XL - 2018

EE25BTECH11049 - Sai Krishna Bakki

General Aptitude (GA)

Q.1-Q.5 carry one mark each

1. ”Going by the _____ that many hands make light work, the school _____ involved all the students in the task.”

   The words that best fill the blanks in the above sentence are

   (GATE XL 2018)

   (a) principle, principal
   (b) principal, principle
   (c) principle, principle
   (d) principal, principal

2. ”Her _____ should not be confused with miserliness; she is ever willing to assist those in need.”

   The word that best fills the blank in the above sentence is

   (GATE XL 2018)

   (a) cleanliness
   (b) punctuality
   (c) frugality
   (d) greatness

3. Seven machines take 7 minutes to make 7 identical toys. At the same rate, how many minutes would it take for 100 machines to make 100 toys?

   (GATE XL 2018)

   (a) 1
   (b) 7
   (c) 100
   (d) 700

4. A rectangle becomes a square when its length and breadth are reduced by 10 m and 5 m, respectively. During this process, the rectangle loses 650 m^2 of area. What is the area of the original rectangle in square meters?

   (GATE XL 2018)

(a) 1125
(c) 2924
(b) 2250
(d) 4500

5. A number consists of two digits. The sum of the digits is 9. If 45 is subtracted from the number, its digits are interchanged. What is the number?

(GATE XL 2018)

(a) 63
(c) 81
(b) 72
(d) 90

Q.6-Q.10 carry two mark each

6. For integers a, b and c, what would be the minimum and maximum values respectively of $a + b + c$ if $\log|a| + \log|b| + \log|c| = 0$?

(GATE XL 2018)

(a) -3 and 3
(c) -1 and 3
(b) -1 and 1
(d) 1 and 3

7. Given that a and b are integers and $a + a^2b^3$ is odd, which one of the following statements is correct?

(GATE XL 2018)

(a) a and b are both odd
(c) a is even and b is odd
(b) a and b are both even
(d) a is odd and b is even

8. From the time the front of a train enters a platform, it takes 25 seconds for the back of the train to leave the platform, while travelling at a constant speed of 54 km/h. At the same speed, it takes 14 seconds to pass a man running at 9 km/h in the same direction as the train. What is the length of the train and that of the platform in meters, respectively?

(GATE XL 2018)

(a) 210 and 140
(c) 245 and 130
(b) 162.5 and 187.5
(d) 175 and 200

9. Which of the following functions describe the graph shown in the below figure?

(GATE XL 2018)

(a) $y = ||x| + 1| - 2$
(c) $y = ||x| + 1| - 1$
(b) $y = ||x| - 1| - 1$
(d) $y = ||x - 1| - 1|$

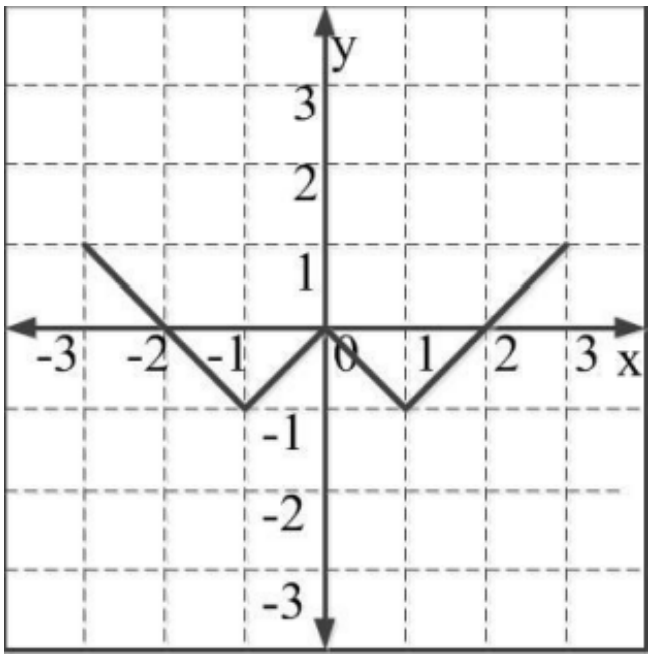


Figure 1

10. Consider the following three statements: (i) Some roses are red. (ii) All red flowers fade quickly. (iii) Some roses fade quickly.

    Which of the following statements can be logically inferred from the above statements? (GATE XL 2018)

    (a) If (i) is true and (ii) is false, then (iii) is false.

    (b) If (i) is true and (ii) is false, then (iii) is true.

    (c) If (i) and (ii) are true, then (iii) is true.

    (d) If (i) and (ii) are false, then (iii) is false.

END OF THE QUESTION PAPER

GATE 2018 – Chemistry (Compulsory) XL-P

Q.1-Q.5 carry one mark each

1. For the complete combustion of graphite and diamond in oxygen individually, the standard enthalpy change (ΔH°_{298}) values are -393.5 kJ mol^{-1} and -395.4 kJ mol^{-1}, respectively. Then, the ΔH°_{298} for the conversion of graphite into diamond is (GATE XL 2018)

