श्री चित्रा तिरुनाल आयुर्विज्ञान और प्रौद्योगिकी संस्थान, त्रिवेंद्रम , केरल– 695 011
(एक राष्ट्रीय महत्व का संस्थान, विज्ञान एवं प्रौद्योगिकी विभाग, भारत सरकार)
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ENTRANCE EXAMINATION - ACADEMIC SESSION JANUARY 2025

Program: PhD [CHEMICAL SCIENCES]

Time: Max. Marks:

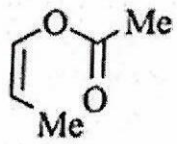
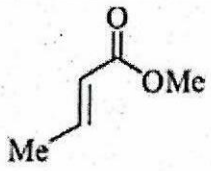
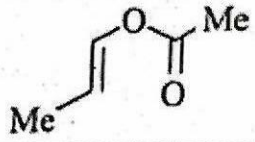
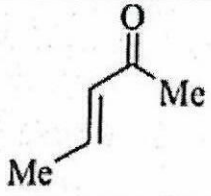
(Select the most appropriate answer)
(There are **no negative** marks for wrong answers)

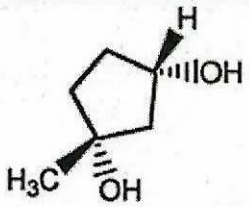
1	Which of the following electrode works by ion exchange mechanism?	
	a	Glass electrode
	b	Enzyme electrode
	c	Calomel electrode
	d	K+ sensing electrode
2	Name the polymer that is used in the manufacture of paints and lacquers.	
	a	Polypropene
	b	Polyvinyl chloride
	c	Glyptal
	d	Bakelite
3	The entropy change when transferring 100kJ heat to a large mass of water at 0°C is ----------	
	a	268 J/K
	b	113 J/K
	c	210 J/K
	d	366 J/K
4	The work done when 50g of iron reacts with HCl in a closed vessel of fixed volume is ----------	
	a	6 kJ
	b	0.5 kJ
	c	0
	d	-2.2 kJ
5	Select the most intense line among the following.	
	a	Pre-resonance Raman line
	b	Raman Stokes line
	c	Raleigh line
	d	Raman anti-stokes line
6	Reactions in which the reactants react in more than one way yielding different sets of products is known as ---------	
	a	Consecutive reactions
	b	Parallel reactions
	c	Chain reactions
	d	Complex reactions
7	Select the correct order of acidic strength from the following.	

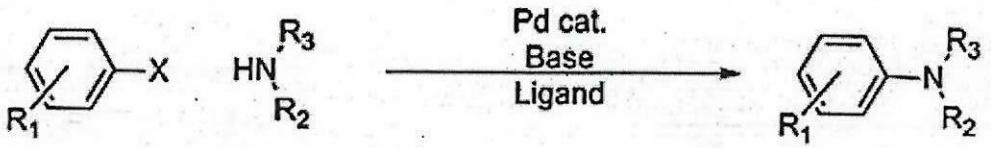
	a	$HF>NH_3>CH_4>H_2O$
	b	$HF>H_2O>CH_4>NH_3$
	c	$HF>H_2O>NH_3>CH_4$
	d	$HF>CH_4>H_2O>NH_3$
8	Which among the following is Raman inactive?	
	a	H_2O symmetric stretch
	b	H_2O bending
	c	CO_2 bending
	d	CO_2 symmetric stretch
9	Microwave spectra of a molecule have three rotational constants. The molecule is -----	
	a	Spherical top
	b	Asymmetric
	c	Oblate
	d	Prolate
10	The total fundamental modes of vibrations for NH_3 are 6. Out of these how many bending modes of vibrations are there?	
	a	2
	b	4
	c	3
	d	1
11	The area under the stress - strain curve gives the measure of _____	
	a	Toughness
	b	Brittleness
	c	Ablation
	d	Modulus
12	The mode of sterilization of PVC blood bags is _____	
	a	ETO sterilization
	b	Autoclaving
	c	Sterilization by radiation
	d	Dry heat sterilization
13	An organic compound X is oxidized by using acidified $K_2Cr_2O_7$. The product obtained reacts with phenyl hydrazine but reacts negatively to silver mirror test. What could be the possible structure of X?	
	a	$(CH_3)_2CHOH$
	b	CH_3CHO
	c	CH_3CH_2OH
	d	CH_3COCH_3
14	_____ is used to measure Flexural strength of a biomaterial?	
	a	Calculation from the stress-strain curve
	b	Compression test
	c	Tensile test
	d	Three- and four-point bend test
15	The tilting disc of Chitra Heart Valve Prosthesis is made out of	
	a	HDPE
	b	LDPE
	c	LLDPE
	d	UHMWPE
16	Wollastonite is an example of	
	a	Metal
	b	Bioceramic
	c	Polymer
	d	Glass
17	The science of evaluating wear properties of biomedical implants is called_____	

