GATE 2014
XL: Life Sciences

EE25BTECH11049 - Sai Krishna Bakki

General Aptitude - GA

1. Choose the most appropriate word from the options given below to complete the following sentence. A person suffering from Alzheimer's disease _____ short-term memory loss. (GATE XL 2014)

(A) experienced
(B) has experienced
(C) is experiencing
(D) experiences

2. Choose the most appropriate word from the options given below to complete the following sentence. _____ is the key to their happiness; they are satisfied with what they have. (GATE XL 2014)

(A) Contentment
(B) Ambition
(C) Perseverance
(D) *Option D not provided*

3. Which of the following options is the closest in meaning to the sentence below?
"As a woman, I have no country." (GATE XL 2014)

(A) Women have no country.
(B) Women are not citizens of any country.
(C) Women's solidarity knows no national boundaries.
(D) Women of all countries have equal legal rights.

4. In any given year, the probability of an earthquake of Magnitude 6 occurring in the Garhwal Himalayas is 0.04. The average time between successive occurrences of such earthquakes is _____ years. (GATE XL 2014)

5. The population of a new city is 5 million and is growing at 20% annually. How many years would it take to double at this growth rate? (GATE XL 2014)

(A) 3-4 years
(B) 4-5 years
(C) 5-6 years
(D) 6-7 years

6. In a group of four children, Som is younger to Riaz. Shiv is elder to Ansu. Ansu is youngest in the group. Which of the following statements is/are required to find the eldest child in the group?
Statements:
   1. Shiv is younger to Riaz.
   2. Shiv is elder to Som.

(GATE XL 2014)

(A) Statement 1 by itself determines the eldest child.
(B) Statement 2 by itself determines the eldest child.
(C) Statements 1 and 2 are both required to determine the eldest child.
(D) Statements 1 and 2 are not sufficient to determine the eldest child.

7. Moving into a world of big data will require us to change our thinking about the merits of exactitude. To apply the conventional mindset of measurement to the digital, connected world of the twenty-first century is to miss a crucial point. As mentioned earlier, the obsession with exactness is an artefact of the information-deprived analog era. When data was sparse, every data point was critical, and thus great care was taken to avoid letting any point bias the analysis.
The main point of the paragraph is: (GATE XL 2014)

(A) The twenty-first century is a digital world
(B) Big data is obsessed with exactness
(C) Exactitude is not critical in dealing with big data
(D) Sparse data leads to a bias in the analysis

8. The total exports and revenues from the exports of a country are given in the two pie charts below. The pie chart for exports shows the quantity of each item as a percentage of the total quantity of exports. The pie chart for the revenues shows the percentage of the total revenue generated through export of each item. The total quantity of exports of all the items is 5 lakh tonnes and the total revenues are 250 crore rupees. What is the ratio of the revenue generated through export of Item 1 per kilogram to the revenue generated through export of Item 4 per kilogram?

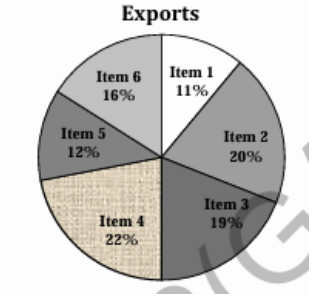


Fig. 1: Caption

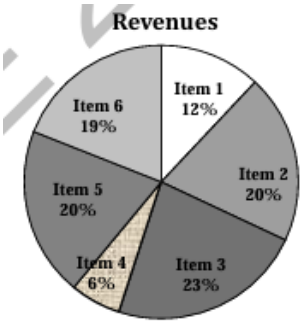


Fig. 2

(GATE XL 2014)

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

9. X is 1 km northeast of Y. Y is 1 km southeast of Z. W is 1 km west of Z. P is 1 km south of W. Q is 1 km east of P. What is the distance between X and Q in km? (GATE XL 2014)

(A) 1
(B) $\sqrt{2}$
(C) $\sqrt{3}$
(D) 2

10. 10% of the population in a town is HIV+. A new diagnostic kit for HIV detection is available; this kit correctly identifies HIV+ individuals 95% of the time, and HIV- individuals 89% of the time. A

particular patient is tested using this kit and is found to be positive. The probability that the individual is actually positive is _____ (GATE XL 2014)

END OF THE QUESTION PAPER

CHEMISTRY (XL-H)

1. Hybridizations of nitrogen in NO_2^+, NO_3^-, NH_4^+ respectively are: (GATE XL 2014)

(A) sp, sp2, sp3
(B) sp, sp3, sp2
(C) sp2, sp, sp3
(D) sp3, sp2, sp

2. Potassium metal crystallizes in body-centered cubic structure. The number of atoms per unit cell is: (GATE XL 2014)

(A) one
(B) two
(C) three
(D) four

3. Assuming ideal condition, the solution that has the highest freezing point is: (GATE XL 2014)

(A) 0.002 M aqueous solution of copper nitrate
(B) 0.001 M aqueous solution of potassium dichromate
(C) 0.001 M aqueous solution of sodium chloride
(D) 0.002 M aqueous solution of magnesium chloride

4. The major product formed in the following reaction is:

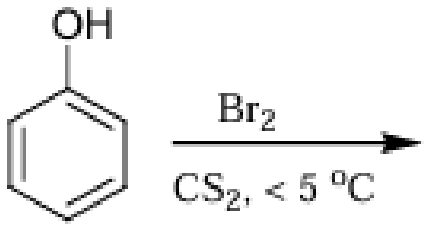
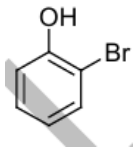
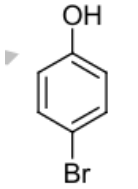
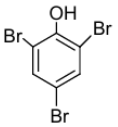


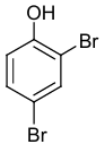
Fig. 3

(GATE XL 2014)

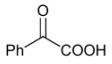
(A) 

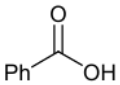
(B) 

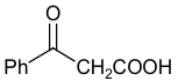
(C) 

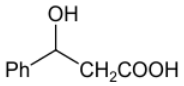
(D) 

5. The acid that undergoes decarboxylation most readily upon heating is: (GATE XL 2014)

(A) 

(B) 

(C) 

(D) 

6. A ball of mass 330 g is moving with a constant speed, and its associated de Broglie wavelength is 1 x 10^{-33} m. The speed of the ball is _____ m/s. (h = 6.6 x 10^{-34})
(GATE XL 2014)