   (a) $+1.9$ kJ mol^{-1} (c) $+3.8$ kJ mol^{-1}

   (b) -1.9 kJ mol^{-1} (d) -3.8 kJ mol^{-1}

2. For a 4s orbital of hydrogen atom, the magnetic quantum number (m_l) is (GATE XL 2018)

   (a) 4 (c) 1

   (b) 3 (d) 0

3. Hybridization of xenon in XeF_2 is (GATE XL 2018)

   (a) sp (c) sp^3

   (b) sp^2 (d) sp^3d

4. Two equivalents of **P** react with one equivalent of **Q** to produce a major product **R**. (GATE XL 2018)

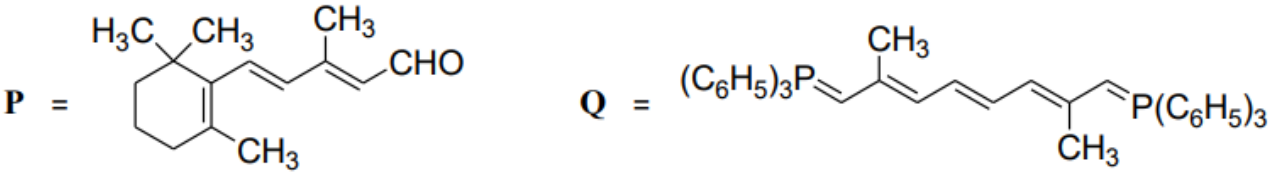


Figure 2

The number of double bonds present in the major product **R** is _____.

5. The total number of possible stereoisomers for the compound with the structural formula $CH_3CH(OH)CH{=}CHCH_2CH_3$ is _____. (GATE XL 2018)

6. Among B–H, C–H, N–H and Si–H bonds in BH_3, CH_4, NH_3 and SiH_4, respectively, the polarity of the bond which is shown **INCORRECTLY** is (GATE XL 2018)

(a) $B^{\delta+}–H^{\delta-}$

(b) $C^{\delta-}–H^{\delta+}$

(c) $N^{\delta-}–H^{\delta+}$

(d) $Si^{\delta-}–H^{\delta+}$

7. Among the following statements: (GATE XL 2018)

(i) $[NiCl_4]^{2-}$ (atomic number of Ni = 28) is diamagnetic

(ii) Ethylamine is a weaker Lewis base compared to pyridine

(iii) $[NiCl_2\{P(C_6H_5)_3\}_2]$ has two geometrical isomers

(iv) Bond angle in H_2O is greater than that in H_2S

The **CORRECT** one is:

(a) (i)

(b) (ii)

(c) (iii)

(d) (iv)

8. In $[Mn(H_2O)_6]^{2+}$ (atomic number of Mn = 25), the d–d transitions according to crystal field theory (CFT) are

(GATE XL 2018)

(a) Laporte forbidden and spin forbidden

(b) Laporte allowed and spin allowed

(c) Laporte forbidden and spin allowed

(d) Laporte allowed and spin forbidden

9. The major product **M** in the reaction is

(GATE XL 2018)

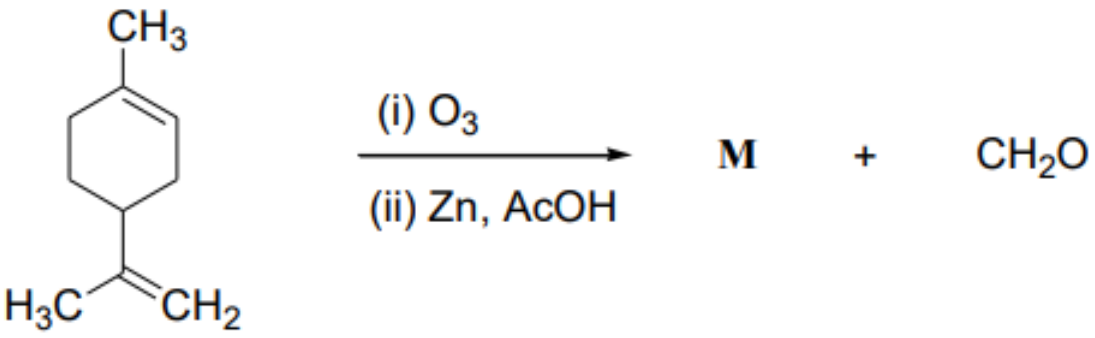
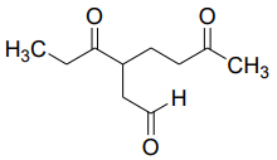
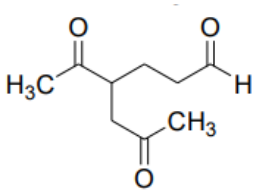
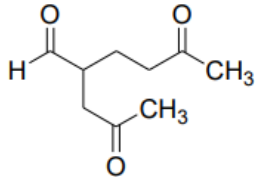
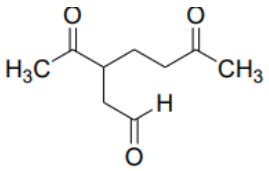


Figure 3

(a) 

(c) 

(b) 

(d) 

10. The two major products of the reaction are

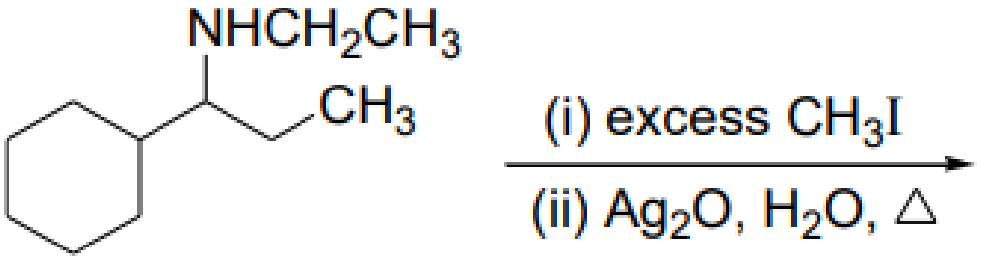
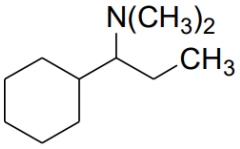
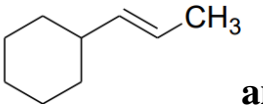
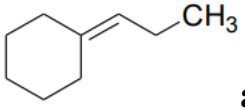


