Previous Year

Solved Question Paper

I.I.T. JAM EXAM 2022

BIOTECHNOLOGY

Examination

(Original Question Paper with Answer Key)

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Section A: Q.1 – Q.10 Carry ONE mark each.	
Q.1	Which of the following is involved in innate immune response in higher mammals?
(A)	T cell antigen receptor
(B)	B cell antigen receptor
(C)	Toll-like receptor
(D)	Major histocompatibility complex-II molecule
	Ans. C
Q.2	Which among the following belongs to the family "Retroviridae"?
(A)	Human Immunodeficiency virus
(B)	Ebola virus
(C)	Dengue virus
(D)	Influenza virus
	Ans. A

Q.3	Which of the following is a glycolipid?
(A)	Cerebroside
(B)	Phosphatidylcholine
(C)	Phosphatidylserine
(D)	Cardiolipin
	Ans.A
Q.4	Which of the following bacterial component contains "dipicolinic acid"?
(A)	Endospore
(B)	Capsule
(C)	Flagella
(D)	Pili
	Ans. A

Q.5	The fossilization process in which mineral rich water penetrates through the pores of decomposed organic matter is known as _____.
(A)	Carbonization
(B)	Chemical fossilization
(C)	Petrifaction
(D)	Microfossilization
	Ans. C
Q.6	A random fluctuation in gene frequency is called
(A)	Genetic drift
(B)	Genetic load
(C)	Panmixis
(D)	Genetic shift
	Ans. A

Q.7	The number of "Barr Bodies" present in a somatic cell of a woman suffering from Turner syndrome is _____.
(A)	0
(B)	1
(C)	2
(D)	3
	Ans. A
Q.8	Which of the following are produced by Mangrove trees to survive in the waterlogged swampy forests?
(A)	Trichomes
(B)	Pneumatophores
(C)	Spermatophores
(D)	Cambia
	Ans.B

Q.9	Indeterminate growth in plants is due to the presence of perpetually undifferentiated tissues, called as _____.
(A)	Tracheids
(B)	Meristems
(C)	Parenchyma
(D)	Sclerenchyma
	Ans. B
Q.10	The osmotic potential (ψ) of pure water is _____ MPa.
(A)	-1
(B)	0
(C)	0.1
(D)	10
	Ans. B

Section A: Q.11 – Q.30 Carry TWO marks each.	
Q.11	Bacteria containing a tuft of flagella that comes out from one pole is called ___.
(A)	Lophotrichous
(B)	Peritrichous
(C)	Monotrichous
(D)	Amphitrichous
	Ans.A
Q.12	Which of the following activity is associated with *Klenow* fragment?
(A)	5′-3′ exonuclease activity
(B)	5′-3′ endonuclease activity
(C)	Polymerase activity
(D)	3′-5′ endonuclease activity Ans. C

Q.13	A frameshift mutation is caused by ____.
(A)	5-Bromouracil
(B)	Acridine
(C)	Glutathione
(D)	Hypoxanthine
	Ans. B
Q.14	The zone of a pond system where respiration is more than production is called as _____.
(A)	Limnetic zone
(B)	Littoral zone
(C)	Epilimnion zone
(D)	Benthic zone
	Ans. D

Q.15	An organism that causes obstruction of lymphatic system in humans is _____.
(A)	*Borrelia burgdorferi*
(B)	*Brucella abortus*
(C)	*Yersinia pestis*
(D)	*Wuchereria bancrofti* Ans.D
Q.16	A man having a dominant genetic trait (TT genotype) can taste phenylthiocarbamide (PTC), marries a woman who cannot taste PTC. The PTC tasting ability of their biological son and daughter is
(A)	Son taster; Daughter non-taster
(B)	Daughter taster; Son non-taster
(C)	Both are non-tasters
(D)	Both are tasters Ans. D

Q.17	Which of the following enzymes is absent in a person suffering from Alkaptonuria?
(A)	Tyrosinase
(B)	Homogentisic acid oxidase
(C)	Catechol dioxygenase
(D)	Phenylalanine hydroxylase
	Ans. B
Q.18	The bacterium that can tolerate high concentrations of salt and also ferment mannitol is
(A)	*Staphylococcus aureus*
(B)	*Staphylococcus epidermis*
(C)	*Streptococcus pyogenes*
(D)	*Serratia marcescens*
	Ans. A