7. Diphosphonic acid $H_4P_2O_5$ has no P–P bond. This acid is:
(GATE XL 2014)

(A) tetrabasic
(B) tribasic
(C) dibasic
(D) monobasic

8. The magnetic moment of an octahedral Co(II) complex is 4.0 μ_B. The CFSE (in Δ_o units) is:
(GATE XL 2014)

9. The complex ion $[Cr(H_2O)_6]^{3+}$ exhibits: (GATE XL 2014)

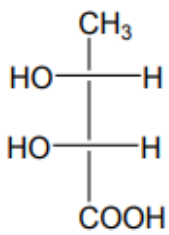
(A) slightly distorted octahedral geometry
(B) tetragonally elongated octahedral geometry
(C) tetragonally compressed octahedral geometry
(D) perfect octahedral geometry

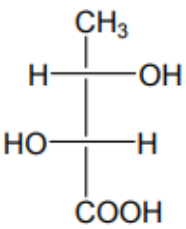
10. Assuming ideal behavior, the density of fluorine gas at 20°C and 0.3 atm is _____ g L^{-1}.
(GATE XL 2014)
(Molecular weight of F_2 = 38 g mol^{-1}, R = 0.082 L atm mol^{-1} K^{-1})

11. For a first order reaction, the time required for 50% completion is 20 minutes. The time required for 99.9% completion of the reaction is _____ minutes.
(GATE XL 2014)

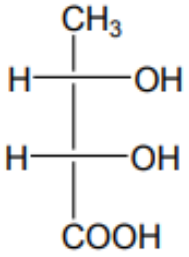
12. At 298 K, the bond dissociation energies of C–H, C–C and C=C are 415, 344 and 615 kJ mol^{-1}, respectively. The enthalpy of atomization of carbon is 717 kJ mol^{-1} and that of hydrogen is 218 kJ mol^{-1}. The heat of formation of naphthalene at 298 K is _____ kJ mol^{-1}.
(GATE XL 2014)

13. The Fischer projection that represents (2R,3S)-2,3-dihydroxybutanoic acid is:
(GATE XL 2014)

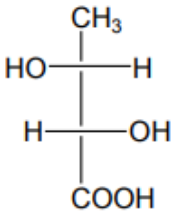
(A) 

(B) 

(C)

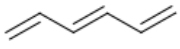


(D)

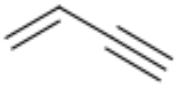


14. A hydrocarbon undergoes ozonolysis to form formaldehyde and glyoxal. The compound is:
(GATE XL 2014)

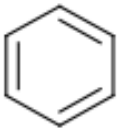
(A)



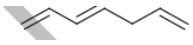
(B)



(C)

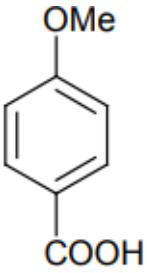


(D)



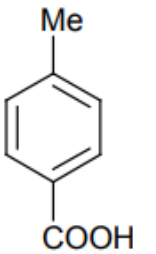
15. The order of acidity of the following acids is:
(GATE XL 2014)

(A)



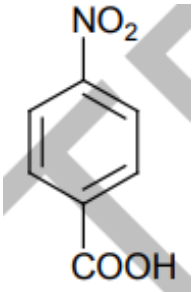
(1)

(B)



(2)

(C)



(3)

(D)

(4)

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

END OF THE QUESTION PAPER

BIOCHEMISTRY (XL-I)

1. During an enzyme catalyzed reaction, the equilibrium constant: (GATE XL 2014)

(A) increases
(B) decreases
(C) remains unchanged
(D) may increase or decrease

2. A mixture of Arginine, Phenylalanine and Histidine was separated by cation exchange chromatography at pH 7. Order of elution is: (GATE XL 2014)

(A) Arg, His, Phe
(B) Phe, His, Arg
(C) His, Phe, Arg
(D) Arg, Phe, His

3. Which protease does **NOT** cleave after arginine? (GATE XL 2014)

(A) Trypsin
(B) Proteinase K
(C) Thrombin
(D) Chymotrypsin

4. The receptor for epinephrine is: (GATE XL 2014)

(A) Tyrosine kinase receptor
(B) Serine-threonine kinase receptor
(C) G-protein coupled receptor
(D) Ligand activated transcription factor

5. Choose the option with two reducing sugars: (GATE XL 2014)

(A) Lactose, Maltose
(B) Trehalose, Sucrose
(C) Maltose, Trehalose
(D) Lactose, Sucrose

6. The affinity of an antibody can be determined by: (GATE XL 2014)

(A) MALDI-TOF MS
(B) Isoelectric focusing
(C) SDS-PAGE
(D) Equilibrium dialysis

7. Which molecule is an allosteric activator of PFK-1? (GATE XL 2014)

(A) Fructose-1,6-bisphosphate
(B) Fructose-2,6-bisphosphate
(C) Glucose-6-phosphate
(D) Citrate

8. For a single substrate enzyme, a reaction is carried out at a substrate concentration four times the value of K_m. The observed initial velocity will be _____ % of $V_{\max}$.
(GATE XL 2014)

9. Consider the following biochemical reaction:

$$\text{Fructose 6-phosphate} + \text{ATP} \longrightarrow \text{Fructose 1,6-bisphosphate} + \text{ADP}$$

The equilibrium constant under biochemical standard conditions (K'_{eq}) for the above reaction is 254. The standard free energy change ($\Delta G^{\circ'}$) for the conversion of fructose 6-phosphate is _____ kJ/mol.

10. Given below is the hydropathy plot of a monomeric transmembrane protein.

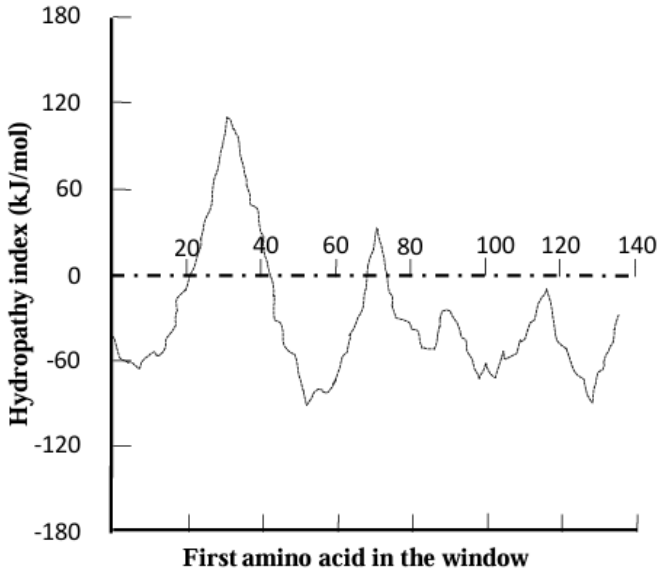


Fig. 4: Caption

(GATE XL 2014)

