GATE 2014
XL: Life Sciences

EE25BTECH11049 - Sai Krishna Bakki

1. The movie was funny and I _____.

(GATE XL 2022)

(A) could help laughing
(B) couldn't help laughed
(C) couldn't help laughing
(D) could helped laughed

2. $x : y : z = \frac{1}{2} : \frac{1}{3} : \frac{1}{4}$. What is the value of $\frac{x+z-y}{y}$?

(GATE XL 2022)

(A) 0.75 (B) 1.25 (C) 2.25 (D) 3.25

3. Both the numerator and the denominator of $\frac{3}{4}$ are increased by a positive integer, x, and those of $\frac{15}{17}$ are decreased by the same integer. This operation results in the same value for both the fractions. What is the value of x?

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(A) 1 (B) 2 (C) 3 (D) 4

4. A survey of 450 students about their subjects of interest resulted in the following outcome.
   - 150 students are interested in Mathematics.
   - 200 students are interested in Physics.
   - 175 students are interested in Chemistry.
   - 50 students are interested in Mathematics and Physics.
   - 60 students are interested in Physics and Chemistry.
   - 40 students are interested in Mathematics and Chemistry.
   - 30 students are interested in Mathematics, Physics and Chemistry.
   - Remaining students are interested in Humanities.

   Based on the above information, the number of students interested in Humanities is

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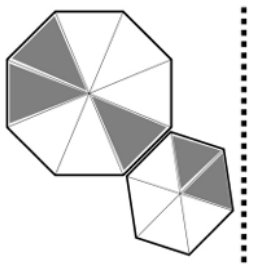
(A) 10 (B) 30 (C) 40 (D) 45

5. For the picture shown above, which one of the following is the correct picture representing reflection with respect to the mirror shown as the dotted line?

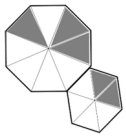


(GATE XL 2022)

(A) 

(B) 

(C) 

(D) 

6. In the last few years, several new shopping malls were opened in the city. The total number of visitors in the malls is impressive. However, the total revenue generated through sales in the shops in these malls is generally low. Which one of the following is the CORRECT logical inference based on the information in the above passage?

(GATE XL 2022)

(A) Fewer people are visiting the malls but spending more
(B) More people are visiting the malls but not spending enough
(C) More people are visiting the malls and spending more
(D) Fewer people are visiting the malls and not spending enough

7. In a partnership business the monthly investment by three friends for the first six months is in the ratio 3 : 4 : 5. After six months, they had to increase their monthly investments by 10%, 15% and 20%, respectively, of their initial monthly investment. The new investment ratio was kept constant for the next six months. What is the ratio of their shares in the total profit (in the same order) at the end of the year such that the share is proportional to their individual total investment over the year?

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(A) 22 : 23 : 24
(B) 22 : 33 : 50
(C) 33 : 46 : 60
(D) 63 : 86 : 110

8. Consider the following equations of straight lines:

$$\text{Line L1}: 2x - 3y = 5$$
$$\text{Line L2}: 3x + 2y = 8$$
$$\text{Line L3}: 4x - 6y = 5$$
$$\text{Line L4}: 6x - 9y = 6$$

Which one among the following is the correct statement?

(GATE XL 2022)

(A) L1 is parallel to L2 and L1 is perpendicular to L3
(B) L2 is parallel to L4 and L2 is perpendicular to L1
(C) L3 is perpendicular to L4 and L3 is parallel to L2
(D) L4 is perpendicular to L2 and L4 is parallel to L3

9. Given below are two statements and four conclusions drawn based on the statements.

Statement 1: Some soaps are clean.
Statement 2: All clean objects are wet.

Conclusion I: Some clean objects are soaps.
Conclusion II: No clean object is a soap.
Conclusion III: Some wet objects are soaps.
Conclusion IV: All wet objects are soaps.

Which one of the following options can be logically inferred?

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(A) Only conclusion I is correct
(B) Either conclusion I or conclusion II is correct
(C) Either conclusion III or conclusion IV is correct
(D) Only conclusion I and conclusion III are correct

10. An ant walks in a straight line on a plane leaving behind a trace of its movement. The initial position of the ant is at point P facing east. The ant first turns 72° anticlockwise at P, and then does the following two steps in sequence exactly FIVE times before halting.

(A) moves forward for 10 cm.
(B) turns 144° clockwise.

The pattern made by the trace left behind by the ant is

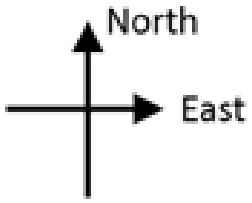

Fig. 1

(GATE XL 2022)

(A) 

(C) 

(B) 

(D) 

11. Consider a second order reaction, $2A \rightarrow$ Product. The concentration of A is represented as [A]. Which of the following is the CORRECT plot for determining the rate constant for the above reaction?

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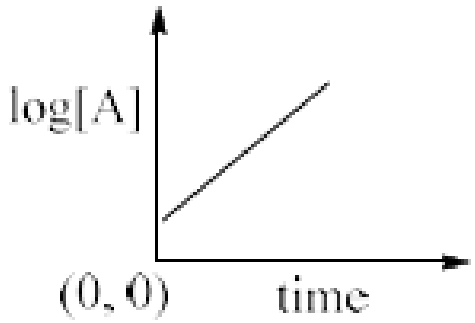
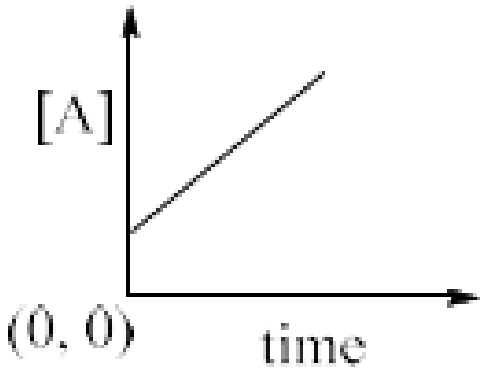
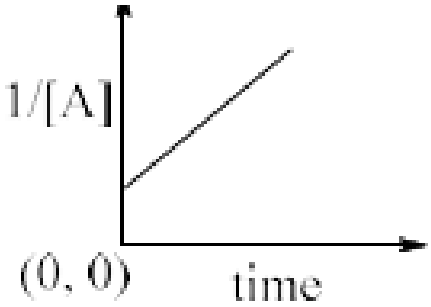
(A)



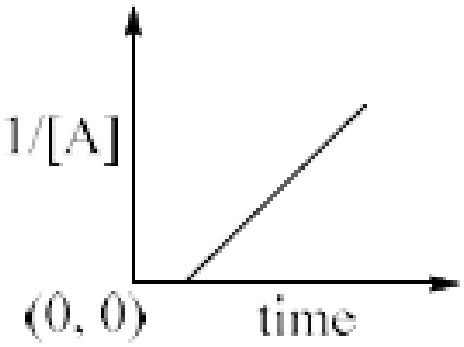
(B)



(C)



(D)



12. Which among the following has the least second ionization energy?

(GATE XL 2022)

(A) Al (B) Si (C) P (D) S

13. Which among the following metal ions has the highest enthalpy of hydration? (Assume the given metal ions hav
Given: Atomic numbers of Ti, V, Cr and Mn are 22, 23, 24 and 25, respectively.

