	An example of aprotic solvent	
	a	water
	b	formic acid
	c	ammonia
	d	dimethyl sulphoxide
33	Flexible PVC tubes are used for watering. If some organic solvents are passed through this tube, it becomes stiff. This is due to the fact that the organic solvents	
	a	plasticize PVC and raise Tg.
	b	remove plasticizer and raise Tg.
	c	remove plasticizer and lower Tg.
	d	react with PVC and increase Tg
34	<p>The compound shown in this figure is a</p>	
	a	Triterpene
	b	Triglyceride
	c	Tripeptide
	d	None of the above
35	Hybridization of xenon in $\text{XeF}_2$ is	



	a	sp
	b	sp <sup>2</sup>
	c	sp <sup>3</sup>
	d	sp <sup>3</sup> d
36	The total number of possible stereoisomers for the compound with the structural formula $\text{CH}_3\text{CH}(\text{OH})\text{CH}=\text{CHCH}_2\text{CH}_3$ is _____.	
	a	2
	b	3
	c	4
	d	6
37	Which of the following is least basic?	
	a	aniline
	b	p-methylaniline
	c	diphenylamine
	d	triphenylamine
38	Which of the following is weakest acid?	
	a	benzenesulphonic acid
	b	benzoic acid
	c	benzyl alcohol
	d	phenol
39	Which of the following is a strong electrophile?	
	a	$\text{NO}_2^+$
	b	$\text{NO}_2$
	c	$\text{NO}^+$
	d	$\text{NO}$
40	The lower critical solution temperature (LCST) of temperature-sensitive polymer Poly(N-isopropyl acrylamide) PNIPAM is _____.	
	a	31
	b	32.5
	c	32
	d	37
41	Different forms of CaP ceramics are used as biomaterials, Which among the following is the chemical formula of brushite?	
	a	$\text{CaHPO}_4 \cdot 2\text{H}_2\text{O}$
	b	$\text{CaHPO}_4$
	c	$\text{Ca}_3(\text{PO}_4)_2$
	d	$\text{Ca}_8\text{H}_2(\text{PO}_4)_6 \cdot 5\text{H}_2\text{O}$
42	The normal modes of a $\text{CO}_2$ molecule that is IR active include which of the following? I. Bending II. Symmetric stretching III. Asymmetric stretching	
	a	I and II only
	b	II and III only
	c	I and III only
	d	I, II and III
43	A colloidal solution exhibits _____.	
	a	Low osmotic pressure
	b	High osmotic pressure
	c	No osmotic pressure
	d	Very high osmotic pressure



44	Oil soluble dye is mixed with a emulsion which remains colourless. Type of emulsion must be _____	
	a	water in oil
	b	oil in water
	c	water in water
	d	oil in oil
45	An emulsifier _____	
	a	Homogenises an emulsion
	b	Accelerates dispersion
	c	Stabilises an emulsion
	d	Helps in the flocculation of an emulsion
46	Which of the following forms the most stable gaseous negative ion?	
	a	F
	b	Cl
	c	Br
	d	I
47	The element having highest ionization enthalpies within their periods are called _____	
	a	Noble gases
	b	Halogens
	c	Alkali metals
	d	Transition elements
48	Considering the elements B, Al, Mg and K, the correct order of their metallic character is _____	
	a	$B > Al > Mg > K$
	b	$Al > Mg > B > K$
	c	$Mg > Al > K > B$
	d	$K > Mg > Al > B$
49	Which of the following does not reflect the periodicity of elements?	
	a	Bonding behaviour
	b	Electronegativity
	c	Ionization potential
	d	Neutron / Proton ratio
50	Which of the following is incorrect with respect to the property indicated?	
	a	Electronegativity: $F_2 > Cl_2 > Br_2$
	b	Electron affinity: $Cl_2 > F_2 > Br_2$
	c	Oxidising power: $F_2 > Cl_2 > Br_2$
	d	Bond energy: $F_2 > Cl_2 > Br_2$
51	The IUPAC name of isoprene is	
	a	2-methyl-but-2,3 diene
	b	2-methyl-but-1,3 diene
	c	2-methyl-but-1,4 diene
	d	2-methyl-but-1,2 diene
52	Amongst the following, a free radical inhibitor is	
	a	benzyl peroxide
	b	benzene
	c	hydroquinone
	d	hydrocarbons
53	The maximum number of isomers for an alkene with molecular formula $C_4H_8$ is	
	a	5