(A) 1
(B) 2
(C) 4
(D) 5

11. An aqueous solution contains two compounds X and Y. This solution gave absorbance values of 1.0 and 0.4 at 220 and 280 nm, respectively, in a 1 cm path length cell. Molar absorption coefficients (ε) of the compounds X and Y are as shown in the table below. The concentration of Y in the solution is _____ mM. (GATE XL 2014)

	ε_{220} ($M^{-1}cm^{-1}$)	ε_{280} ($M^{-1}cm^{-1}$)
Compound X	1000	200
Compound Y	800	400

12. A purified oligomeric protein was analyzed by SDS-PAGE under reducing and non-reducing conditions. A one litre solution of 1 mg/mL concentration has 4.01×10^{18} molecules of the oligomeric protein. Based on the data shown below, deduce the total number of polypeptide chains that constitute this protein.

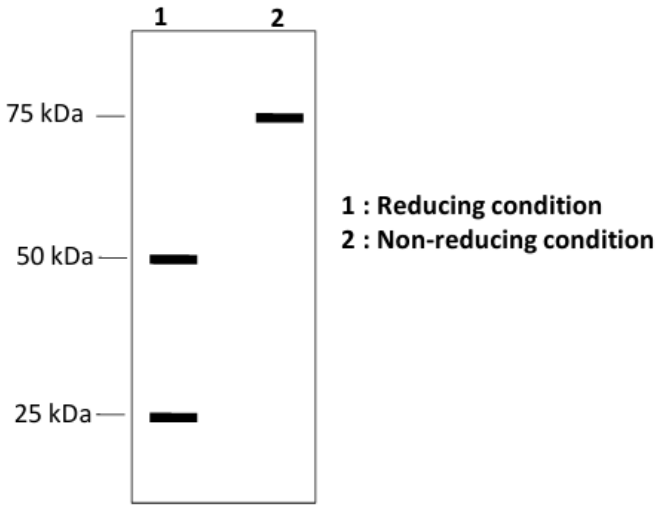


Fig. 5: Caption

(GATE XL 2014)

(A) 2
(B) 4
(C) 6
(D) 12

13. The concentration of Mg^{2+} ions outside a cell is twice the concentration inside. If the transmembrane potential of the cell is −60 mV (inside negative), the free energy change of transporting Mg^{2+} ions across the membrane against the concentration gradient at 37 °C is _____ kJ/mol.
(Faraday constant: 96.5 kJ/V mol)
(GATE XL 2014)

14. Match the entries in Group I with those in Group II:

Group I
P) J chain
Q) Serpin
R) β_2-microglobulin
S) Artemis

Group II
(A) VDJ recombinase complex
(B) Component of MHC class I
(C) B cell co-receptor complex
(D) C1 complement inhibitor
(E) Component of MHC class II
(F) Multimerization of IgA and IgM

(GATE XL 2014)

(A) P-3, Q-4, R-5, S-1
(B) P-6, Q-5, R-2, S-3
(C) P-6, Q-4, R-2, S-1
(D) P-3, Q-4, R-1, S-6

15. The kinetic data for a single substrate enzyme is shown below. The concentration of inhibitor [I] used in the reaction was equal to the K_i of the inhibitor. The K_m value of an uninhibited reaction is 2×10^{-5} M. In the presence of the inhibitor, the observed K_m value is _____ $\times 10^{-5}$ M.
(GATE XL 2014)

16. One litre of phosphate buffer was prepared by adding 208 g of Na_2HPO_4 (Mol. wt. 142) and 71 g of NaH_2PO_4 (Mol. wt. 120) in water. If the pK_a for the dissociation of $H_2PO_4^-$ into HPO_4^{2-} and H^+ is 6.86, the pH of the buffer will be _____.

(GATE XL 2014)

17. Shown below is an electrospray ionization mass spectrum of a protein.

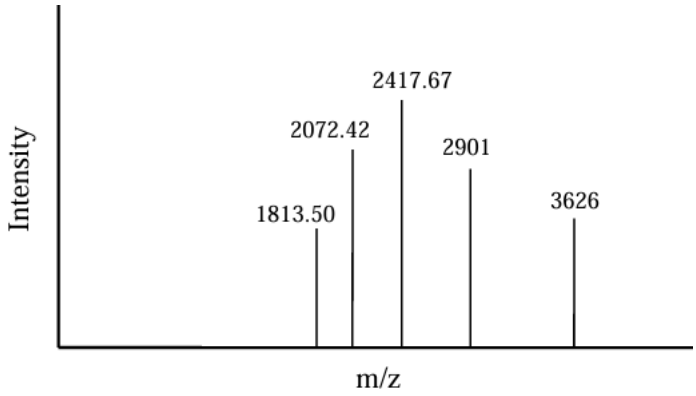


Fig. 6: Caption

The numbers on top of the peaks are the m/z values. The mass of the protein deduced from the given data is _____ kDa.
(GATE XL 2014)

18. A human gene has only three exons (I, II, and III in the given order). Total RNA was isolated from cultured human kidney cells and reverse transcribed. The resultant cDNA was used as a template in a PCR reaction containing a forward primer specific to Exon I and a reverse primer specific to Exon III. When the PCR product was analyzed by gel electrophoresis, two bands were observed of sizes 2.5 kb and 1 kb. However, when Northern blotting was performed with the same total RNA using a radiolabeled probe specific to Exon II, only one band was observed. Based on these observations, which one of the following statements is **FALSE**? (GATE XL 2014)

(A) Northern blotting with a probe specific to Exon III will show two bands. (GATE XL 2014)

(B) The gene codes for two mRNA splice variants.
(C) If the forward primer were specific to Exon II, two bands will be observed.
(D) The Exon II is 1.5 kb in size.

19. Using Sanger's dideoxy chain termination method, a particular exonic region of a protein coding gene was sequenced for two individuals (Subject 1 and Subject 2). The figure shows a segment of the autoradiogram corresponding to a small window of the DNA sequence. Which one of the following interpretations is correct for the sequenced DNA fragments?