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(A) Ti^{2+} (B) V^{2+} (C) Cr^{2+} (D) Mn^{2+}

14. Among the following, the one having smallest bond angle is

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(A) PH_3 (B) PF_3 (C) NF_3 (D) NH_3

15. Which of the following is the CORRECT statement about hexoses?

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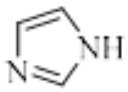
(A) D-mannose is C-4 epimer of D-glucose
(B) D-galactose is C-2 epimer of D-glucose
(C) D-glucose and L-glucose are diastereomers
(D) D-glucose and D-galactose are diastereomers

16. The bases present in DNA are

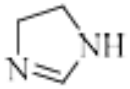
(GATE XL 2022)

(A) adenine, cytosine, guanine and thymine
(B) adenine, guanine, thymine and uracil
(C) adenine, cytosine, thymine and uracil
(D) cytosine, guanine, thymine and uracil

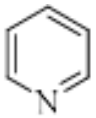
17. The CORRECT order of basicity for the following compounds is



I



II



III

(GATE XL 2022)

(A) I II III (B) II III I (C) II I III (D) III I II

18. Molar conductance of monobromoacetic acid at infinite dilution is calculated to be $x \times 10^{-4}$ S m^2 mol^{-1} at 25°C. The value of x is (round off to the nearest integer). Given:

Electrolyte	**Limiting molar conductance at 25°C in 10^{-4} S m^2 mol^{-1}**
HBr	427.95
KBr	151.64
$CH_2BrCOOK$	112.72

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(A) 164 (B) 195 (C) 389 (D) 467

19. A sample of benzene, contaminated with a non-volatile and non-ionic solute, boils at 0.31°C higher than that of pure benzene. The molality of the solute in the contaminated solution is _____ (round off to two decimal places). Given: Gas constant = 8.314 J K^{-1} mol^{-1} Molecular weight of benzene is 78.11 g mol^{-1} Normal boiling point of benzene is 80.1°C Enthalpy of vaporization of benzene is 30.76 kJ mol^{-1}

(GATE XL 2022)

20. Among the following statements about cobalt complexes, which is/are CORRECT? Given: Atomic number of Co is 27

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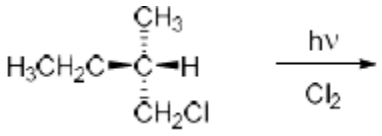
$Co(NH_3)_4^{2+}$ exhibits square planar geometry
$Co(en)_3^{3+}$ does not show optical isomerism (en = ethylenediamine)
$Co(H_2O)_6^{3+}$ is paramagnetic in nature
$Co(NH_3)_5Cl^{2+}$ shows ligand-to-metal charge transfer

21. Consider the following reaction:



The CORRECT statement(s) related to mono-chlorination at carbon-2 position is/are

(GATE XL 2022)

(A) The reaction proceeds through alkyl radical intermediate
(B) Complete inversion of configuration at carbon-2 takes place
(C) Complete retention of configuration at carbon-2 takes place
(D) A mixture of enantiomers is formed

22. Consider the following enzyme catalyzed reaction:

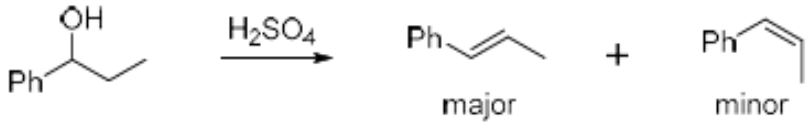
$$E + S \rightleftharpoons ES \rightarrow P + E$$

where E is enzyme, S is substrate, ES is enzyme-substrate complex and P is product. The CORRECT statement(s) for the above reaction is/are

(GATE XL 2022)

(A) Maximum possible rate of product formation is dependent on k_2 and initial concentration of enzyme.
(B) For a low substrate concentration, the rate of product formation is first order with respect to enzyme and also first order with respect to the substrate.
(C) The rate of product formation is independent of the concentration of enzyme substrate complex.
(D) For a very high substrate concentration, initial rate of product formation is zero order with respect to the substrate.

23. Consider the following reaction: The CORRECT pathway(s) involved in the reaction is/are



(GATE XL 2022)

(A) E2 followed by isomerization
(B) E1 followed by isomerization
(C) SN1 followed by isomerization
(D) Isomerization through carbocation

24. An aqueous solution of aspirin (HA) is prepared at pH 7.4. The ratio of concentration of A^- and HA at equilibrium is _____ (round off to the nearest integer). Given: K_a of aspirin is 3.98×10^{-4}

(GATE XL 2022)

25. The total number of 3-centre-2-electron bonds in B_4H_{10} is _____ (in integer).

(GATE XL 2022)

26. The equilibrium constant for isomerization of 1-butene to trans-2-butene at 27°C is _____ (round off to one decimal place). Given: Gas constant = 8.314 J K^{-1} mol^{-1} $\Delta_f G^o$ of 1-butene = +71.39 kJ mol^{-1} $\Delta_f G^o$ of trans-2-butene = +63.06 kJ mol^{-1}

(GATE XL 2022)

27. A 16 mW monochromatic light emits 4×10^{16} photons in 1 second. When this light incidents on a metal strip, photoelectrons are emitted. The wavelength of the emitted photoelectrons $\left(\text{in Å}\right)$ is

_____ (round off to one decimal place). Given: Work function of the metal = 2.0 eV Charge of an electron = 1.6×10^{-19} C Mass of an electron = 9.1×10^{-31} kg Planck's constant = 6.626×10^{-34} J s

(GATE XL 2022)

28. Which of the immune cells listed below are agranular?

P. Eosinophils
Q. Mast cells
R. Monocytes
S. T-cells

(GATE XL 2022)

(A) P and Q only
(B) Q and R only
(C) R and S only
(D) S and P only

29. Which one of the following enzymes is located in the outer mitochondrial membrane?

(GATE XL 2022)

(A) Citrate synthase
(B) Fumarase
(C) Monoamine oxidase
(D) Succinate dehydrogenase

30. Which one of the following statements about the DNA polymerase III of E. coli is NOT correct?

(GATE XL 2022)

(A) It catalyzes nick translation.
(B) Its absence is lethal to E. coli.
(C) It synthesizes a complementary DNA strand using a single-stranded template.
(D) It possesses $3' \rightarrow 5'$ exonuclease activity.

31. Which one of the following compounds is NOT a translation inhibitor?

(GATE XL 2022)

(A) Chloramphenicol
(B) Cycloheximide
(C) Puromycin
(D) Rifampicin

32. A dye was allowed to undergo migration on a chromatographic paper using a solvent. The dye, and the solvent-front migrated 5 and 20 cm, respectively, from the point of origin. The retention factor (rounded off to two places of decimals) for the dye is _____.