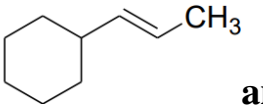
Figure 4

(GATE XL 2018)

(a)  **and** $CH_2=CH_2$

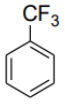
(b)  **and** $N(CH_3)_2CH_2CH_3$

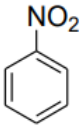
(c)  **and** $N(CH_3)_2CH_2CH_3$

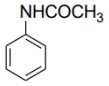
(d)  **and** $HN(CH_3)CH_2CH_3$

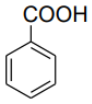
11. The compound, which upon mono-nitration using a mixture of HNO_3 and H_2SO_4, does **NOT** give the meta-isomer as the major product, is

(GATE XL 2018)

(a) 

(b) 

(c) 

(d) 

12. The standard reduction potential (E°) for the conversion of $Cr_2O_7^{2-}$ to Cr^{3+} at 25 °C in an aqueous solution of pH 3.0 is 1.33 V. The concentrations of $Cr_2O_7^{2-}$ and Cr^{3+} are 1.0×10^{-4} M and 1.0×10^{-3} M, respectively. Then the potential of this half-cell reaction is
(**Given**: Faraday constant = 96500 C mol^{-1}, Gas constant R = 8.314 J K^{-1} mol^{-1})

(GATE XL 2018)

(a) 1.04 V
(c) 0.84 V
(b) 0.94 V
(d) 0.74 V

13. The solubility product (K_{sp}) of $Mg(OH)_2$ at 25 °C is 5.6×10^{-11}. Its solubility in water is $S \times 10^{-2}$ g/L, where the value of S is _____ (up to two decimal places). (GATE XL 2018)
(**Given**: Molecular weight of $Mg(OH)_2$ = 58.3 g mol^{-1})

14. The activation energy (E_a) values for two reactions carried out at 25 °C differ by 5.0 kJ mol^{-1}. If the pre-exponential factors (A_1 and A_2) for these two reactions are of the same magnitude, the ratio of rate constants (k_1/k_2) is _____ (up to two decimal places). (GATE XL 2018)
(**Given**: Gas constant R = 8.314 J K^{-1} mol^{-1})

15. One mole of helium gas in an isolated system undergoes a reversible isothermal expansion at 25 °C from an initial volume of 2.0 liters to a final volume of 10.0 liters. The change in entropy (ΔS) of the surroundings is _____ J K^{-1} (up to two decimal places). (GATE XL 2018)
(**Given**: Gas constant R = 8.314 J K^{-1} mol^{-1})

END OF THE QUESTION PAPER

GATE 2018 - Biochemistry-XL(Q)

Q. 1 – Q. 10 carry one mark each. Q. 11 – Q. 20 carry two marks each.

1. To which one of the following classes of enzymes does chymotrypsin belong?
(GATE XL 2018)

(a) Oxidoreductase
(b) Hydrolyse
(c) Transferase
(d) somerase

2. The substrate saturation profile of an enzyme that follows Michaelis-Menten kinetics is depicted in the figure. What is the order of the reaction in the concentration range between 0.8 to 1.4 M?

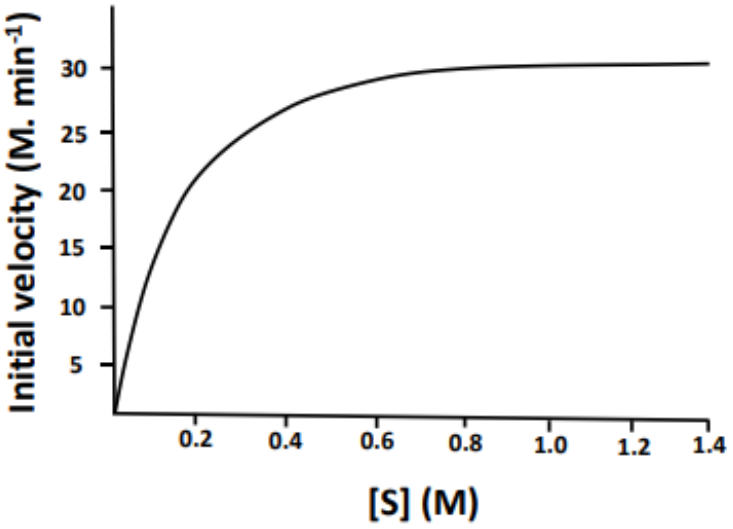


Figure 5

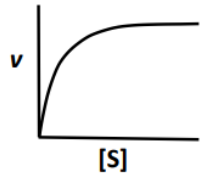
(GATE XL 2018)

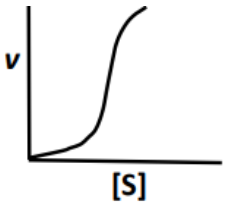
(a) Zero
(b) Fraction
(c) First
(d) Second