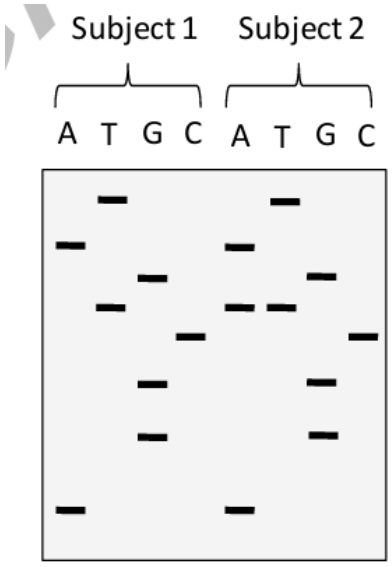


Fig. 7

(GATE XL 2014)

(A) Subject 2 has two allelic variants.
(B) Subject 1 has the sequence 5'-TAGTCGGA-3'.
(C) Subject 2 has the sequence 5'-AGGCTAGAT-3'.
(D) Subject 1 has a single nucleotide deletion in the gene.

20. A 7 kb DNA molecule of a specific sequence has two EcoRI and one PvuII restriction endonuclease sites. The restriction sites are shown below. The DNA was completely digested with both EcoRI and PvuII. The digestion product was purified and added to an appropriately buffered reaction mixture at 37°C, which contained the Klenow fragment of DNA polymerase I and α-^{32}P dNTPs. After one hour, the DNA in the reaction product was purified and analyzed by electrophoresis. The bands were visualized by both ethidium bromide (EtBr) staining and autoradiography. The result is shown below. Which one of the following restriction maps is in agreement with the above result?

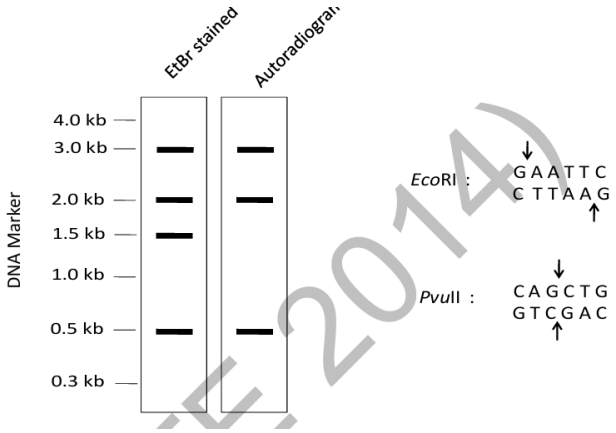
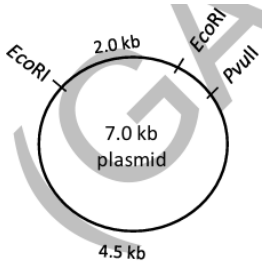


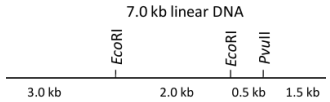
Fig. 8: Caption

(GATE XL 2014)

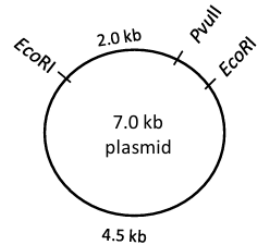
(A)



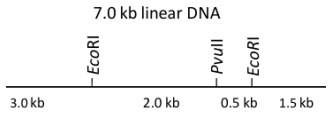
(B)



(C)



(D)



END OF THE QUESTION PAPER

Botany Section

1. Plant which grows attached to another plant species but is not a parasitic is known as (GATE XL 2014)

(A) Endophyte
(B) Halophyte
(C) Epiphyte
(D) Lithophyte

2. An ideal cybrid should have (GATE XL 2014)

(A) both nuclear genome and cytoplasmic genome equally from both the parents
(B) nuclear genome from one of the parents and cytoplasmic genome from other parent
(C) nuclear genome predominantly/exclusively from one of the parents and cytoplasmic genome equally from both the parents
(D) nuclear genome equally from both the parents and cytoplasmic genome predominantly/ exclusively from one of the parents

3. Transmission Electron Micrograph of fungal cell can usually be distinguished from plant cell due to lack of P and having less abundant Q. Find the correct combination of P and Q. (GATE XL 2014)

(A) P- Plastid; Q-Vacuoles
(B) P- Plastid; Q-Mitochondria
(C) P- Plastid; Q-Endoplasmic reticulum
(D) P- Mitochondria; Q-Plastid

4. Identify the **CORRECT** answer
RNA interference (RNAi)
P. is an event of post transcriptional gene silencing
Q. works through RNA induced silencing complex (GATE XL 2014)

(A) P only
(B) Q only
(C) Both P and Q
(D) neither P nor Q

5. Find the odd one out (GATE XL 2014)

(A) Petal
(B) Sepal
(C) Petiole
(D) Tepal

6. **Plantibody** is the (GATE XL 2014)

(A) **Antibody** expressed in transgenic plant
(B) **Transgenic plant** that expresses antibody
(C) **Antibody** against plant based antigen
(D) **Transgenic plant** that expresses antigen

7. In a typical oil-seed crop, the matured seeds are enriched with (GATE XL 2014)

(A) Phospholipid
(B) Galactolipid
(C) Neutral lipid
(D) Sphingolipid

8. Match the following products (Column I) with the corresponding plant species (Column II): (GATE XL 2014)

Column I: P. Saffron, Q. Gamboge, R. Litmus, S. Turmeric
Column II: 1. Garcinia sp., 2. Rocella tinctoria, 3. Crocus sativus, 4. Curcuma sp.

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

9. The semi-dwarf trait of corn, wheat and rice plants used in breeding program during 1960s resulted in green revolution. Later this 'green-revolution gene' has been identified to be involved in either signal transduction pathway or biosynthesis of (GATE XL 2014)

(A) Auxin
(B) Gibberellin
(C) Cytokinin
(D) Ethylene

10. In classical model to explain the plant-pathogen interaction, the host will not develop the disease upon the pathogen attack when (GATE XL 2014)

(A) The resistance gene (R) is non-functional
(B) The avirulence gene (Avr) is non-functional
(C) Both R and Avr are non-functional
(D) Both R and Avr are functional

11. Select the CORRECT combination from the promoter (Column I), transcription machinery used (Column II) and target tissue type (Column III) to express a foreign gene in a plant system.