	a	Rheology
	b	Tribology
	c	Ablation
	d	Degradation
18	Diamond-like carbon coating is employed to improve_____ of metallic implants	
	a	Fluidity
	b	Bulk properties
	c	Density
	d	Surface properties
19	Ethylene Oxide is a gas that is used to _____ medical devices	
	a	Sterilize
	b	Fumigate
	c	Decontaminate
	d	Decompose
20	Dacron, a material used for fabrication of vascular grafts, is the trade name of _____	
	a	PVC
	b	PEEK
	c	PET
	d	PTFE
21	The ratio of Ca/P in bioactive calcium phosphates is	
	a	<1.5
	b	> 1.5
	c	1
	d	None of the above
22	The most commonly used materials in prosthetics and orthodontics are____	
	a	Phenolic resins
	b	Acrylic resins
	c	Enamel
	d	Silicone
23	_____ is an example of disposable medical device.	
	a	Endoscopes
	b	Laryngoscopes
	c	Hypodermic needles
	d	Surgical forceps
24	Which polymer is used to make Medical gloves?	
	a	PVC
	b	Nitrile
	c	Latex
	d	All of the above
25	Hydrogels that are used in 3D bioprinting are called	
	a	Ceramic putty
	b	Bioink
	c	Sintered powder
	d	None of the above
26	Which among the following is a biopolymer?	
	a	Polylactic acid
	b	Polycaprolactone
	c	Polyvinylalcohol
	d	Collagen
27	_____ is the technology used to weld Chira Blood Bags	
	a	Heat welding
	b	Radio Frequency welding
	c	Pressure welding
	d	Ultrasonic welding

28	Absorption frequency of C=O is 1700 cm -1 in a molecule. What will be the absorption frequency of C-O in the same molecule?	
	a	1306 cm^{-1}
	b	650 cm^{-1}
	c	1202 cm^{-1}
	d	1100 cm^{-1}
29	The ionic strength of 0.1M $MgCl_2$ is ----------	
	a	0.1 M
	b	0.2 M
	c	0.4 M
	d	0.3 M
30	The molar conductivity of CH 3 COONa, HCl and NaCl at infinite dilution are A, B and C Sm^2 mol -1 respectively at 25°C. The molar conductivity at infinite dilution for CH_3COOH is represented as	
	a	[A-B-C] Sm^2 mol^{-1}
	b	[A+B-C] Sm^2 mol^{-1}
	c	[A+B+C] Sm^2 mol^{-1}
	d	[A-B+C] Sm^2 mol^{-1}
31	An acid, HI, reacts with a solution of K_2SO_3 according to the equation $2\ H^+(aq) + SO_3^{-2}(aq) \rightleftarrows H_2O(l) + SO_2(g)$. If 0.2 mole of SO_2 is liberated, how many moles of H^+ will be consumed?	
	a	0.1 mole
	b	0.2 mole
	c	0.3 mole
	d	0.4 mole
32	When the pressure of ammonia gas is increased at constant temperature	
	a	the energy of the molecules increases
	b	the bonds between the atoms are broken
	c	the spaces between the molecules increase
	d	liquid ammonia forms
33	What is the formula of chromium (III) sulfide?	
	a	CrS_3
	b	Cr_2S_3
	c	Cr_3S_2
	d	Cr_3S
34	Energy is involved in both physical and chemical changes. The energy in chemical changes compared to physical changes is generally	
	a	greater
	b	the same
	c	no different
	d	greater in some but smaller in others
35	The state in which two opposing chemical reactions continue but the net change is zero is the state of	
	a	oxidation
	b	reduction
	c	complete ionization
	d	equilibrium
36	Consider the chemical reaction $A(g) + B(g) \rightarrow AB(g) + heat$; $K_E = 0.50$. As the concentration of B is increased at constant temperature, the value of K_E will	
	a	decrease
	b	increase
	c	remain the same
	d	none of these

37	For the reaction between hydrogen and iodine, suppose the initial concentration of each reactant is one mole per liter. If the concentration of both the hydrogen gas and the iodine vapor is changed to two moles per liter, the speed of the reaction will be	
	a	unchanged
	b	doubled
	c	tripled
	d	quadrupled
38	The isotope carbon-14 can be used to trace the path of carbon through the reactions of photosynthesis. In which sequence would the carbon-14 most likely be found?	
	a	carbon dioxide → pyruvic acid → glucose
	b	water → free oxygen → glucose
	c	carbon dioxide → PGAL → glucose
	d	ammonia → nitrates → plant proteins
39	Which of the following organic compound with molecular formula $C_3H\ C_{12}$ exhibits only one signal in the IH NMR spectrum?	
	a	1, 2-dichloropropane
	b	1, 1-dichloropropane
	c	2, 2-dichloropropane
	d	1, 3-dichloropropane
40	An organic compound (MF; $C_8H_{10}O$) exhibited the following ^1H NMR special data: 62.5 (3H, s), 3.8 (314, s), 6.8 (2H, d, J 8 Hz), 7.2 (2H, d, J 8 Hz) ppm. Which of the following is that compound among the choices?	
	a	4-methylbenzyl alcohol
	b	4-methyl anisole
	c	4-ethylphenol
	d	2-ethylphenol
41	An organic compound Q exhibited the following spectral data obtained by mass spectroscopy. IR: 1760 cm^{-1} ^{1}HNMR: chemical reference (ppm): 7.2 (IH, d, 16.0 Hz), 5.1 (IH, m), 2.1 (3H, s), 1.8 (3H, d, J = 7.0 Hz) ^{13}CNMR chemical reference (ppm): 170 (carbonyl carbon). Which of the following is compound Q?	
	a	
	b	
	c	
	d	
42	Which of the following is true about transesterification?	
	a	exchanging the organic alkyl group of alcohol with the organic group alkyl of an ester
	b	exchanging the organic alkyl group of an ester with the organic group alkyl of an ether