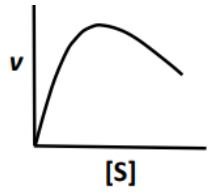
3. Which one of the following conformations of glucose is most stable?
(GATE XL 2018)

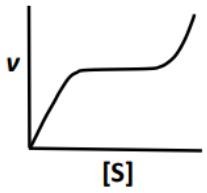
(a) Boat
(b) Half Chair
(c) Chair
(d) Planar

4. Which one of the following profiles represent the phenomenon of cooperativity?
(GATE XL 2018)

(a) 

(c) 

(b) 

(d) 

5. Which one of the following amino acids is responsible for the intrinsic fluorescence of proteins?

(GATE XL 2018)

(a) Pro
(b) Meth
(c) His
(d) Trp

6. The glycosylation of the proteins occurs in (GATE XL 2018)

(a) glyoxysomes
(b) lysosomes
(c) Golgi apparatus
(d) plasma membrane

7. Which one of the following properties of the myeloma cells is used in the hybridoma technology to generate monoclonal antibody? (GATE XL 2018)

(a) lack of thymidylate synthase
(b) over-expression of hypoxanthine-guanine phosphoribosyl transferase
(c) over-expression of inosine 5′-monophosphate cyclohydrolase
(d) lack of hypoxanthine-guanine phosphoribosyl transferase

8. The movement of protons through the FoF_1-ATPase during mitochondrial respiration is required for (GATE XL 2018)

(a) the increase in pH of mitochondrial matrix
(b) changing the conformation of FoF_1-ATPase to expel the ATP
(c) importing Pi from intermembrane space
(d) decreasing the affinity of ADP to FoF_1-ATPase

9. The number of $NADP^+$ molecules required to completely oxidize one molecule of glucose to CO_2 through pentose phosphate pathway is _____ (correct to integer number). (GATE XL 2018)

10. Measurement of the absorbance of a solution containing NADH in a path length of 1 cm cuvette at 340 nm shows the value of 0.31. The molar extinction coefficient of NADH is 6200 $M^{-1}cm^{-1}$. The concentration of NADH in the solution is _____ μM (correct to integer number).

(GATE XL 2018)

Q. 11 – Q. 20 carry two marks each.

11. Among the reagents given below, which combination will **NOT** break the disulphide bonds in immunoglobulin molecules?

(GATE XL 2018)

(a) Reduced glutathione
(b) Dithiothritol
(c) Sodium dodecyl sulphate
(d) Methionine

(a) b,d
(b) a,d
(c) a,c
(d) c,d

12. Match the protein elution condition given in **Group I** with the appropriate chromatography matrices from **Group II**.

Group I		**Group II**	
P	Increasing concentration of sodium chloride	i	Phenyl-Sepharose
Q	Increasing concentration of histidine	ii	Chromatofocusing
R	Decreasing concentration of ammonium sulphate	iii	DEAE-Sephacryl
S	Decreasing concentration of H^+	iv	Ni-NTA

(GATE XL 2018)

(a) P-iii; Q-iv; R-i; S-ii
(b) P-ii; Q-iv; R-i; S-iii
(c) P-i; Q-ii; R-iii; S-iv
(d) P-iv; Q-ii; R-iii; S-i

13. Which one of the following is **NOT** a neurotransmitter? (GATE XL 2018)

(a) Adrenaline
(b) Glutamate
(c) Histamine
(d) Histidine

14. The type-II hypersensitivity reaction is mainly mediated by (GATE XL 2018)

    (a) IgE
    (c) IgA
    (b) IgM
    (d) T cells

15. Which reaction mechanism drives the conversion of 3-phosphoglyceraldehyde to 1,3-bisphosphoglycerate? (GATE XL 2018)

    (a) Oxidation without anhydride bond formation
    (b) Oxidation coupled with anhydride bond formation
    (c) Substrate level phosphorylation
    (d) Formation of carboxylate

16. A polymerase reaction is carried out for 10 cycles in a volume of 1 mL with 5 molecules of template DNA. Assuming 100% efficiency, the number of molecules of DNA present in 100 μL at the end of the reaction is _____. (GATE XL 2018)

17. The secondary structure topology diagram of a 400 amino acid long "Protein-X" is depicted in the figure. The start and end amino acid residue numbers of each α-helix are marked. The percentage (correct to integer number) of residues forming α-helix is _____.

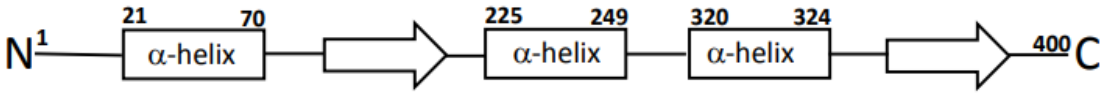


Figure 6

(GATE XL 2018)

18. An enzyme follows Michaelis-Menten kinetics with substrate S. The fraction of the maximum velocity (V_{max}) will be observed with the substrate concentration [S] = $4K_m$ is _____.(correct to decimal number) (GATE XL 2018)

19. The mass spectrum of benzoic acid will generate the fragment as a base peak (100% relative abundance) of *m/z* (mass to charge ratio) at _____ (correct to integer number) (GATE XL 2018)

20. The standard free energy ($\Delta G'$) values of reactions catalyzed by citrate lyase and citrate synthetase are −670 and −8192 cal/mol, respectively.

$$\textbf{Citrate} \xrightleftharpoons{\text{Citrate lyase}} \textbf{Acetate} + \textbf{Oxaloacetate} \quad \Delta G'_1 = -670 \text{ cal/mol}$$

$$\textbf{Acetyl-CoA}+\textbf{Oxaloacetate}+H_2O \xrightleftharpoons{\text{Citrate synthetase}} \textbf{Citrate}+\text{CoA} \quad \Delta G_2' = -8192\,\text{cal/mol}$$

The standard free energy (in cal/mol) of acetyl-CoA hydrolysis is _____
(correct to integer number). (GATE XL 2018)

END OF THE QUESTION PAPER

GATE 2018 – Botany (XL-R)

Q. 1 – Q. 10 carry one mark each. Q. 11 – Q. 20 carry two marks each.

1. Which of the following genera produces dimorphic seeds that help to broaden the time of germination in a variable habitat?