	b	4
	c	3
	d	2
54	Which of the following general behavior is shown by polymers	
	a	Newtonian
	b	Elastic
	c	Viscous
	d	Viscoelastic
55	Migration of a protein in an SDS polyacrylamide gel is inversely proportional to?	
	a	Molecular weight
	b	log of molecular weight
	c	negative charge
	d	isoelectric point
56	Which of the following best predicts the direction of a chemical reaction?	
	a	G (Gibbs free energy change)
	b	H (enthalpy change)
	c	E (internal energy change)
	d	S (entropy change)
57	Which of the following polymer is not suitable for complexing with DNA?	
	a	Polyethyleneimine
	b	Polyarginine
	c	Poly L-Lysine
	d	Polyacrylates
58	The intrinsic fluorescence of proteins is mainly due to the presence of	
	a	Alanine
	b	Histidine
	c	Tryptophan
	d	Methionine
59	Cobalt-60 is used in the radiation therapy of cancer and can be produced by bombardment of cobalt-59 with which of the following?	
	a	Neutrons
	b	Alpha particles
	c	Beta particles
	d	X-rays
60	The surface tension of a liquid vanishes at	
	a	triplet point
	b	the boiling point
	c	critical temperature
	d	none of the above
61	W20 (Women 20) Inception Meeting on February 27th -28th, 2023, was hosted at .....city.	
	a	Trivandrum
	b	Chennai
	c	Aurangabad
	d	Hyderabad
62	'Suposhit Maa Abhiyan', nutritional support program for pregnant mothers and girls, was launched in .....	
	a	Kerala
	b	Karnataka
	c	Assam



	d	Rajasthan
63		The Unique Identification Authority of India is a statutory authority established under the provisions of Aadhaar act 2016 by the Govt. of India under.....
	a	Ministry of Electronics and Information Technology
	b	Ministry of Defence
	c	Ministry of External Affairs
	d	Ministry of Science & Technology
64		Jan Aushadhi Train seeks to raise awareness about
	a	Create awareness about Jan Aushadhi scheme
	b	Provide affordable medical devices
	c	Conduct medical camps
	d	Provide vaccinations at free of cost
65		'Medium Range Surface-to-Air Missile (MRSAM)' is produced at .....
	a	IOCL
	b	GAIL
	c	SAIL
	d	BDL
66		The capital city of ..... is Pyongyang.
	a	South Africa
	b	North Korea
	c	Singapore
	d	Japan
67		'World Braille Day' is observed on
	a	Jan 1
	b	Jan 4
	c	Jan 7
	d	Jan 10
68		National Data & Analytics Platform (NDAP), was launched by
	a	State Bank of India
	b	NITI Aayog
	c	HDFC
	d	NASSCOM
69		Which Institute has won the National Intellectual Property Award 2019 in the category "Top Indian R & D Institution/Organisation for Patents & Commercialization"?
	a	SCTIMST
	b	IIT Roorkee
	c	IIT Guwahati
	d	Arrow Greentech Ltd.
70		New Space India Limited is the commercial arm of .....
	a	SCTIMST
	b	ISRO
	c	DRDO
	d	BHEL
71		The oath to the Judge of a high court is administered by .....
	a	Prime Minister
	b	President
	c	Governor
	d	Chief Justice of India



72	NITI Aayog organized the fifth edition of the Women Transforming India (WTI) Awards in March 2022. As part of the Azadi ka Amrit Mahotsav, the WTI Awards were conferred on ..... women achievers to celebrate their contribution towards a 'Sashakt Aur Samarth Bharat'.	
	a	25
	b	50
	c	75
	d	100
73	Who has been appointed as coordinator for the G20 summit, which will be hosted by India in 2023	
	a	Ajith Doval
	b	Harsh Vardhan Shringla
	c	S Jaishankar
	d	Amitabh Kant
74	The maximum term of a Panchayat in a state is ..... years	
	a	5
	b	4
	c	3
	d	2
75	According to National Commission for Protection of Child Rights (NCPCR) a child is defined as any person in the age group of?	
	a	0-5
	b	0-10
	c	0-15
	d	0-18
76	The Whistle Blowers Protection Act was enacted in the year .....	
	a	2015
	b	2014
	c	2013
	d	2012
77	The 5G testbed has been developed as a multi-institute collaborative project by eight institutes led by .....	
	a	IIT Bombay
	b	IIT Delhi
	c	IIT Madras
	d	IIT Kanpur
78	What is the name of the first Indian space mission to observe the Sun?	
	a	Aditya-L1
	b	Chandrayaan-1
	c	Mangalyaan
	d	Chandrayaan-2
79	1853 is a landmark in India's Transport because of first .....	
	a	Passenger train
	b	Cargo plane
	c	Submarine
	d	None of the above
80	Which section of the Drugs and Cosmetics Act, 1940 defines the standards of quality for drugs?	
	a	16
	b	20
	c	21