Column I	Column II	Column III
P. Ubiquitin	1. Chloroplast	i. Leaf
Q. Napin	2. Nucleus	ii. Seed
R. RbcL	3. Mitochondria	
S. RbcS		

(GATE XL 2014)

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

12. In a plant species, flower colour purple is dominant over white. One such purple-flowered plant upon selfing produced 35 viable plants, of which 9 were white-flowered and the rest were purple-flowered. What fraction of these purple-flowered progeny is expected to be pure purple-flowered line? (GATE XL 2014)

(A) $\frac{1}{2}$
(B) $\frac{1}{3}$
(C) $\frac{1}{4}$
(D) $\frac{2}{3}$

13. Following diagram represents the sequence of genes in a normal chromosome of a plant species. Match the CORRECT combination for chromosomal mutation using Column I and Column II.

Column I	Column II
P.GHIKL JMN	1. Tandem duplication
Q.GJ KLHIMN	2. Deletion
R.GHIJ KLKLMN	3. Pericentric inversion
S.GHJ KLMN	4. Non-reciprocal translocation

(GATE XL 2014)

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

14. Match the nuclei status of mutant plant (Column I) with the typical chromosome number (Column II), when the wild type plant species is having 2N = 46 chromosomes.

Column I	Column II
P. Trisomic	1. 23
Q. Triploid	2. 45
R. Monosomic	3. 47
S. Monoploid	4. 69

(GATE XL 2014)

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

15. Match the following reporter genes used in plant transformation experiments with the source of gene and detection/assay system.

Reporter gene	Source	Detection/assay
P. β-glucuronidase	3. E. coli	i. Radioactive assay
Q. Green fluorescence protein	1. Aequorea victoria	ii. Fluorimetric
R. Luciferase	2. Photinus pyralis	iii. Fluorescence
S. Chloramphenicol acetyl transferase		iv. Luminescence

(GATE XL 2014)

(A) P-3-i, Q-1-ii, R-2-iii, S-3-iv
(B) P-3-ii, Q-1-iii, R-2-iv, S-3-i
(C) P-2-ii, Q-1-iii, R-3-iv, S-1-i
(D) P-1-ii, Q-2-iii, R-3-i, S-3-iv

16. Find the CORRECT statements in the context of Global warming effect on plant photosynthesis. (GATE XL 2014)

(A) P & Q
(B) R & S
(C) P & R
(D) P & S

17. Statements given below are either TRUE (T) or FALSE (F). Find the correct combination. (GATE XL 2014)

(A) P-T, Q-F, R-T, S-F
(B) P-T, Q-T, R-T, S-F
(C) P-T, Q-F, R-F, S-T
(D) P-T, Q-F, R-T, S-T

18. Match the following diagrams P, Q, R, and S with the inflorescence type (Column I) and the corresponding plant species (Column II).

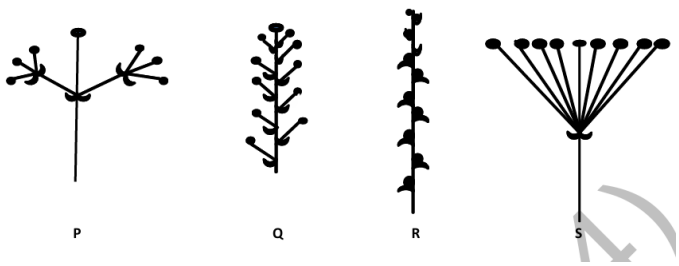


Fig. 9

Column I	Column II
1. Umbel	i. Pedicularis sp.
2. Raceme	ii. Smilacina sp.
3. Compound determinate	iii. Epilobium sp.
4. Spike	iv. Pelargonium sp.

(GATE XL 2014)

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

19. Find the right combination for P, Q, R and S with respect to gametophyte development in flowering plants. (GATE XL 2014)

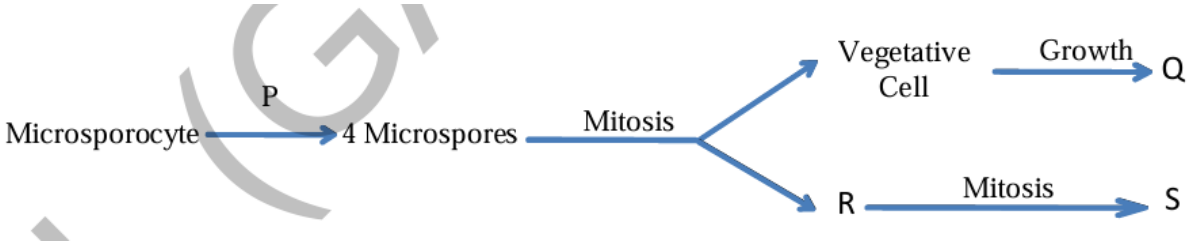


Fig. 10: Caption

(A) P-Meiosis, Q-Generative cell, R-Pollen Tube, S-2 Sperm Cells
(B) P-Meiosis, Q-Pollen Tube, R-Generative Cell, S-2 Sperm Cells
(C) P-Mitosis, Q-Generative Cell, R-Pollen Tube, S-2 Sperm Cells
(D) P-Growth, Q-2 Sperm Cells, R-Pollen Tube, S-Generative Cell

20. Match the definition (Column I) with the type of plant community (Column II).

Column I	Column II
P. Occupation of an area by plant communities to maturity	1. Formation
Q. A major ecological unit of vegetation	2. Consociation
R. A smaller unit of plant association	3. Faciation
S. Subdivision of plant association (minor temp/moisture)	4. Plant succession

(GATE XL 2014)

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

END OF THE QUESTION PAPER

Microbiology Section

1. Most viral capsids have (GATE XL 2014)

(A) 08 faces
(B) 12 faces
(C) 16 faces
(D) 20 faces

2. Intergenic suppression involves mutation in (GATE XL 2014)

(A) rRNA
(B) mRNA
(C) tRNA
(D) cDNA

3. Which one of the following proteins does **NOT** bind to a gaseous ligand? (GATE XL 2014)

(A) Leghemoglobin
(B) Carbonic anhydrase
(C) Nitrogenase
(D) NADPH oxidase

4. A bacterial culture (5×10^8 cells/ml) is maintained in a chemostat of working volume 10 L. If the doubling time of the bacteria is 50 min, the required rate of flow of nutrients (in ml/min) is _____. (GATE XL 2014)

5. Rheumatic fever is an example of (GATE XL 2014)

(A) autoimmune disease
(B) type IV hypersensitive reaction
(C) immunodeficiency disease
(D) neurodegenerative disorder