(GATE XL 2018)

(a) Xanthium
(b) Pisum
(c) Mangifera
(d) Linum

2. The genes for microRNA (miRNA) in plants are usually transcribed by

(GATE XL 2018)

(a) RNA polymerase I
(b) RNA polymerase II
(c) RNA polymerase III
(d) RNA polymerase IV

3. Which of the statements is **TRUE** for transposable elements Ac and Ds?

(GATE XL 2018)

(a) Both Ac and Ds are autonomous because they encode their own transposase
(b) Both Ac and Ds are non-autonomous because they do not encode their own transposase
(c) Only Ac is autonomous because it encodes its own transposase
(d) Only Ds is autonomous because it encodes its own transposase

4. Identify the **CORRECT** statement.

(GATE XL 2018)

(a) Receptor-like kinases play role in gametophytic self-incompatibility in Brassicaceae
(b) Receptor-like kinases play role in sporophytic self-incompatibility in Solanaceae
(c) Ribonucleases play role in sporophytic self-incompatibility in Brassicaceae
(d) Ribonucleases play role in gametophytic self-incompatibility in Solanaceae

5. Which of the following statements is **TRUE** for an ecotone?

(GATE XL 2018)

(a) An ecotone is the synonym of an ecosystem
(b) An ecotone is an interface zone of two or more ecosystems
(c) An ecotone is a special feature of land biomes

(d) An ecotone is exclusively characterized by decreased biodiversity

6. Acid rain with a pH of 4.0 is more acidic than the rain with a pH of 6.0 by
(GATE XL 2018)

(a) 2 times
(b) 10 times
(c) 100 times
(d) 1000 times

7. Which of the following plants produces Ylang-ylang oil?
(GATE XL 2018)

(a) Cananga odorata
(b) Carcum copticum
(c) Pandanus odoratissimus
(d) Pimenta racemosa

8. Identify the **INCORRECT** statement in connection with polar transport of auxin.
(GATE XL 2018)

(a) The putative influx carrier AUX1 is a cytosolic protein
(b) Polar auxin transport in root tends to be both acropetal and basipetal in direction
(c) Naphthylphthalamic acid (NPA) is an inhibitor of polar auxin transport
(d) AUX1 and PIN1 proteins are located in the opposite ends of a cell for polar transport

9. Which of the following stains is used to visualize callose under the microscope?
(GATE XL 2018)

(a) Alcian blue
(b) Aniline blue
(c) Toluidine blue
(d) Thymol blue

10. The coding sequence of a gene XLR18 has the single ORF of 783 bp. The approximate molecular weight of the XLR18 protein in kDa is _____.
(GATE XL 2018)

11. Statements given below are either **TRUE (T)** or **FALSE (F)**. Select the **CORRECT** combination.

P. Mitosis occurs exclusively in diploid mother cell
Q. Mitosis occurs both in diploid and haploid mother cells
R. Meiosis occurs exclusively in diploid mother cell
S. Meiosis occurs both in diploid and haploid mother cells
(GATE XL 2018)

(a) P-T, Q-F, R-T, S-F

(b) P-F, Q-T, R-F, S-T

(c) P-T, Q-F, R-F, S-T

(d) P-F, Q-T, R-T, S-F

12. You are asked to design a genetic construct for high-level expression of a gene encoding the therapeutic protein 18 (TP18) via plastid transformation. Select the **CORRECT** set of genetic elements for this construct.

(GATE XL 2018)

(a) Actin1 promoter → TP18 coding sequence → Actin1 transcription terminator

(b) Ubiquitin1 promoter → TP18 coding sequence → Ubiquitin1 transcription terminator

(c) rbcS promoter → TP18 coding sequence → rbcS transcription terminator

(d) rbcL promoter → TP18 coding sequence → rbcL transcription terminator

13. Select the **CORRECT** combination of the following statements.

P. The cyclic electron transport chain involving PSI results in net production of both ATP and NADPH
Q. The cyclic electron transport chain involving PSI results in net production of ATP
R. Rubisco enzyme usually converts RuBP and CO_2 into 2-phosphoglycolate and 3-phosphoglycerate
S. Rubisco enzyme usually converts RuBP and O_2 into 2-phosphoglycolate and 3-phosphoglycerate

(GATE XL 2018)

(a) P, Q

(b) R, S

(c) Q, S

(d) P, R

14. Match the fruit characters with their families and representative plant species.

(GATE XL 2018)

Fruit character	**Family**	**Plant species**
P. Syconus	1. Moraceae	i. *Canavalia ensiformis*
Q. Capsule, opening by apical pores or valves	2. Fabaceae	ii. *Artabotrys odoratissimus*
R. Legume	3. Papaveraceae	iii. *Ficus religiosa*
S. An etaerio of drupe	4. Annonaceae	iv. *Papaver somniferum*
		v. *Pistacia vera*
		vi. *Citrus aurantium*