(GATE XL 2022)

33. The pK_a values of the carboxylic and amino groups of an amino acid with a non-ionizable side chain are 2.17 and 9.13, respectively. The isoelectric point (rounded off to two places of decimals) of this amino acid is _____.

(GATE XL 2022)

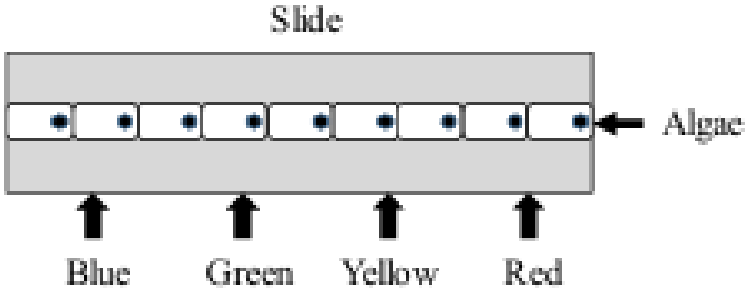
34. The number of ATP molecules required for the complete assimilation of one molecule of CO_2 in Calvin cycle is _____.

(GATE XL 2022)

35. The absorbance of a 5×10^{-4} M solution of tyrosine at 280 nm wavelength is 0.75. The path length of the cuvette is 1 cm. The molar absorption coefficient at the given wavelength in $M^{-1}cm^{-1}$, correct to the nearest integer, is _____.

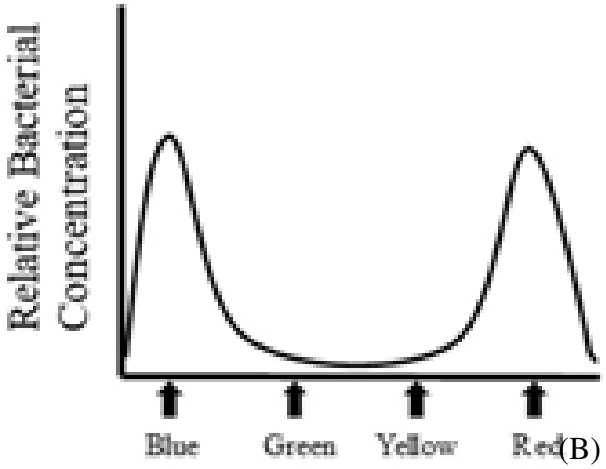
(GATE XL 2022)

36. Filamentous photosynthetic algae were placed on a microscopic slide and illuminated with light of different colors as illustrated. The bacteria that are known to migrate towards the region of high O_2 were also added uniformly on the slide. Which one of the following options illustrates the distribution of bacteria along the length of the microscopic slide after illumination?

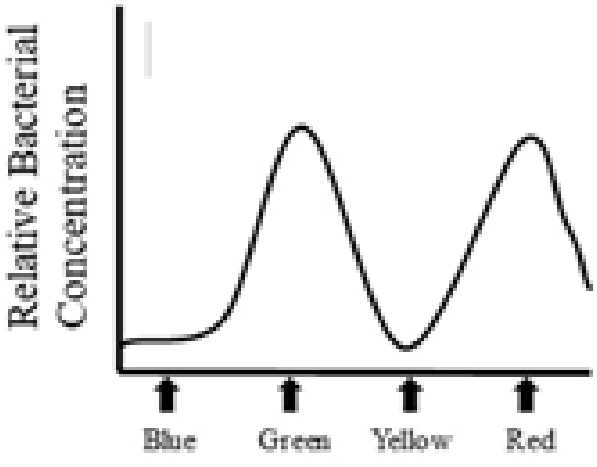


(GATE XL 2022)

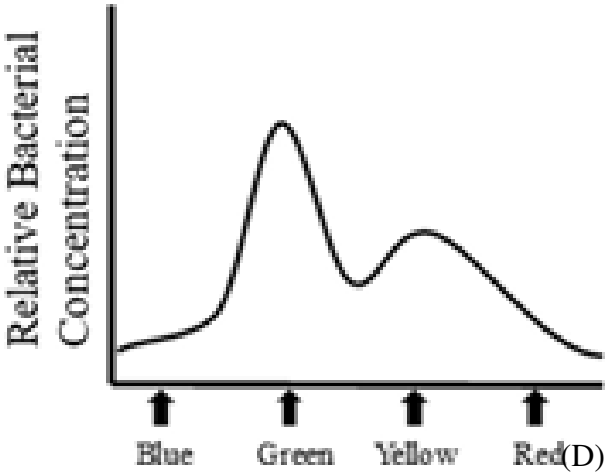
(A)



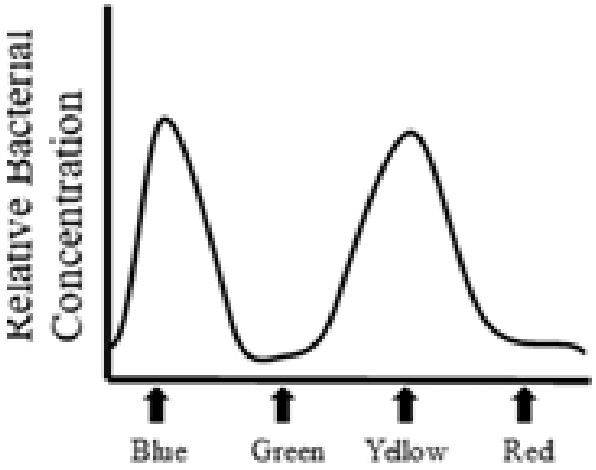
(B)



(C)



(D)



37. Two RNAs shown below were used separately as templates in an in vitro translation system, which can generate proteins in all possible reading frames.

$$RNA_1 : 5' - (AG)_n - 3'$$
$$RNA_2 : 5' - (AAG)_n - 3'$$

The RNA_1 translated product contained Arg and Glu. The RNA_2 translated product contained Arg, Glu, and Lys. Which one of the following codons directs the incorporation of Arg?

(GATE XL 2022)

(A) AAG (B) AGA (C) GAA (D) GAG

38. Which of the following statements about endogenous synthesis of insulin are correct?

P. Insulin is synthesized as preproinsulin.
Q. Preproinsulin is converted to proinsulin.
R. Single-site cleavage of proinsulin eliminates C chain.
S. Mature insulin consists of disulphide-linked A and B chains.