	c	exchanging the organic alkyl group of an ester with the organic group alkyl of an alcohol
	d	exchanging the organic alkyl group of an ester with the organic group alkyl of an alkane
43	What is the complete IUPAC name of the following substance? 	
	a	(1R,3S)-1-methylcyclopentane-1,3-diol
	b	(1S,3R)-1-methylcyclopentane-1,3-diol
	c	(1S,3S)-1-methylcyclopentane-1,3-diol
	d	(1R,3R)-1-methylcyclopentane-1,3-diol
44	The fact that the fluorescence wavelength is often much longer than the irradiation wavelength (Stokes shift) is a consequence of which phenomenon?	
	a	low extinction coefficients (Lambert-Beer law)
	b	vertical transitions (Kasha's rule)
	c	high ISC rates (El Sayed rule)
	d	the Franck–Condon principle
45	The molar extinction coefficient of B (MW = 180) is 4×10^3 L mol^{-1} cm^{-1}. One-liter solution of C which contains 0.1358 g pharmaceutical preparation of B, shows an absorbance of 0.411 in a 1 cm quartz cell. What is the percentage (w/w) of B in the pharmaceutical preparation?	
	a	10.20
	b	13.60
	c	20.40
	d	29.12
46	The rate law for a reaction between the substances A and B is given by rate = K[A]n [B]m. On doubling the concentration of A and halving the concentration of B. What will be the ratio of the new rate of the earlier rate of the reaction?	
	a	$(12)^{m+n}$
	b	m+n
	c	n-m
	d	2^{n-m}
47	What is the correct order of reactivity series of the halogen?	
	a	F > Cl > Br > I
	b	I > Cl > Br > F
	c	F > Br > Cl > I
	d	I > Br > Cl > F
48	When a radioactive element emits a beta particle	
	a	the positive charge of the nucleus increases by 1
	b	the number of neutrons in the nucleus increases
	c	oxidation takes place
	d	the atomic mass of the element increases by 1
49	When an atom of an element emits a beta particle, the new element, compared with the original element, has	
	a	the same mass number
	b	a mass number one greater
	c	the same atomic number
	d	an atomic number one less
50	Which statement is **false**? Hydroxides are substances which	
	a	react with hydrogen ions
	b	turn litmus blue

	c	form salts with non-metallic oxides
	d	have ability to accept protons
51	The expression "a cubic foot of air" is unsatisfactory because	
	a	air volume is negligible
	b	air has a very low density
	c	gas volume is dependent on its temperature
	d	gas volume is difficult to measure
52	A toy balloon tends to become spherical when inflated because	
	a	gases exert pressure equally in all directions
	b	the balloon contains carbon dioxide
	c	air tends to be permeable
	d	the rubber used in balloons contains impurities
53	Which gas occupies the **smallest** volume?	
	a	Gas A: 2 moles at 760 mm and 273 K
	b	Gas B: 1 mole at 380 mm and 273 K
	c	Gas C: 1 mole at 760 mm and 273 K
	d	Gas D: 2 moles at 760 mm and 546 K
54	Which of the following organic compound is formed when aniline reacts with acetaldehyde?	
	a	Diazonium salt
	b	Immine
	c	Schiff's base
	d	Carbylamine
55	Which of the following is the known name for the reaction given below?  (where, X=Cl, Br, I, OTf; R_2=Alkyl, aryl, H; R_3=alkyl, aryl)	
	a	Ullmann reaction
	b	Gabriel phthalimide synthesis
	c	Buchwald-Hartwig Reaction
	d	Chan-Lam coupling
56	The benzylic acid rearrangement reaction of a cyclic diketone leads to _____	
	a	Ring expansion
	b	Ring contraction
	c	Ring fusion
	d	Isomers
57	Which of the following type of reaction shows heterolytic bond cleavage?	
	a	SN1 reaction
	b	Addition reaction
	c	Elimination reaction
	d	Free radical halogenations
58	Which of the following instruments is used to measure the energy of the monochromatic radiation most accurately?	
	a	Photoelectric cell
	b	Thermopile
	c	The potential detector
	d	The chemical actinometer
59	The fact that the fluorescence wavelength is often much longer than the irradiation wavelength (Stokes shift) is a consequence of which phenomenon?	
	a	low extinction coefficients (Lambert-Beer law)
	b	vertical transitions (Kasha's rule)
	c	high ISC rates (El Sayed rule)

	d	the Franck–Condon principle
60	During photosynthesis, light energy is absorbed by	
	a	ADP
	b	ATP
	c	NADP
	d	chlorophyll
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

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Answer Key

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

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