(a) P-2-iv, Q-3-ii, R-1-vi, S-4-v

(b) P-1-iii, Q-3-iv, R-2-i, S-4-ii

(c) P-3-i, Q-2-iii, R-4-ii, S-1-vi

(d) P-4-v, Q-1-ii, R-2-v, S-3-i

15. Select the **CORRECT** combination by matching the disease, affected plant and the causal organism.

(GATE XL 2018)

Disease	**Affected plant**	**Causal organism**
P. Black rot	1. Corn	i. *Fusarium oxysporum* f.sp. *cubense*
Q. Loose smut	2. Banana	ii. *Acidovorax avenae* subsp. *citrulli*
R. Panama wilt	3. Watermelon	iii. *Botryosphaeria obtusa*
S. Bacterial fruit blotch	4. Apple	iv. *Ustilago maydis*
		v. *Plasmopara viticola*
		vi. *Venturia inaequalis*

(a) P-2-v, Q-1-iv, R-3-iii, S-4-vi

(b) P-2-ii, Q-1-i, R-4-iii, S-3-i

(c) P-4-iii, Q-1-iv, R-2-i, S-3-ii

(d) P-4-vi, Q-1-iii, R-3-ii, S-2-v

16. Select the **CORRECT** combination by matching **Group-I** with **Group-II**.

(GATE XL 2018)

Group-I	**Group-II**
P. Photorespiration	1. Glutamate → 2-Oxoglutarate
Q. Respiration	2. Acetyl-CoA → Malonyl-CoA
R. Amino acid degradation	3. 2-Oxoglutarate → Succinyl-CoA
S. Fatty acid synthesis	4. Glycine → Serine

(a) P-4, Q-2, R-3, S-4

(b) P-4, Q-1, R-4, S-1

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

(d) P-4, Q-2, R-3, S-2

17. Match the plant alkaloids with their uses and source species.

(GATE XL 2018)

Alkaloid	**Use**	**Source species**
P. Codeine	1. Stimulant	i. *Hyoscyamus niger*
Q. Caffeine	2. Analgesic	ii. *Catharanthus roseus*
R. Scopolamine	3. Antineoplastic	iii. *Cola nitida*
S. Vinblastine	4. Anticholinergic	iv. *Papaver somniferum*
		v. *Coptis japonica*
		vi. *Senecio jacobaea*

(a) P-2-iv, Q-1-iii, R-4-i, S-3-ii

(b) P-4-iii, Q-2-v, R-1-vi, S-3-i

(c) P-2-v, Q-1-vi, R-3-iv, S-4-ii

(d) P-3-ii, Q-4-iii, R-1-iv, S-2-i

18. In garden pea, dwarf plants with terminal flowers are recessive to tall plants with axial flowers. A true-breeding tall plant with axial flowers was crossed with a true-breeding dwarf plant with terminal flowers. The resulting F1 plants were testcrossed, and the following progeny were obtained:

Tall plants with axial flowers = 320
Dwarf plants with terminal flowers = 318
Tall plants with terminal flowers = 79
Dwarf plants with axial flowers = 83

(GATE XL 2018)

The map distance between the genes for plant height and flower position is _____ cM.

19. Two true-breeding snapdragon (Antirrhinum majus) plants, one with red flowers and another with white flowers were crossed. The F1 plants were all with pink flowers. When the F1 plants were selfed, they produced three kinds of F2 plants with red, pink and white flowers in a 1:2:1 ratio. The probability that out of the five plants picked up randomly, two would be with pink flowers, two with white flowers and one with red flowers is _____ %.

(GATE XL 2018)

END OF THE QUESTION PAPER

GATE 2018 — Microbiology (XL-S)

Q. 1 – Q. 10 carry one mark each & Q. 11 – Q. 20 carry two marks each.

1. David Baltimore's classification of viruses is based on differences in
(GATE XL 2018)

   (a) host cell receptors used by viruses
   (b) the pathways required to synthesize virus mRNA
   (c) the modes of transmission of viruses
   (d) the envelope proteins on the surface of viruses

2. Which of the following immune system components can function as an opsonin?
(GATE XL 2018)

   (a) Antibodies
   (b) T-cell receptors
   (c) Histamines
   (d) Interferons

3. The oral polio vaccine (OPV) consists of
(GATE XL 2018)

   (a) live attenuated virus
   (b) killed virus
   (c) viral toxin
   (d) viral capsid subunit

4. Which of the following eukaryotic cellular components carries out intracellular degradation during autophagy?
(GATE XL 2018)

   (a) Nucleus
   (b) Golgi bodies
   (c) Ribosomes
   (d) Lysosomes

5. Analysis of DNA sequences suggest that eukaryotic mitochondrial genomes primarily originated from
(GATE XL 2018)

   (a) fungi
   (b) protozoa
   (c) algae
   (d) bacteria

6. Binomial nomenclature has **NOT** yet been adopted for
(GATE XL 2018)

(a) bacteria
(b) fungi
(c) viruses
(d) protozoa

7. Which of the following is **NOT** an accepted method for sterilization?
(GATE XL 2018)

(a) Autoclaving
(b) X-rays
(c) Gamma rays
(d) UV rays

8. The primary product of nitrogen fixation is
(GATE XL 2018)

(a) N_2
(b) NH_4^+
(c) NO_2^-
(d) NO_3^-

9. In humans, the key stages in the life cycle of malarial parasites occur in
(GATE XL 2018)

(a) red blood cells and the liver
(b) red blood cells and platelets
(c) red blood cells and the pancreas
(d) red blood cells and the gut

10. You have a 50 mg/mL stock solution of arginine. To prepare 1 liter of growth medium for an arginine auxotroph that requires 70 μg/mL of arginine, the volume of this stock solution that should be added is _____ mL (up to 1 decimal point).
(GATE XL 2018)

11. Accumulating evidence suggest that Domain Archaea is more closely related to Domain Eukarya than to Domain Bacteria. Which of the following properties are shared between eukaryotes and archaea?