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(A) P, Q, and R
(B) P, Q, and S
(C) P, R, and S
(D) Q, R, and S

39. Which one of the following enzymes converts testosterone to estradiol?

(GATE XL 2022)

(A) Aromatase
(B) 3β-hydroxysteroid dehydrogenase
(C) 5α-reductase
(D) 17β-hydroxysteroid dehydrogenase

40. Purification of 6×His-tagged protein using Ni-NTA column is an example of _____.

(GATE XL 2022)

(A) affinity chromatography
(B) hydrophobic-interaction chromatography
(C) ion-exchange chromatography
(D) size-exclusion chromatography

41. Which of the following carbohydrates has/have a $\beta 1 \rightarrow 4$ glycosidic linkage?

(GATE XL 2022)

(A) Cellulose
(B) Chitin
(C) Lactose
(D) Maltose

42. Which of the following statements about IgA is/are correct?

(GATE XL 2022)

(A) It is secreted into colostrum.
(B) It is transported across the cell by transcytosis.
(C) Its secretion is facilitated by poly-Ig receptor.
(D) It primarily exists as a dimer in serum.

43. The standard free energy changes for conversion of phosphoenol pyruvate (PEP) to pyruvate, and ATP synthesis are shown below.

$$PEP + H_2O \rightleftharpoons pyruvate + P_i \quad \Delta G'^{\circ} = -61.9 \text{ kJ} \cdot \text{mol}^{-1}$$
$$ADP + P_i \rightleftharpoons ATP + H_2O \quad \Delta G'^{\circ} = 30.5 \text{ kJ} \cdot \text{mol}^{-1}$$

The starting concentrations of PEP, ADP, pyruvate, and ATP are 25, 25, 50, and 50 mM, respectively. The value of universal gas constant (R) is 8.315 $\text{J}\cdot\text{mol}^{-1}K^{-1}$. The actual free energy change in $\text{kJ}\cdot\text{mol}^{-1}$ for the reaction

$$PEP + ADP \rightarrow pyruvate + ATP$$

carried out at 37°C will be _____ (rounded off to one place of decimal).

(GATE XL 2022)

44. The dissociation constant for a receptor-ligand pair is 0.25×10^{-7} M. The ligand was added to a solution of the receptor such that the receptor was 50% saturated at equilibrium. Assume that the receptor has one ligand binding site. The concentration of the free ligand at equilibrium in nM, correct to the nearest integer, should be _____.

(GATE XL 2022)

45. The half-maximal velocity of an enzyme catalyzed reaction was found at a substrate concentration of 0.5×10^{-6} M. This enzyme follows Michaelis-Menten kinetics. In the presence of a competitive inhibitor, the half-maximal velocity was found at a substrate concentration of 1.5×10^{-6} M. Given that the enzyme-inhibitor pair has a dissociation constant of 2×10^{-7} M, the concentration of the competitive inhibitor in μM, rounded off to one place of decimal, was _____.

(GATE XL 2022)

46. A forty-times diluted sample of ssRNA gave an A_{260} of 0.01. The concentration of the ssRNA before the dilution in μg/mL was _____ (correct to the nearest integer).

(GATE XL 2022)

47. In Angiosperms, normally 'Exarch Xylem' occurs in

(GATE XL 2022)

(A) dicot stem
(B) monocot stem
(C) dicot root
(D) dicot leaf

48. 'Quiescent Center' is present in

(GATE XL 2022)

(A) leaf meristem
(B) root apical meristem
(C) shoot apical meristem
(D) floral meristem

49. With reference to virulence (vir) region of nopaline type Ti plasmid of *Agrobacterium tumefaciens*, match Group-I (vir gene) and Group-II (coded protein) in CORRECT combination.

Group-I	**Group-II**
P. vir A	I. Single strand T-DNA binding protein
Q. vir B	II. Topoisomerase
R. vir E	III. Membrane protein, channel for T-DNA
S. vir D	IV. Sensor protein, constitutive expression

(GATE XL 2022)

(A) P-IV, Q-III, R-II, S-I
(B) P-IV, Q-III, R-I, S-II
(C) P-IV, Q-II, R-I, S-III
(D) P-I, Q-III, R-II, S-IV

50. Anomalous secondary growth is observed in

(GATE XL 2022)

(A) Triticum (B) Oryza (C) Zea (D) Dracaena

51. Which of the following plant diseases is/are caused by bacteria?

(GATE XL 2022)

(A) Angular leaf spot of cotton
(B) Citrus canker

(C) Apple scab
(D) Leaf curl of papaya

52. Phylogenetic system of classification is/are proposed by

(GATE XL 2022)

(A) Carolus Linnaeus
(B) John Hutchinson
(C) Engler and Prantl
(D) Bentham and Hooker

53. Which of the following is/are part of marine ecosystem?

(GATE XL 2022)

(A) Open ocean
(B) Chaparral
(C) Deep sea
(D) Estuaries

54. In $NADP^+$-malic enzyme type C_4 photosynthesis cycle, n molecule(s) of ATP is/are required for the assimilation of one molecule of CO_2. The value of n is _____ (in integer).

(GATE XL 2022)

55. An *Arabidopsis thaliana* mutant plant developed defective flowers with altered floral organ identity and patterning. In this mutant, the four floral whorls contain Sepal-Sepal-Carpel-Carpel, from the periphery to the center of the flower. Based on the typical ABC model of floral organ patterning, which among the following are mutated in this plant?

(GATE XL 2022)

(A) Class A gene(s)
(B) Class B gene(s)
(C) Class C gene(s)
(D) Double mutant for Class A and Class C genes

56. Match the secondary metabolites in Group-I with types of secondary metabolites in Group-II in CORRECT order.

Group-I	**Group-II**
P. Myrcene	I. Sesquiterpene
Q. β-Farnesene	II. Cyanogenic glycoside
R. Amygdalin	III. Flavone
S. Nicotine	IV. Alkaloid
T. Luteolin	V. Monoterpene

(GATE XL 2022)

(A) P-I, Q-V, R-II, S-IV, T-III
(B) P-V, Q-II, R-IV, S-I, T-III
(C) P-II, Q-III, R-IV, S-V, T-I
(D) P-V, Q-I, R-II, S-IV, T-III

57. Match Group-I (enzyme), Group-II (reaction catalyzed by the enzyme), and Group-III (subcellular localization in CORRECT combination.