Q.19 Match the following

Group I	Group II
P) Streptomycin	1) Inhibits beta-subunit of RNA polymerase
Q) Cycloheximide	2) Inhibits peptidyl transferase activity of 50S subunit
R) Rifamycin	3) Inhibits peptidyl transferase activity of 60S subunit
S) Chloramphenicol	4) Inhibits binding of formyl methionine tRNA to ribosome

(A) P-1, Q-3, R-4, S-2

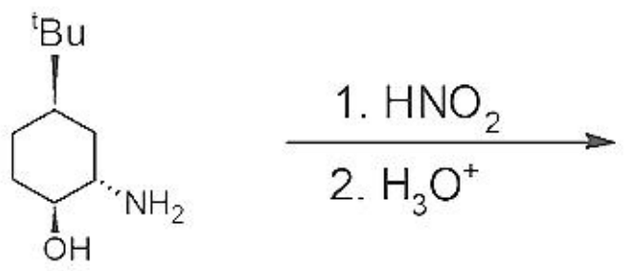
(B) P-4, Q-3, R-1, S-2

(C) P-2, Q-3, R-1, S-4

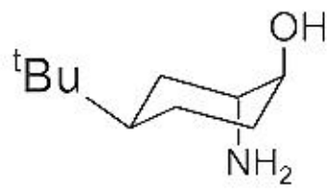
(D) P-3, Q-4, R-1, S-2

Ans. B

Q.20 The major product formed in the given reaction is



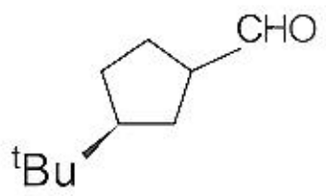
(A)



(B)

(C)

(D)



Ans. B

Q.21	DNA gyrase can
(A)	cut single-stranded DNA
(B)	relax supercoiled DNA
(C)	introduce negative supercoiling in DNA
(D)	not utilize ATP
	Ans. C
Q.22	The stationary phase of cation-exchange chromatography can be
(A)	DEAE-cellulose
(B)	CM-cellulose
(C)	Sephadex G-50
(D)	Heparin-Sepharose
	Ans. B

Q.23	Components of a Transmission Electron Microscope are
(A)	Electron gun, objective lens, positron beam, projector lens
(B)	Neutron beam, projector lens, objective lens, evacuated tube
(C)	Electron beam, projector lens, objective lens, condenser lens
(D)	X-ray beam, projector lens, objective lens, condenser lens
	Ans. C
Q.24	In a honey bee population, the workers are infertile but protect the queen from intruders and help in reproduction. This is an example of
(A)	K selection
(B)	Sexual selection
(C)	Kin selection
(D)	Disruptive selection
	Ans. C

Q.25	For an enzyme following Michaelis-Menten kinetics, when [S]=K_M then, the velocity v is *([S] is substrate concentration, K_M is Michaelis constant, V_{max} is maximal velocity)*
(A)	$[S] \times V_{max}$
(B)	$0.75 \times V_{max}$
(C)	$0.5 \times V_{max}$
(D)	$K_M \times V_{max}$ Ans. C
Q.26	The net equation for aerobic glycolysis is
(A)	$Glucose+2ATP \longrightarrow 2\ lactate+2ADP+2P_i$
(B)	$Glucose+2ADP+2P_i+2NAD^+ \longrightarrow 2\ pyruvate+2ATP+2NADH+2H_2O+4H^+$
(C)	$Glucose+2ADP+2P_i \longrightarrow 2\ pyruvate+2ATP+2H_2O$
(D)	$Glucose+2ADP+2P_i+2NAD^+ \longrightarrow 2\ lactate+2ATP+2NADH+2H_2O+4H^+$
	MARKS TO ALL

Q. 27	In the electron transport chain, flavin mononucleotide (FMN) can adopt _____ as the highest oxidation state and is capable of accepting or donating _____ electrons, respectively.
(A)	2; 2 or 3
(B)	2; 1 or 2
(C)	3; 2 or 3
(D)	3; 1 or 2
	Ans. D
Q.28	In bacteria, the σ factor that plays a major role in transcription during the stationary phase is
(A)	σ^{70}
(B)	σ^{54}
(C)	σ^{28}
(D)	σ^{32}
	MARKS TO ALL