(a) Protein biogenesis
(b) Presence of sterol containing membranes
(c) Ribosomal subunit structures
(d) Adaptation to extreme environmental conditions
(e) Fatty acids with ester linkages in the cell membrane

(GATE XL 2018)

Options:

(a) (ii), (iii) and (v)
(b) (i), (ii), (iv), and (v)
(c) (i) and (iii)
(d) (iii) and (iv)

12. Match the antimicrobial agents in group I with their category/mode of action in group II.

Group I	**Group II**
(i) Fluoroquinolones	(p) beta lactam antimicrobial
(ii) Amphotericin B	(q) inhibition of protein synthesis
(iii) Tetracycline	(r) inhibition of nucleic acid synthesis
(iv) Amoxicillin	(s) antifungal agent

(GATE XL 2018)

(a) (i)-(q), (ii)-(s), (iii)-(r), (iv)-(p) (c) (i)-(r), (ii)-(s), (iii)-(q), (iv)-(p)

(b) (i)-(s), (ii)-(r), (iii)-(p), (iv)-(q) (d) (i)-(s), (ii)-(r), (iii)-(q), (iv)-(p)

13. Match the microorganisms to their predominant modes of transmission.

Microorganism	**Mode of Transmission**
(i) *Bordetella pertussis*	(p) Vector-borne
(ii) Dengue virus	(q) Blood-borne
(iii) *Entamoeba histolytica*	(r) Droplet infection
(iv) Hepatitis B virus	(s) Contaminated food

(GATE XL 2018)

(a) (i)-(r), (ii)-(p), (iii)-(s), (iv)-(q) (c) (i)-(q), (ii)-(p), (iii)-(s), (iv)-(r)

(b) (i)-(s), (ii)-(q), (iii)-(p), (iv)-(r) (d) (i)-(s), (ii)-(r), (iii)-(p), (iv)-(q)

14. Match the precursors/intermediates with the corresponding metabolic pathways.

Precursor/Intermediates	**Metabolic pathway**
(i) Inosine monophosphate	(p) L-methionine biosynthesis
(ii) Ornithine	(q) L-tryptophan biosynthesis
(iii) Chorismate	(r) Purine biosynthesis
(iv) Homocysteine	(s) L-arginine biosynthesis

(GATE XL 2018)

(a) (i)-(q), (ii)-(r), (iii)-(s), (iv)-(p) (c) (i)-(r), (ii)-(p), (iii)-(s), (iv)-(q)

(b) (i)-(p), (ii)-(r), (iii)-(s), (iv)-(q) (d) (i)-(r), (ii)-(s), (iii)-(q), (iv)-(p)

15. Match the scientists to their area of major contribution.

Scientists	**Area of major contribution**
(i) Antonie van Leeuwenhoek	(p) Taxonomy
(ii) Carl Linnaeus	(q) Antimicrobial agents
(iii) Sir Alexander Fleming	(r) Vaccination
(iv) Louis Pasteur	(s) Microscopy

(GATE XL 2018)

(a) (i)-(s), (ii)-(q), (iii)-(p), (iv)-(r)
(b) (i)-(s), (ii)-(p), (iii)-(q), (iv)-(r)
(c) (i)-(p), (ii)-(s), (iii)-(r), (iv)-(q)
(d) (i)-(q), (ii)-(p), (iii)-(r), (iv)-(s)

16. Which of the following combinations would improve the resolution of a microscope?

(i) Increasing the half aperture angle of the objective lens
(ii) Decreasing the wavelength of the illumination source
(iii) Decreasing the numerical aperture of the objective lens
(iv) Decreasing the refractive index of immersion medium

(GATE XL 2018)

Options:

(a) (i) and (ii)
(b) (ii) and (iii)
(c) (ii) and (iv)
(d) (i) and (iii)

17. Active transport involves the movement of a biomolecule against a concentration gradient across the cell membrane using metabolic energy. If the extracellular concentration of a biomolecule is 0.005 M and its intracellular concentration is 0.5 M, the least amount of energy that the cell would need to spend to transport this biomolecule from the outside to the inside of the cell is _____ kcal/mol (up to 2 decimal points). (Temperature $T = 298$ K and universal gas constant $R = 1.98$ cal/mol·K)
(GATE XL 2018)

18. A continuous cell culture being carried out in a stirred tank reactor is described in terms of its cell mass concentration X and substrate concentration S. The concentration of the substrate in the sterile feed stream is $S_F = 10$ g/L and yield coefficient $Y_{x/s} = 0.5$. The flow rates of the feed stream and the exit stream are equal ($F = 5$ mL/min) and constant. If the specific growth rate (h^{-1}) $\mu = \dfrac{0.3S}{1+S}$, the steady state concentration of S is _____ g/L (up to 1 decimal point).
($V = 3$ L given in original problem.)