(GATE XL 2022)

(A) P-III-a, Q-IV-d, R-I-b, S-II-c
(B) P-II-a, Q-III-d, R-I-b, S-IV-c
(C) P-IV-a, Q-II-b, R-I-d, S-III-c
(D) P-IV-a, Q-II-d, R-I-b, S-III-c

58. Match Group-I (selection agent) and Group-II (gene) in CORRECT combination.

(GATE XL 2022)

Group-I	Group-II	Group-III
P. PEP Carboxylase	I. 2 Glycolate + $2O_2 \rightarrow$ 2 Glyoxylate + $2H_2O_2$	a. Cytosol - C4 cycle
Q. Rubisco	II. Pyruvate + NAD^+ + CoA $\rightarrow$ Acetyl-CoA + CO_2 + NADH	b. Peroxisome - C_2 cycle
R. Glycolate oxidase	III. Phosphoenolpyruvate + $HCO_3^- \rightarrow$ Oxaloacetate + P_i	c. Mitochondria - aerobic respiratio
S. Pyruvate dehydrogenase	IV. 3 (Ribulose 1,5-bisphosphate) + $3CO_2$ + $3H_2O \rightarrow$ 6 (3-phosphoglycerate) + $6H^+$	d. Chloroplast - C_3 cycle

Group-I	Group-II
P. Kanamycin	I. pmi
Q. Hygromycin	II. bar
R. Phosphinothricin	III. nptII
S. Mannose	IV. ptxD
	V. dhfr
	VI. hpt

(A) P-III, Q-VI, R-II, S-I
(B) P-IV, Q-III, R-II, S-I
(C) P-I, Q-VI, R-III, S-II
(D) P-II, Q-I, R-V, S-VI

59. Match Group I (plant natural product), Group II (class) and Group III (source plant) in CORRECT combination.

(GATE XL 2022)

Group-I	Group-II	Group-III
P. Reserpine	I. Stilbenes	a. Manihot esculanta
Q. Resveratrol	II. Cyanogenic glycoside	b. Crocus sativus
R. Picrocrocin	III. Alkaloid	c. Vitis vinifera
S. Linamarin	IV. Monoterpene glycoside	d. Rauwolfia serpentina

(A) P-I-d, Q-II-c, R-IV-a, S-III-b
(B) P-III-d, Q-IV-b, R-I-c, S-II-a
(C) P-II-a, Q-III-b, R-I-d, S-IV-c
(D) P-III-d, Q-I-c, R-IV-b, S-II-a

60. Match Group I (plant disease), Group II (causal organism) and Group III (affected plant) in CORRECT combination.

(GATE XL 2022)

Group-I	Group-II	Group-III
P. Karnal Bunt	I. Phytophthora infestans	a. Rice
Q. Ergot	II. Blumeria graminis	b. Potato
R. Late blight	III. Neovossia indica	c. Rye
S. Powdery mildew	IV. Puccinia recondita	d. Wheat
	V. Claviceps purpurea	e. Barley
	VI. Alternaria solani	f. Brinjal

(A) P-II-a, Q-V-b, R-III-d, S-I-e
(B) P-III-d, Q-V-c, R-II-e, S-IV-f
(C) P-III-d, Q-V-c, R-I-b, S-II-e
(D) P-V-c, Q-I-d, R-VI-b, S-II-e

61. Make CORRECT match between Group-I and Group-II, in relation to interaction between two species.

(GATE XL 2022)

Group-I	Group-II
P. Neutralism	I. neither can survive under natural condition without the other
Q. Allelopathy	II. direct inhibition of one species by the other species using toxic compound
R. Amensalism	III. neither is affected by the association with the other
S. Mutualism	IV. one is inhibited and the other is not affected

(A) P-I, Q-II, R-III, S-IV
(B) P-III, Q-II, R-IV, S-I
(C) P-IV, Q-III, R-II, S-I
(D) P-III, Q-IV, R-II, S-I

62. Which of the following matches is/are CORRECT?

(GATE XL 2022)

(A) Surface fibre - Cotton - Gossypium hirsutum
(B) Bast fibre - Flax - Corchorus capsularis
(C) Drying oil - Safflower oil - Helianthus annuus
(D) Nondrying-oil - Castor oil - Ricinus communis

63. Which of the following is/are phanerogamic parasite(s)?

(GATE XL 2022)

(A) Cuscuta reflexa
(B) Orobanche cernua
(C) Ocimum sanctum
(D) Santalum album

64. When a true breeding tall plant containing red flowers was crossed with the true breeding dwarf plant containing white flowers, all F1 plants were tall with red flowers. When the F1 plant was self-pollinated, considering independent assortment of plant height and flower colour traits, the calculated percentage probability of dwarf plants bearing red flowers in the F2 generation is _____ percent (round off to 2 decimal places).

(GATE XL 2022)

65. A hypothetical plant gene ADSH22 is encoded by the nuclear genome. The length of the mature mRNA for ADSH22 is 2150 nucleotides (nts). This mRNA has a 270 nts long 5' UTR and 200 nts long 3' UTR. Taking average molecular weight of an amino acid as 115 Dalton (Da), the calculated molecular weight of ADSH22 protein is _____ kDa (round off to 1 decimal place).

(GATE XL 2022)

66. The terminal acceptor of electron during anaerobic respiration in Methanococcus is

(GATE XL 2022)

(A) Nitrate ion
(B) Sulfate ion
(C) Carbon dioxide
(D) Oxygen

67. Which one of the following mutagens convert DNA's adenine to hypoxanthine?

(GATE XL 2022)

(A) Ultraviolet light
(B) Mitomycin C
(C) Methyl methanesulfonate
(D) Nitrous acid

68. Which one of the following leukocytes are present in the largest proportion in healthy human blood?

(GATE XL 2022)

(A) Neutrophils
(B) Eosinophils
(C) Basophiles
(D) Monocytes

69. The site of photosynthesis in cyanobacteria is

(GATE XL 2022)

(A) Chloroplast
(B) Chromatophores
(C) Thylakoids
(D) Chlorosomes

70. The antimicrobial activity of vancomycin is due to the

(GATE XL 2022)

(A) inhibition of nucleic acid synthesis
(B) damage to the cytoplasmic membrane
(C) inhibition of cell wall synthesis
(D) regulation of DNA supercoiling

71. Phenolics act as disinfectant by

(GATE XL 2022)

(A) rupturing plasma membrane followed by leakage of cellular contents
(B) bond formation between adjacent pyrimidine bases
(C) forming adduct with amino acid and unsaturated fatty acids
(D) alkylation of proteins

72. Which of the following methods are used for the identification of microorganisms?

(GATE XL 2022)

(A) Nucleic acid hybridization
(B) Southern blotting
(C) 16s rRNA sequencing
(D) Percentage G-C content

73. Which of the following are present in Gram-negative bacteria?

(GATE XL 2022)

(A) Lipopolysaccharide
(B) Teichoic acid
(C) Periplasm
(D) Endotoxin

74. Nonsense suppressor mutation is found in _____.

(GATE XL 2022)

(A) rRNA
(B) tRNA
(C) start codon of mRNA
(D) stop codon of mRNA

75. Choose the correct match for structural components of bacteria to their function.

(GATE XL 2022)

Structural component	**Function**
(P) Flagella	(i) prevent cell lysis
(Q) Cell wall	(ii) chemotaxis
(R) Metachromatic granules	(iii) storage for ATP
(S) Magnetosomes	(iv) cell orientation

(A) (P)-(ii), (Q)-(iii), (R)-(i), (S)-(iv)

(B) (P)-(ii), (Q)-(i), (R)-(iii), (S)-(iv)
(C) (P)-(ii), (Q)-(i), (R)-(iv), (S)-(iii)
(D) (P)-(i), (Q)-(iv), (R)-(iii), (S)-(ii)