	d	22
81	Choose the option that is most nearly same in meaning of the word "Ubiquitous"	
	a	Unanimous
	b	Omnipresent
	c	Doubt
	d	Anonymous
82	Choose the option that is most nearly same in meaning of the word "Callous"	
	a	Kind
	b	Apathy
	c	Sympathetic
	d	Insensitive
83	Choose the option that is most nearly same in meaning of the word "Genesis"	
	a	End
	b	Abolishment
	c	Origin
	d	Attack
84	What will be the remainder if $3^7$ is divided by 8?	
	a	1
	b	2
	c	3
	d	4
85	A quantity $x=240$ is increased by 50%. What is the resultant value?	
	a	120
	b	240
	c	360
	d	480
86	A quantity $x=100$ is first increased by 20% and then the resultant is decreased by 10%. What is the final value?	
	a	108
	b	109
	c	110
	d	111
87	Anoop bought a car for INR 320000 and sold it for INR 240000. What is the loss percentage?	
	a	20
	b	25
	c	30
	d	35
88	Rohan bought 100 glasses for INR 8500. He broke 20 glasses while transporting them. What should be the selling price of each of the remaining glasses in order to have an overall profit of 4%?	
	a	100.5
	b	110.5
	c	120.5
	d	130.5
89	A worker A can finish work in 3 days and B can finish work in 9 days. How long will it take to finish the work if they both worked together?	
	a	$9/2$ days



	b	9/7 days
	c	9/5 days
	d	9/4 days
90	Pipes A and B can fill a tank in 4 and 8 hours respectively. Pipe C can empty it in 16 hours. If all the three pipes are opened together, then how long will it take to fill the tank?	
	a	4.5 hours
	b	2 hours
	c	6 hours
	d	3.2 hours
91	A man rows upstream 18 km and downstream 30 km taking 3 h each time. What is the velocity of the current?	
	a	2 km/h
	b	3 km/h
	c	4 km/h
	d	5 km/h
92	A car covers first 300 m at a speed of 54 km/h and next 500 m at a speed of 72 km/h. What is the average speed of the car?	
	a	50 km/h
	b	47 km/h
	c	60 km/h
	d	64 km/h
93	How many words can be formed out of the letters of the word "UNITED" taking all the letters at a time considering no letter is to be repeated?	
	a	620
	b	720
	c	820
	d	920
94	How many words can be formed from the letters of the word "APPLE" taking all the letters at a time considering no letter is to be repeated and first and last letter of the words are "P"?	
	a	6
	b	12
	c	24
	d	48
95	A bag contains 6 black and 8 white balls. One ball is drawn at random. What is the probability that the ball drawn is white?	
	a	3/7
	b	4/7
	c	5/7
	d	6/7
96	A card is drawn from a pack of 52 cards. What is the probability of getting a queen of club or a king of heart?	
	a	1/26
	b	2/26
	c	3/26
	d	4/26
97	Fill in the number that completes the following sequence 3, 5, 7, 11, 13, 17, 19, .....	
	a	20
	b	21



	c	22
	d	23
98	Fill in the blank most appropriately.	
	A ..... of wolves.	
	a	Bunch
	b	Fleet
	c	Pack
	d	Litter
99	Which of the following words does not have a similar meaning to densely populated?	
	a	Populace
	b	Crowded
	c	Populous
	d	Packed
100	Find the unit digit of $122^{122} \times 133^{133}$	
	a	1
	b	2
	c	3
	d	4





श्री चित्रा तिरुनाल आयुर्विज्ञान और प्रौद्योगिकी संस्थान, त्रिवेंद्रम, केरल- 695 011  
(एक राष्ट्रीय महत्व का संस्थान, विज्ञान एवं प्रौद्योगिकी विभाग, भारत सरकार)  
SREE CHITRA TIRUNAL INSTITUTE FOR MEDICAL SCIENCES AND TECHNOLOGY, TRIVANDRUM  
KERALA - 695 011

(An Institution of National Importance, Department of Science and Technology, Govt. of India)

**ENTRANCE EXAMINATION - ACADEMIC SESSION JANUARY 2025**  
**Program: PhD [BIOMATERIALS SCIENCES AND TECHNOLOGY]**

**Answer Key**

Question No.	Correct answer	Question No.	Correct answer	Question No.	Correct answer
1.	b	38.	c	75	d
2.	d	39.	a	76	b
3.	d	40.	c	77	c
4.	b	41.	a	78	a
5.	a	42.	c	79	a
6.	b	43.	a	80	a
7.	d	44.	b	81	b
8.	c	45.	c	82	d
9.	b	46.	b	83	c
10.	c	47.	a	84	c
11.	a	48.	d	85	c
12.	b	49.	d	86	a
13.	d	50.	d	87	b
14.	c	51.	b	88	b
15.	a	52.	c	89	d
16.	c	53.	b	90	d
17.	c	54.	d	91	a
18.	b	55.	b	92	d
19.	a	56.	a	93	b
20.	d	57.	d	94	a
21.	c	58.	c	95	b
22.	b	59.	a	96	a
23.	c	60.	c	97	d
24.	d	61.	c	98	c
25.	a	62.	d	99	a
26.	b	63.	a	100	b
27.	c	64.	a		
28.	c	65.	d		
29.	b	66.	b		
30.	c	67.	b		
31.	b	68.	b		
32.	d	69.	a		
33.	b	70.	b		
34.	c	71.	c		
35.	d	72.	c		
36.	c	73.	b		
37.	d	74.	a		

*Dr. P. R. Unnithan*  
*Answer Key*