Q.29	A rise in cytosolic calcium ion concentration just after fertilization in a sea urchin egg leads to
(A)	Formation of fertilization envelope
(B)	Acrosomal reaction
(C)	Formation of vegetal pole
(D)	Formation of animal pole
Q.30	In a nephron, _____ follows the ascending limb of the "loop of Henle".
(A)	Descending limb
(B)	Distal tubule
(C)	Collecting tubule
(D)	Proximal tubule

Ans.A

Ans. B

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Section B: Q.31 – Q.40 Carry TWO marks each.	
Q.31	Transpirational pull that extends down to the roots in plants can be interrupted by
(A)	Process of cavitation
(B)	Process of gravitation
(C)	Formation of water vapor pockets
(D)	Positive pressure in xylem sap
	Ans. A,C
Q.32	Transfer of plasmids into animal cells can be achieved by
(A)	Electroporation
(B)	Liposome-mediated process
(C)	Calcium chloride treatment
(D)	Sucrose treatment
	Ans. A,B,C

Q.33	Archaeal cell membranes contain lipids that are
(A)	Ether linked
(B)	Ester linked
(C)	Branched alkyl chain
(D)	Linear alkyl chain
	Ans. A, C
Q.34	Which of the following are producers in an ecological system?
(A)	Macrophytes
(B)	Phytoplanktons
(C)	Zooplanktons
(D)	Cyanobacteria
	Ans. A, B, D

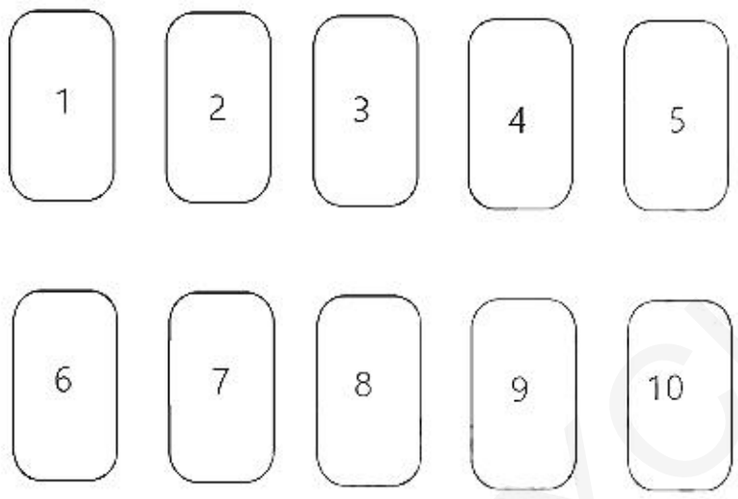
Q.35	Which of the following acts as wound hormones in plants?
(A)	Ethylene
(B)	Cytokinins
(C)	Abscisic acid
(D)	Dextrin
	Ans. A, B , C
Q.36	The enriched media used to facilitate the growth of fastidious microorganisms are
(A)	Selenite F broth
(B)	Blood agar
(C)	Chocolate agar
(D)	Loeffler's serum
	Ans.B C D

Q.37	Match the bacterial structure to function (i) Cell wall (a) Virulence factor (ii) Glycocalyx (b) Selective permeability (c) Attachment to surfaces (d) Protection from osmotic lysis
(A)	(i)-(b), (ii)-(d)
(B)	(i)-(d), (ii)-(a)
(C)	(i)-(c), (ii)-(b)
(D)	(i)-(d), (ii)-(c)

Ans. BD

Q.38	Identify the correct pairs: (i) Thermophile (a) grows optimal at 37 °C (ii) Mesophile (b) grows optimal at low temperature (iii) Psychrophile (c) grows optimal at high saline conditions (iv) Halophile (d) grows optimal at 67 °C
(A)	(i)-(d)
(B)	(ii)-(b)
(C)	(iii)-(a)
(D)	(iv)-(c)
	Ans.AD
Q.39	A single copy of an allele in sickle-cell heterozygous individuals reduces the frequency and severity of malaria. The reason for this is
(A)	Low oxygen binding capacity of hemoglobin
(B)	Single amino acid substitution in hemoglobin deforms the red blood cells
(C)	Abnormal hemoglobin is toxic for malaria parasite
(D)	Malaria parasite escapes the deformed red blood cells
	Ans. A, B

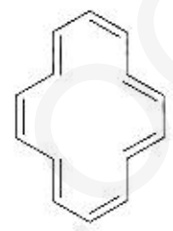
Q.40	The correct statement/s for bimolecular nucleophilic substitution reactions is/are
(A)	It goes through a carbocation formation
(B)	There is an inversion of configuration if the reacting center is chiral
(C)	Reaction is enhanced when carried out in polar solvents
(D)	The reaction intermediate is trigonal bipyramidal
	Ans. B,D OR B,C,D.