76. Match the pathogen with the appropriate disease.

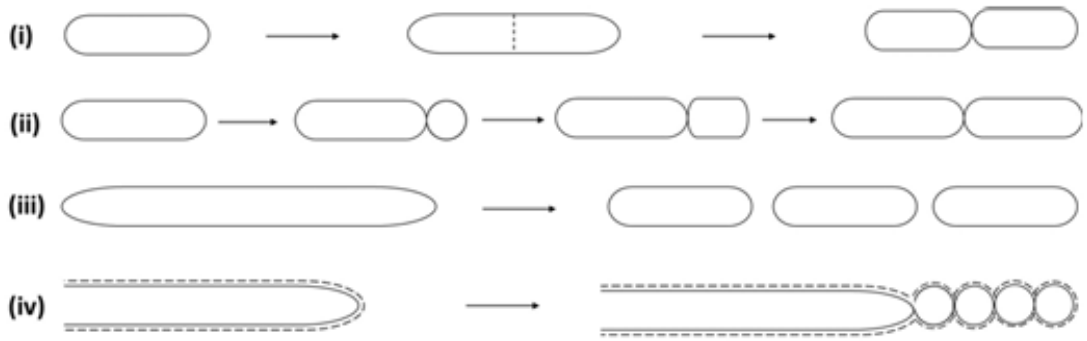
(GATE XL 2022)

Pathogen	Disease
(P) Streptococcus pyogenes	(i) Scarlet fever
(Q) Brucella species	(ii) Pott's disease
(R) Mycobacterium tuberculosis	(iii) Traveler's diarrhea
(S) Escherichia coli	(iv) Undulant fever

(A) (P)-(ii), (Q)-(iii), (R)-(i), (S)-(iv)
(B) (P)-(ii), (Q)-(i), (R)-(iii), (S)-(iv)
(C) (P)-(i), (Q)-(iv), (R)-(ii), (S)-(iii)
(D) (P)-(i), (Q)-(iv), (R)-(iii), (S)-(ii)

77. Match the correct mode of cell division with respective bacteria.

(GATE XL 2022) **Mode of cell division**



Bacteria

P) Streptomyces species
Q) Rhodopseudomonas acidophila
R) Bacillus subtilis
S) Nocardia species

(A) (P)-(ii), (Q)-(iii), (R)-(i), (S)-(iv)
(B) (P)-(ii), (Q)-(i), (R)-(iii), (S)-(iv)
(C) (P)-(iv), (Q)-(ii), (R)-(i), (S)-(iii)
(D) (P)-(i), (Q)-(iv), (R)-(iii), (S)-(ii)

78. The correct sequence of overall biochemical reaction which expresses the process of denitrification is _____

(GATE XL 2022)

(A) $2NO_3^- \rightarrow 2NO_2^- \rightarrow N_2O \rightarrow 2NO \rightarrow N_2$
(B) $2NO_3^- \rightarrow 2NO_2^- \rightarrow 2NO \rightarrow N_2O \rightarrow N_2$
(C) $2NO_3^- \rightarrow 2NO \rightarrow 2NO_2^- \rightarrow N_2O \rightarrow N_2$
(D) $2NO_3^- \rightarrow N_2O \rightarrow 2NO \rightarrow 2NO_2^- \rightarrow N_2$

79. Which of the following diseases are caused by family of DNA viruses?

(GATE XL 2022)

(A) Hepatitis B
(B) Smallpox
(C) Influenza
(D) Rabies

80. Which of the following Gram-positive cocci are found in biofilm of dental plaque?

(GATE XL 2022)

(A) Gonococcus
(B) Streptococcus mutans
(C) Streptococcus sobrinus
(D) Fusobacterium species

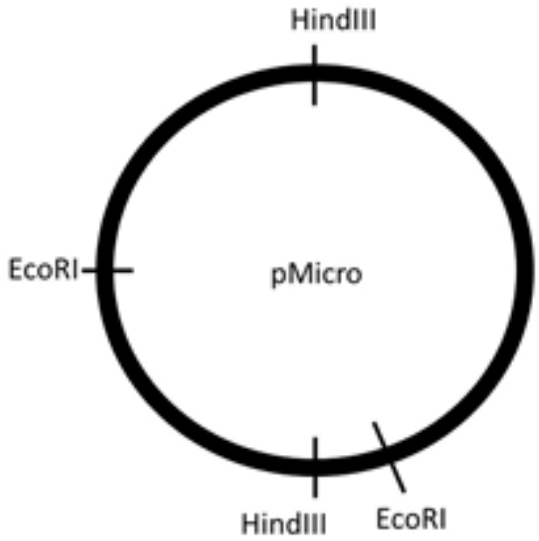
81. Which of the following statements are TRUE for archaea?

(GATE XL 2022)

(A) Cell wall in archaea contains muramic acid and D-amino acid
(B) N-Formylmethionine is the first amino acid to initiate new polypeptide chain synthesis in archaea
(C) Methionine is the first amino acid used during protein synthesis in archaea
(D) Membrane of archaea contains phytanyl rather than fatty acids

82. If the plasmid given below is digested with restriction enzymes HindIII and EcoRI, considering complete digestion, how many DNA fragments will be released?

(GATE XL 2022)



83. Escherichia coli growing under favorable conditions doubles in every 20 minutes. If the initial number of Escherichia coli cells is 100, what will be the logarithmic number of cells at 17^{th} generation? (Answer up to 1 decimal place)

(GATE XL 2022)

84. What will be value of the Numerical Aperture (NA), if half aperture angle is 58° and oil immersed objective is used for the process of light microscopy? (Answer up to 1 decimal place) Consider $\sin 58° = 0.85$ and refractive index of immersion oil used is = 1.50.

(GATE XL 2022)

85. Which one of the following organic compounds is composed of only (i) a nitrogen containing base, (ii) a single five-carbon sugar, and (iii) a triphosphate?

(GATE XL 2022)

(A) Nucleoside
(B) Nucleotide
(C) Base
(D) Nucleic acid

86. Which one of the following animals develops adaptive predator avoidance morphology because of the presence of high predator number in its habitat?

(GATE XL 2022)

(A) Daphnia sp.
(B) Scaphiopus sp.
(C) Wolbachia sp.
(D) Rhodnius sp.

87. To which class of Drosophila developmental genes does fushi tarazu (ftz) belong?

(GATE XL 2022)

(A) Gap genes
(B) Segment polarity genes
(C) Pair rule genes
(D) Maternal effect genes

88. The action of which class of enzyme inhibitors can be reversed by adding an excess of substrate?

(GATE XL 2022)

(A) Uncompetitive inhibitors
(B) Competitive inhibitors
(C) Non-specific inhibitors
(D) Allosteric inhibitors

89. Mendel deduced the genetic principle of inheritance by experimenting on sweet pea plants. One of the experiments involved crossing plants with two contrasting characters, tall (dominant) and dwarf (recessive), which yielded all tall plants in the first generation. When the same genetic cross was independently repeated by a researcher, only short plants were obtained. Which one of the following can possibly explain the altered outcome?