6. Oxygenases that catalyse the initial step in the degradation of polycyclic aromatic hydrocarbons by using molecular oxygen belong to which enzyme class? (GATE XL 2014)

(A) Hydrolase
(B) Transferase
(C) Lyase
(D) Oxido-reductase

7. Which one of the following is **NOT** involved in horizontal gene transfer? (GATE XL 2014)

(A) Conjugation
(B) Transformation
(C) Transduction
(D) Mutation

8. The principle of immunization was first explained by (GATE XL 2014)

(A) Edward Jenner
(B) Elie Metchnikoff
(C) Louis Pasteur
(D) Robert Koch

9. Lysozyme catalyzes the breakdown of (GATE XL 2014)

(A) NAG-NAM
(B) lipopolysaccharide
(C) teichoic acid
(D) lipoprotein A

10. Which one of the following microscopic techniques can be used to study the contour of proteins? (GATE XL 2014)

(A) SEM
(B) TEM
(C) AFM
(D) Confocal microscopy

11. Match compounds in Group I with inhibitory activities in Group II.

Group I	Group II
(P) Vancomycin	(i) Folate metabolism
(Q) Rifampin	(ii) DNA synthesis
(R) Puromycin	(iii) Protein synthesis
(S) Ciprofloxacin	(iv) RNA synthesis
	(v) Cell wall synthesis

(GATE XL 2014)

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

12. Match the organisms with the appropriate growth curves.
(P) Bacteria
(Q) Extracellular virus
(R) Intracellular virus

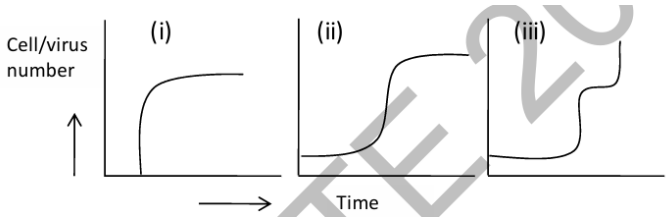


Fig. 11

(GATE XL 2014)

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

13. The length of a coding region in an mRNA is 897 bases. How many amino acids will be there in the polypeptide synthesized using this mRNA? (GATE XL 2014)

(A) 297
(B) 298
(C) 299
(D) 897

14. Match the media in Group I for screening microbial isolates in Group II.

Group I	Group II
(P) Blood agar media	(i) Coliforms
(Q) Minimal media	(ii) Protease producers
(R) Skimmed milk agar media	(iii) Hemolytic microbes
(S) Bile salt media	(iv) Lipase producers
	(v) Autotrophs

(GATE XL 2014)

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

15. During a bacterial growth experiment, the total viable cell count at 2 h and 6 h was 1×10^4 cells/ml and 1×10^9 cells/ml, respectively. The specific growth rate (in h^{-1}) of the culture is _____. (GATE XL 2014)

16. The concentration of sodium chloride in the cytoplasm of a *Halobacterium* sp. was found to be 250 ng/nl. The molarity (in M) of sodium chloride is _____. (GATE XL 2014)

17. Match organisms in Group I with shapes in Group II and flagellar arrangements in Group III.

Group I	Group II	Group III
(P) Salmonella typhi	(i) Helical	(1) Non-motile
(Q) Saccharomyces cerevisiae	(ii) Rod	(2) Amphitrichous
(R) Aquaspirillum serpens	(iii) Curved rod	(3) Peritrichous
(S) Vibrio cholerae	(iv) Ovoid	(4) Polar

(GATE XL 2014)

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

18. Lethal dose curves of different microorganisms (1, 2, 3 and 4) are shown below. Which of these organisms is most pathogenic?

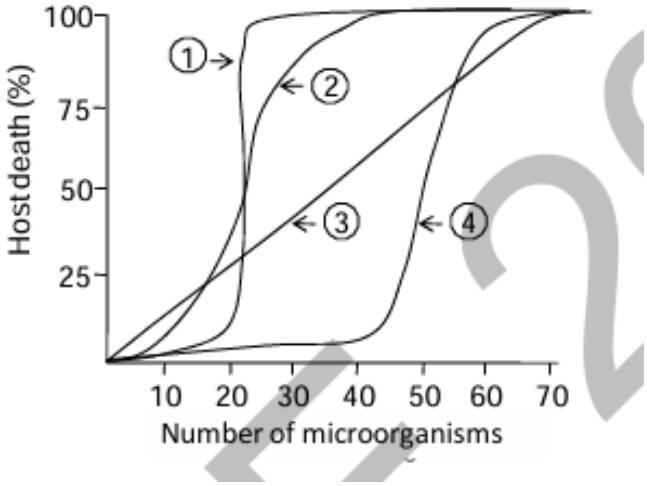


Fig. 12

(GATE XL 2014)

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

19. The 16S rRNA sequence is widely used in bacterial systematics because it is (GATE XL 2014)

(A) Highly conserved
(B) Short length
(C) Unique to each strain
(D) Encoded by plasmids

20. Which of the following methods is best suited to isolate pure colonies from a mixed bacterial culture? (GATE XL 2014)

(A) Pour plate method
(B) Streak plate method
(C) Spread plate method
(D) Roll tube method

END OF THE QUESTION PAPER

Zoology Section

1. Small geographic areas with high concentrations of endemic species and a large number of endangered and threatened species are known as (GATE XL 2014)

(A) endemic sinks
(B) critical communities
(C) biodiversity hot spots
(D) endemic metapopulations

2. Which ONE of the following animals has ”Osculum” as an excretory structure? (GATE XL 2014)

(A) Hydra
(B) Sponge
(C) Jelly Fish
(D) Sea pen

3. During development of which ONE of the following organisms, bilateral meroblastic cleavage is found? (GATE XL 2014)

(A) Mollusc
(B) Fish
(C) Bird
(D) Amphibian

4. The mitochondrion is NOT considered a part of the endomembrane system on account of which ONE of the following reasons? (GATE XL 2014)

(A) It does not undergo structural changes
(B) It is not derived from the ER or Golgi
(C) It does not synthesize proteins
(D) It is not attached to the outer nuclear envelope

5. The end products of glycolysis include ATP, (GATE XL 2014)

(A) CO_2 and H_2O
(B) H_2O and pyruvate
(C) NADH and pyruvate
(D) CO_2 and NADH

6. The TATA box is found in the vicinity of the transcription start site. The role of this box is to (GATE XL 2014)

(A) serve as a ribosome recruitment site
(B) serve as RNA polymerase binding site
(C) provide 3-D structural integrity to a DNA molecule
(D) act as a terminator sequence