Section C: Q.41 – Q.50 Carry ONE mark each.	
Q.41	A deck of ten cards is given to you as shown below in the figure. One card is drawn at random from this deck. The probability of selecting a number less than 9 is ____. (*to one decimal place*) 
	Ans. 0.8 TO 0.8
Q.42	The average of all positive even integers less than or equal to 40 is ___.
	Ans. 21
Q.43	The smallest positive (non-zero) integer "n" for which the expression $\left(\frac{1+i}{1-i}\right)^n = 1$ holds true, is ___.
	Ans. 4

Q.44	Given that A= $(sin\theta\ cos\theta\ tan\theta + sin\theta\ cos\theta\ cot\theta)$, the value of A is
	Ans. 5
Q.45	An object is placed at the principal focus of a concave lens of focal length 10 cm. The image will be formed at _____cm, between the optical center and the focus of the lens on the same side of the object.
	Ans. -5 OR +5
Q.46	What is the maximum number of hydrogen bonds that a water molecule can make in the liquid state?
	Ans.4
Q.47	How many pairs of autosomal chromosomes are there in normal humans?
	Ans. 22

Q.48	Calculate the temperature (in K) at which the resistance of a metal becomes 20% more than its resistance at 300 K. The value of the temperature coefficient of resistance for this metal is 2.0×10^{-4} /K.
	Ans. 1300
Q.49	In the ^{1}H NMR spectrum of ethanol at 400 MHz, the methyl group splits into _____ number of peaks.
	Ans. 3
Q.50	In a denaturing polyacrylamide gel electrophoresis experiment, pure intact adult human hemoglobin will yield _____(number) bands.
	Ans. 2

Section C: Q.51 – Q.60 Carry TWO marks each.	
Q.51	A man throws a ball vertically up in the air with an initial velocity v_1 such that it reaches a height of 12 m with a speed of 12 m/s. If he throws the same ball vertically up with an initial velocity v_2 such that it reaches a maximum height of 12 m. Calculate v_1/v_2. (*up to 2 decimal places*)
	Ans. 1.25 T0 1.30
Q.52	What is the acceleration due to gravity (m/s^2) on the surface of a planet if its radius is $1/4^{th}$ that of earth and its mass is $1/80^{th}$ that of earth? Assume that the gravity on the surface of the earth is 10 m/s^2.
	Ans. 2
Q.53	In a randomly mating population, the frequency of 'A' allele is 0.7. What is the frequency of 'Aa' genotype in the next generation according to Hardy-Weinberg's law? (*up to two decimal places*)
	Ans. 0.41 TO .043
Q.54	The potential difference to accelerate an electron was quadrupled. By what factor does the *de Broglie* wavelength of the electron beam change?
	Ans. 05 OR 2

Q.55	A 500 nm light is used for imaging in a confocal microscope. What will be the best resolution (in nm) of this microscope? Ans. 150 TO 250
Q.56	Assuming the molecule shown below is aromatic, the value of "*n*" according to "Hückel's rule" is 
	Ans. 3
Q.57	In an actively growing population from a single bacterium, 1,048,576 cells are present after 20^{th} generation. How many cells were there in 5^{th} generation?
	Ans. 32

Q.58	A double stranded DNA molecule of total 5000 base pairs long, has a melting temperature of 85 °C. What will be the % AT base pairs in this sample? (*up to one decimal place*).
	Ans. 1.6 TO 61.8
Q.59	How many GTP molecules are required for the translocation of tRNA from P site to E site during translation elongation process in bacteria?
	Ans. 1
Q.60	Amongst the molecules given below, the total number of molecules that have at least one sp^2 hybridized atom is _____. C_6H_6, NO_2, BF_3, H_2O_2, SO_2, C_2H_2, *L*-Tryptophan Ans. 5

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