(GATE XL 2022)

(A) Tall plants were heterozygous
(B) An enhancer for the tall allele is present in the dwarf plant
(C) A suppressor for the tall allele is present in the dwarf plant
(D) Dwarf plants are homozygous

90. Which of the following is/are responsible for reversible receptor-ligand interaction?

(GATE XL 2022)

(A) Ionic interactions
(B) Hydrogen bonding
(C) Peptide bonding
(D) Hydrophobic interactions

91. In the human body, which of the following is/are involved in processing of a foreign antigen?

(GATE XL 2022)

(A) B-cells
(B) Macrophages
(C) Red blood cells
(D) Platelets

92. Animals can be classified as 'specialists' or 'generalists' with respect to diet and habitat selection. Which of the following organism/s belong/s to the specialist category?

(GATE XL 2022)

(A) Raccoon
(B) Panda
(C) Polar Bear
(D) Koala Bear

93. Match the drug/chemicals listed in Column I with the developmental/physiological defects listed in Column II.

(GATE XL 2022)

Column I	Column II
P. Veratrum alkaloids	(i) Obesity
Q. Thalidomide	(ii) Minamata syndrome
R. Methylmercury	(iii) Cyclopia
S. Diethylstilbesterol	(iv) Phocomelia

(A) P-(iii); Q-(iv); R-(ii); S-(i)
(B) P-(i); Q-(iv); R-(iii); S-(ii)
(C) P-(ii); Q-(iv); R-(iii); S-(i)
(D) P-(ii); Q-(iii); R-(iv); S-(i)

94. Match the animals listed in Column I with primary tissue or organ of residence in the host listed in Column II

(GATE XL 2022)

Column I	Column II
P. Ascaris lumbricoides	(i) Subcutaneous tissue in human
Q. Dracunculus medinensis	(ii) Lymphatic vessels and lymph nodes
R. Enterobius vermicularis	(iii) Small intestine
S. Wuchereria bancrofti	(iv) Caecum or vermiform appendix

(A) P-(iii), Q-(iv), R-(ii), S-(i)
(B) P-(i), Q-(iv), R-(iii), S-(ii)
(C) P-(ii), Q-(iii), R-(iv), S-(i)
(D) P-(iii), Q-(i), R-(iv), S-(ii)

95. Match the cell types listed in Column I with their sources in Column II and the primary functional roles listed in Column III.

(GATE XL 2022)

Column I	Column II	Column III
P. Microglial cells	(i) Lung	a. Visual transduction
Q. Leydig cells	(ii) Eyes	b. Hormone secretion
R. ON cells	(iii) Brain	c. Phagocytosis
S. Pneumocytes	(iv) Testis	d. Gaseous exchange

(A) P-(iii)-b, Q-(iv)-c, R-(ii)-a, S-(i)-d
(B) P-(ii)-c, Q-(iv)-d, R-(i)-a, S-(iii)-b
(C) P-(i)-a, Q-(iv)-b, R-(ii)-c, S-(iii)-d
(D) P-(iii)-c, Q-(iv)-b, R-(ii)-a, S-(i)-d

96. Match the ecological concepts listed in Column I with their definitions listed in Column II.

(GATE XL 2022)

Column I	Column II
P. Dominance hierarchies	(i) Giving up one's own reproductive potential to benefit another individual
Q. Territory	(ii) Selection acting on related animals which affects fitness of an individual
R. Altruism	(iii) Exclusion of competing individuals using agonistic behavior
S. Kin selection	(iv) Preferential access to the food and mates in a group

(A) P-(ii), Q-(iv), R-(i), S-(iii)
(B) P-(iv), Q-(ii), R-(i), S-(ii)
(C) P-(iii), Q-(iv), R-(i), S-(ii)
(D) P-(i), Q-(iv), R-(iii), S-(ii)

97. Match the hormones listed in Column I with their primary source tissues in Column II and the primary target tissues listed in Column III

(GATE XL 2022)

Column I	Column II	Column III
P. Epinephrine	(i) Hypothalamus	a. Pituitary
Q. Prolactin	(ii) Thyroid	b. Heart
R. Calcitonin	(iii) Pituitary	c. Bone
S. Thyrotropin releasing hormone	(iv) Chromaffin tissue	d. Pigeon's crop

(A) P-(iii)-b, Q-(iv)-c, R-(ii)-a, S-(i)-d
(B) P-(iv)-c, Q-(iii)-b, R-(ii)-a, S-(i)-d
(C) P-(iv)-b, Q-(iii)-d, R-(ii)-c, S-(i)-a
(D) P-(iii)-b, Q-(iv)-c, R-(ii)-d, S-(i)-a

98. 2-Deoxyglucose (2-DG) inhibits the proliferation of cells and hence finds use as an anti-cancer agent. It is also used in COVID therapy, where it blocks hyperproliferation of virus-infected cells. Mechanistically, 2-DG blocks glycolysis by inhibiting the activities of which of the following enzyme/s?

(GATE XL 2022)

(A) Hexokinase
(B) Glucose 6-phosphate isomerase
(C) Glucose-6 phosphate dehydrogenase
(D) Phosphofructokinase

99. According to Abbe's equation on microscopy, the ability to resolve two entities inside a cell by light microscopy depends on which of the following factor/s?

(GATE XL 2022)

(A) Magnification of the objective lens
(B) Intensity of incident light
(C) Wavelength
(D) Numerical aperture of the objective lens

100. Match the animal inactivity behaviors listed in Column I with representative animals in Column II and their definitions listed in Column III.

(GATE XL 2022)

Column I	Column II	Column III
P. Torpor	(i) Australian burrowing frogs	a. Prolonged period of inactivity without reducing body temperature
Q. Hibernation	(ii) Polar Bears	b. Inactivity period which accompanies extended periods of dryness
R. Winter sleep	(iii) Ground Squirrels	c. Decreased metabolism with lowered body temperature occurring in daily activity cycles
S. Aestivation	(iv) Hummingbirds	d. Decreased metabolism and lower body temperature for weeks or months

(A) P-(ii)-c, Q-(iv)-b, R-(i)-a, S-(iii)-d
(B) P-(iv)-c, Q-(iii)-d, R-(ii)-a, S-(i)-b
(C) P-(iv)-c, Q-(ii)-b, R-(i)-a, S-(iii)-d
(D) P-(iv)-b, Q-(i)-c, R-(ii)-d, S-(iii)-a

101. If the vital capacity (VC) of an individual is 4900 ml, the tidal volume (TV) is 500 ml, and the inspiratory reserve volume (IRV) is 3300 ml, the expiratory reserve volume (ERV) of the individual is _____ ml (in integer).

(GATE XL 2022)

102. A typical food chain involves producers, herbivores, primary carnivores and secondary carnivores. Based on Lindeman's law of trophic efficiency, if producers have 40 kJ of energy, the energy that will be stored in secondary carnivores is _____ kJ (round off to two decimal places).