7. Which ONE of the following processes does NOT occur in prokaryotic gene expression, but occurs in eukaryotic gene expression? (GATE XL 2014)

(A) Transcription of mRNA, tRNA, and rRNA
(B) Binding of RNA polymerase to the promoter
(C) Addition of a poly-A tail to the 3’ end and the 5’ capping of an mRNA
(D) Translation begins as soon as transcription is initiated

8. In Graves’ disease, the presence of auto antibodies against which ONE of the following molecules is the direct cause of hyperthyroidism? (GATE XL 2014)

(A) Thyroperoxidase
(B) Thyroxine
(C) Thyroid stimulating hormone
(D) Thyroid stimulating hormone receptor

9. In mammals, the two important organs associated with the production and elimination of urea are (GATE XL 2014)

(A) gastrointestinal tract and lungs
(B) gastrointestinal tract and liver
(C) kidneys and lungs
(D) liver and kidneys

10. Some endocrine glands produce hormones that stimulate functions of other endocrine glands. Which ONE of the following hormones specifically acts to increase secretion of other hormones? (GATE XL 2014)

(A) Thyroxine
(B) Prolactin
(C) ACTH
(D) ADH

11. If the recombination frequency between X - Y loci is 12, X - Z loci is 4, and Y - Z loci is 8, then the order of the loci on the chromosome is (GATE XL 2014)

(A) X-Y-Z
(B) Y-X-Z
(C) X-Z-Y
(D) Z-Y-X

12. A cross is made between a white eyed-miniature winged female with a red eyed-normal winged male of *Drosophila melanogaster*. Further crossing of F1 female offspring from this cross with a white eyed-miniature winged male fly gave 95 white eyed-normal winged, 102 red eyed-miniature winged, 226 red eyed-normal winged, and 202 white eyed-miniature winged offspring in F2 generation. What is the percent frequency of recombination between the two genes? (GATE XL 2014)

(A) 20.11
(B) 31.52
(C) 49.10
(D) 34.12

13. A green fluorescent protein (GFP) encoding gene is fused to a gene encoding specific protein for expression in cells. What is the advantage of using GFP over staining cells with fluorescently labeled antibodies that bind to the target protein? (GATE XL 2014)

(A) It bleaches less compared to fluorescent probes
(B) It allows imaging at higher resolution than fluorescent probes
(C) It provides more precise location of the protein than fluorescent probes
(D) Its fusion allows tracking the location of the protein in living cells, while staining usually requires fixation of cells

14. A newborn was accidentally given a drug that destroyed the thymus. Which ONE of the following would be the most likely outcome? (GATE XL 2014)

(A) Lack of class I MHC molecules
(B) Inability to rearrange antigen receptors
(C) Inability to differentiate to mature T cells
(D) Reduction in T-independent number of B cells

15. One individual has a parasitic worm infection and another is responding to an allergen such as pollen. Which ONE of the following features is common to both of them? (GATE XL 2014)

(A) Increase in cytotoxic T cell population
(B) Risk of developing an autoimmune disease
(C) Reduced innate immune response
(D) Increased levels of IgE

16. Five dialysis bags (DB1-DB5), impermeable to sucrose, were filled with various concentrations of sucrose. The bags were placed in separate beakers containing 0.6 M sucrose solution. Every 10 minutes, the bags were weighed and the percent change in mass of each bag was plotted as a function of time.

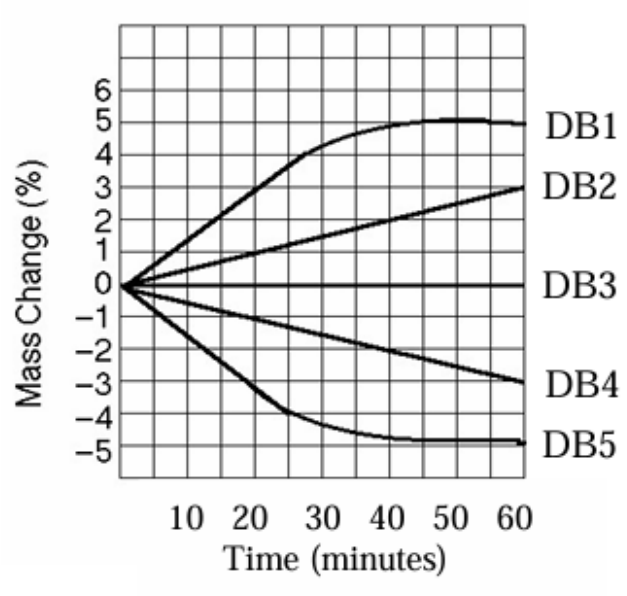


Fig. 13

Which plot in the graph represent(s) bags containing a solution that is hypertonic at 50 minutes? (GATE XL 2014)

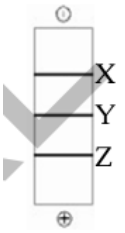
(A) DB2
(B) DB4
(C) DB3
(D) DB4 and DB5

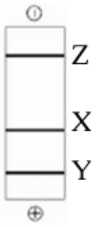
17. Which ONE of the following combinations of products will result, when 3 molecules of acetyl CoA is fed into TCA cycle? (GATE XL 20184)

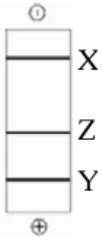
(A) 1 ATP, 2 CO_2, 3 NADH, and 1 $FADH_2$
(B) 3 ATP, 6 CO_2, 9 NADH, and 3 $FADH_2$
(C) 3 ATP, 3 CO_2, 3 NADH, and 3 $FADH_2$
(D) 38 ATP, 6 CO_2, 3 NADH, and 12 $FADH_2$

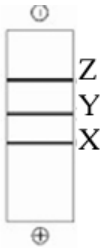
18. A DNA fragment shown below has restriction sites I and II, which create fragments X, Y, and Z. Which ONE of the following agarose gel electrophoresis patterns represents the separation of these fragments? (GATE XL 2014)

Fig. 14

(A)


(B)


(C)


(D)


19. Theoretically, it is possible to resurrect the extinct woolly mammoth by which ONE of the following methods? (GATE XL 2014)

(A) Transferring cell nuclei from the frozen tissue into enucleated unfertilized eggs of a suitable mammal
(B) Introducing sequenced mammoth genome into donor eggs of a suitable mammal
(C) Transferring mammoth nuclear material into stem cells
(D) Collection of oocytes from ovaries of the frozen mammoth for in vitro fertilization and transfer of fertilized eggs into animals such as elephants