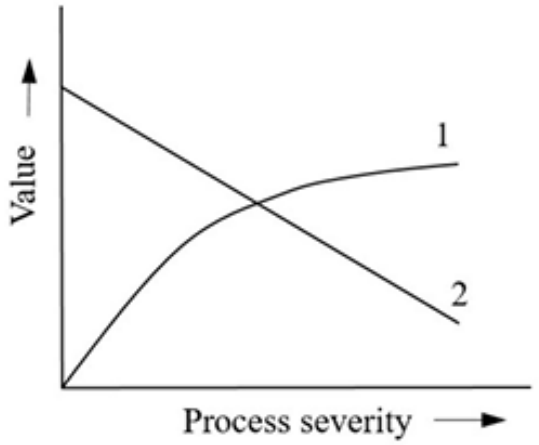
(GATE XL 2022)

103. The average body length of Drosophila nasuta collected from Andaman and Nicobar Islands is 2 mm. From this population, a few males and females having a body length of 3 mm were selected and interbred. The average body length of the resultant progeny was 2.5 mm. The heritability h^2 of the body length in this population is _____. (round off to one decimal place)

(GATE XL 2022)

104. Which among the given options truly depict the lines 1 and 2 in the figure below with respect to the effect of heat processing on food?

(GATE XL 2022)



(A) 1-Safety, 2-Quality
(B) 1-Yield, 2-Safety
(C) 1-Yield, 2-Quality
(D) 1-Quality, 2-Safety

105. Homogenization of milk leads to disintegration of fat globules by

(GATE XL 2022)

(A) Turbulence and pasteurization
(B) Pasteurization and cavitation
(C) Pasteurization and pressurization
(D) Turbulence and cavitation

106. The lowest water activity a_w supporting the growth of Staphylococcus aureus in food under aerobic condition is

(GATE XL 2022)

(A) 0.98
(B) 0.91
(C) 0.89
(D) 0.86

107. Cultures used in industrial production of yogurt are

(GATE XL 2022)

(A) Lactococcus lactis subsp. lactis
(B) Streptococcus thermophilus
(C) Leuconostoc mesenteroides subsp. cremoris
(D) Lactobacillus delbrueckii subsp. bulgaricus

108. In a dairy plant, spray drying technology is used to produce whey powder. The rate of spray drying depends on

(GATE XL 2022)

(A) Temperature of the incoming air
(B) Shape of the cyclone separator
(C) Diameter of the whey droplet
(D) Heat transfer coefficient of hot air

109. The parboiling of paddy results into

(GATE XL 2022)

(A) Increase in the milling losses
(B) Increase in the nutritional value of rice
(C) Increase in the head rice recovery
(D) Increase in the broken rice percentage

110. One hundred kg paddy is dried from 18% wet basis to 13% wet basis moisture content. The amount of water removed (in kg) from the paddy is _____ (round off to one decimal place).

(GATE XL 2022)

111. In a canning industry, the total process time F_0 was calculated as 3 min. If each can contains 20 spores having decimal reduction time of 1.6 min, the probability of spoilage would be _____ in 100 cans (round off to the nearest integer).

(GATE XL 2022)

112. Match the edible oil refining stages given in Column I with their respective functions in Column II

(GATE XL 2022)

Column I	**Column II**
P. Degumming	1. Separation of waxes
Q. Neutralization	2. Removal of pigments
R. Bleaching	3. Removal of phosphatides
S. Winterization	4. Removal of free fatty acids

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

113. Make the correct pair of food packaging technology given in Column I with operating principle or description in Column II.

(GATE XL 2022)

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

114. Which of the following is not a caramel flavour producing compound?

(GATE XL 2022)

Column I	Column II
P. Aseptic packaging	1. Control of the concentration of O_2 and CO_2 inside the package
Q. Active packaging	2. Create a skin tight package wall
R. Modified atmosphere packaging	3. Independent sterilization of food and packaging material and packaging under sterile environment
S. Vacuum packaging	4. Makes non-passive contribution to product development

(A) 3-Hydroxy-2-methylpyran-4-one
(B) 2H-4-Hydroxy-5-methylfuran-3-one
(C) 3-Hydroxy-2-acetylfuran
(D) p-Amino benzoicacid

115. Match the size reduction equipment in Column I with the method of operation in Column II.
(GATE XL 2022)

Column I	Column II
P. Hammer mill	1. Compression
Q. Burr mill	2. Impact
R. Crushing rolls	3. Cutting
S. Rotary knife	4. Attrition

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

116. Most commonly used refrigerant in direct immersion freezing of food is
(GATE XL 2022)

(A) Monochlorodifluoromethane
(B) Dichlorodifluoromethane
(C) Liquid nitrogen
(D) Freon

117. Which among the following are $\omega - 6$ poly unsaturated essential fatty acids?
(GATE XL 2022)

(A) Linoleic acid
(B) α-Linolenic acid
(C) γ-Linolenic acid
(D) Arachidonic acid

118. Which among the following statements are true with respect to protein denaturation?
(GATE XL 2022)

(A) There may be an increase in α-helix and β-sheet structure
(B) It is an irreversible process
(C) When fully denatured, globular proteins resemble a random coil
(D) The peptide bonds are broken

119. Identify the correct pair(s) of milling equipment and the grain for which it is used.
(GATE XL 2022)

(A) Mist polisher–Rice
(B) Break roll–Wheat
(C) Rubber roll–Pigeon pea
(D) Beall degermer–Maize

120. Which among the following expression(s) is/are correct?
(GATE XL 2022)

(A) Reynolds number = $\frac{\text{Density}\times\text{Velocity}\times\text{Characteristic dimension}}{\text{Viscosity}}$

(B) Nusselt number = $\frac{\text{Convective heat transfer coefficient} \times \text{Characteristic dimension}}{\text{Thermal conductivity of solid}}$

(C) Schmidt number = $\frac{\text{Kinematic viscosity of fluid}}{\text{Diffusivity}}$

(D) Biot number = $\frac{\text{Convective heat transfer coefficient} \times \text{Characteristic dimension}}{\text{Thermal conductivity of fluid}}$

121. In a dairy processing plant, milk enters a 30 m long and 2 cm diameter tube at 60°C and leaves at 57°C. The total heat loss over the tube length is 381.15 W. The specific heat capacity, density, and viscosity of milk are 3.85 kJ kg^{-1} K^{-1}, 1020 kg m^{-3}, and 1.20 cP, respectively. The Reynolds number for the flow is _____ (round off to the nearest integer).

(GATE XL 2022)

Given: $\pi = 3.14$

122. The dry bulb temperature and relative humidity of air inside a storage chamber are 37°C and 50%, respectively. The saturation pressure of water vapour at 37°C and barometric pressure are 6.28 kPa and 101.32 kPa, respectively. The humidity ratio of air inside the chamber is _____ kg water (kg dry air)$^{-1}$ (round off to three decimal places).

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Given: Molecular weight of water vapour and dry air are 18.02 g mol^{-1} and 28.97 g mol^{-1}, respectively.