20. Regions of higher abundance of cholesterol molecules on the plasma membrane will (GATE XL 2014)

(A) be more fluid
(B) result in clogged arteries as it can detach from the plasma membrane
(C) be more rigid than the surrounding membrane
(D) have higher rates of lateral movement of proteins into and out of plasma membrane

END OF THE QUESTION PAPER

Food Technology

1. Which one of the following is NOT a source of caffeine? (GATE XL 2014)

(A) Coffee
(B) Cocoa beans
(C) Corn syrup
(D) Tea leaves

2. Yoghurt is prepared using a pair of microorganisms. Choose the correct pair from the following: (GATE XL 2014)

(A) *Lactobacillus bulgaricus*, *Streptococcus thermophilus*
(B) *Lactobacillus lactis*, *Streptococcus thermophilus*
(C) *Lactobacillus bulgaricus*, *Streptococcus lactis*
(D) *Lactobacillus lactis*, *Streptococcus lactis*

3. Choose the target organism for milk pasteurization from the following: (GATE XL 2014)

(A) *Mycobacterium tuberculosis*
(B) *Coxiella burnetii*
(C) *Clostridium botulinum*
(D) *Bacillus cereus*

4. Hypobaric storage is also known as _____ (GATE XL 2014)

(A) Modified atmospheric storage
(B) Controlled atmospheric storage
(C) Low pressure storage
(D) Modified aseptic package

5. In a solution of vegetable oil (molecular mass = 292 kg $kmol^{-1}$) and ethanol (molecular mass = 46 kg $kmol^{-1}$), the concentration of vegetable oil in the solution is measured to be 60% (total mass basis). Therefore, mole fraction of ethanol in the solution is _____ (GATE XL 2014)

6. An experiment started with 4 numbers of bacterial cells. After n^{th} generation, number of cells becomes 128. Therefore, value of n is _____ (GATE XL 2014)

7. One ton of refrigeration will cause one of the following options:

(A) Cooling provided by one kg of ice in one hour
(B) Cooling provided by one ton of ice in one hour
(C) Energy extract to freeze one ton of water in one day
(D) Coefficient of performance is unity

(GATE XL 2014)

8. Fruit juice is flowing in a circular pipe (inner diameter 2 cm) at a mass flow rate of 2 kg s^{-1} and at a temperature of 25°C. The density and viscosity of the juice at 25°C are 1045 kg m^{-3} and 0.5 Pa s, respectively. Take $\pi = 22/7$. The Reynolds number for this flow will be _____
(GATE XL 2014)

9. Shear stress (τ) and shear rate (γ) relationship of a pseudoplastic fluid follows the Power law equation given by, $\tau = k\gamma^n = 2.6\,\gamma^{0.48}$, where 'n' and 'k' are flow behavior index and consistency index respectively. The apparent viscosity (μ_a) of the fluid at a shear rate of 5 s^{-1} is _____ Pa s.
(GATE XL 2014)

10. In a sterilization process, $D_{121.1}$ value of the target organism is 0.22 minute. Time required for 99.999% inactivation of the target organism at 121.1°C will be _____ minutes. (GATE XL 2014)

11. A centrifuge having diameter of 10 cm is rotating at 10000 rpm. Take $\pi = 22/7$ and $g = 9.81\, m\, s^{-2}$. The ratio of centrifugal force to gravitational force will be _____. (GATE XL 2014)

12. Match the items under Group I with items under Group II (GATE XL 2014)

Group I	**Group II**
P. Threonine	1. Fatty acid
Q. Pyridoxine phosphate	2. Sugar
R. Xylose	3. Amino acid
S. Oleic acid	4. Co-enzyme

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

13. Match the items under Group I with items under Group II (GATE XL 2014)

Group I	**Group II**
P. Iron	1. Osteoporosis
Q. Calcium	2. Anemia
R. Zinc	3. Goiter
S. Iodine	4. Dwarfism

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

14. In a counter-current double pipe heat-exchanger, milk is cooled from 110 to 40°C using chilled water as coolant. Water enters at 5°C and leaves at 60°C. Heat flux for the system with overall heat transfer coefficient of 950 W m^{-2} K^{-1} will be _____ W m^{-2}. (GATE XL 2014)

15. Saturated steam at 100°C is injected at 0.2 kg s^{-1} into air stream flowing at 3 kg s^{-1} and 25°C. Air contains 0.012 kg moisture per kg dry air. If the atmospheric pressure is 101.1 kPa, absolute humidity of air will be _____ kg kg^{-1}. (GATE XL 2014)

16. In an evaporator, milk is concentrated from 9.8% TSS to 52% TSS. Assume the solutes in the milk are non-volatile. The amount of vapour produced for 100 kg feed will be _____ kg. (GATE XL 2014)

17. Water enters a cylindrical tank at a steady uniform rate of 0.1 m^3 s^{-1}; simultaneously water is discharged from the tank through an orifice (area 0.05 m^2) located at the bottom of the tank. Initial level of water in the tank from the bottom is 5 m. If the acceleration due to gravity = 9.81 m s^{-2} and coefficient of discharge = 0.30, the final value of the steady-state height of water level from the bottom of tank is _____ m. (GATE XL 2014)

18. Match the following between Group I and Group II in relation to pretreatments. (GATE XL 2014)

Group I	**Group II**
P. Ascorbic acid dip	1. Sogginess in fruits
Q. Heat blanching	2. Minimizes fruit oxidation
R. Deaeration	3. Melting of fat in meat
S. Rendering	4. Removal of odours
	5. Minimizes destruction of vitamin C

(A) P-1, Q-2, R-3, S-4
(B) P-2, Q-1, R-5, S-3
(C) P-1, Q-3, R-4, S-5
(D) P-3, Q-4, R-5, S-2

19. A chocolate mix at 100°C is flowing through a 2 cm diameter and 4 m long stainless steel tube at 13.2 kg per minute. The density of the mix is 1750 kg m^{-3} and its viscosity at 100°C is 2 Pa s. Take $\pi = 22/7$. The pressure drop for this flow will be _____ Pa. (GATE XL 2014)

20. In a tray dryer, 100 kg of a vegetable material in a suitably reduced form is dried to yield a final product of 75 kg. The dried sample of 5 g, when kept in an oven at 105°C for 24 h results in 3.56 g of dry matter. The moisture content of the vegetable, before drying, in dry basis is _____ (GATE XL 2014)

END OF THE QUESTION PAPER