(GATE XL 2018)

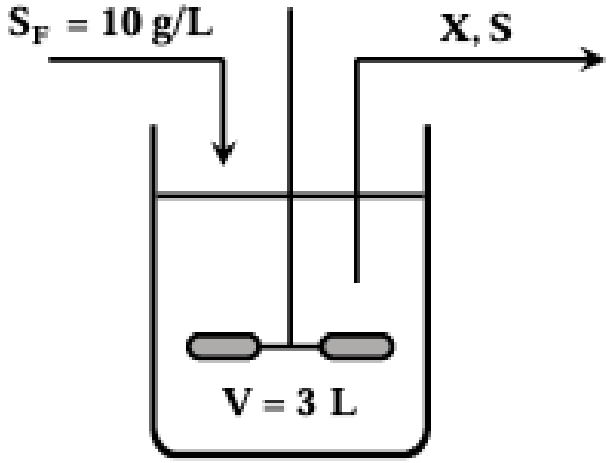


Figure 7: Caption

19. The initial concentration of cells (N_0) growing unrestricted in a culture is 1.0×10^6 cells/mL. If the specific growth rate (μ) of the cells is 0.1 h^{-1}, the time required for the cell concentration to become 1.0×10^8 cells/mL is _____ hours (up to 2 decimal points). (GATE XL 2018)

20. The following stoichiometric equation represents the conversion of glucose to lactic acid in a cell: (GATE XL 2018)

$$\text{Glucose} + 2\ \text{Pi} + 2\ \text{ADP} \longrightarrow 2\ \text{Lactate} + 2\ \text{ATP} + 2\ H_2O$$

If the free energy of conversion of glucose to lactic acid only is $\Delta G^0 = -47000$ cal/mol, the efficiency of energy transfer is _____ % (up to 1 decimal point).

(GATE XL 2018)

(ΔG^0 for ATP hydrolysis is −7.3 kcal/mol.)

END OF THE QUESTION PAPER

GATE 2018 - Zoology (XL-T)

Q. 1 – Q. 10 carry one mark each.

1. Animals belonging to phylum Echinodermata are closer to chordates than other invertebrate phyla. Which ONE of the following reasons can account for this relatedness? (GATE XL 2018)

   (a) Highly evolved nervous system
   (b) Radially symmetric body plan
   (c) Deuterostomic development
   (d) Well-developed muscles

2. A zoologist recovered some tissue from preserved skin of a woolly mammoth. Further genetic analysis requires DNA isolation and increasing its amount. Which **ONE** of the following techniques would be most useful for increasing the amount of DNA? (GATE XL 2018)

   (a) RFLP analysis
   (b) Polymerase chain reaction (PCR)
   (c) Electroporation
   (d) Chromatography

3. In a chemical reaction where the substrate and product are in equilibrium in solution, what will occur if an enzyme is added? (GATE XL 2018)

   (a) The equilibrium of the reaction will not change.
   (b) There will be a decrease in product formed.
   (c) Additional substrate will be formed.
   (d) The free energy of the system will change.

4. Tay-Sachs disease is a human genetic disorder that is associated with defects in which ONE of the following cellular organelles? (GATE XL 2018)

   (a) Endoplasmic reticulum
   (b) Mitochondria
   (c) Golgi apparatus
   (d) Lysosome

5. Increase in the existent population of grey peppered moth, *Biston betularia*, during industrial revolution in Britain is an example of which ONE of the following evolutionary processes? (GATE XL 2018)

   (a) Neutral selection
   (b) Disruptive selection
   (c) Directional selection
   (d) Stabilizing selection

6. Which ONE of the following is NOT a characteristic of a cancer cell? (GATE XL 2018)

(a) Increase in cell motility
(b) Loss of contact inhibition
(c) Decrease in apoptosis
(d) Uncontrolled meiosis

7. Cardiac and cerebral tissues are derived from the following germ layers respectively (GATE XL 2018)

(a) Ectoderm and mesoderm
(b) Mesoderm and ectoderm
(c) Mesoderm and endoderm
(d) Endoderm and ectoderm

8. An animal's ability to escape from a predator by using the explored knowledge of home area is an example of (GATE XL 2018)

(a) Latent learning
(b) Insight learning
(c) Mimicry
(d) Imprinting

9. Bowman's capsules are present in which ONE of the following organs/tissues? (GATE XL 2018)

(a) Renal cortex
(b) Urinary bladder
(c) Renal medulla
(d) Ureter

10. Which **ONE** of the following is the primary function of lung surfactants? (GATE XL 2018)

(a) Remove dust particles from bronchi
(b) Provide immunity to respiratory tract
(c) Prevent alveoli from collapsing by decreasing surface tension
(d) Aid in carbon dioxide exchange

11. Match the disorders/diseases listed in Column I to their respective causative agents listed in Column II. (GATE XL 2018)

Column I	**Column II**
I) African tick bite fever	i) *Trypanosoma gambiense*
II) Yellow fever	ii) Zika virus
III) Microcephaly	iii) *Rickettsia sp.*
IV) Sleeping sickness	iv) Flavivirus

(a) I-iv, II-iii, III-ii, IV-i
(b) I-iii, II-iv, III-ii, IV-i
(c) I-iii, II-iv, III-i, IV-ii
(d) I-iii, II-i, III-iv, IV-ii

12. Glucose monomers are joined together by glycosidic linkages to form a cellulose polymer. During this process, changes in the free energy, total energy, and entropy respectively are represented correctly by which **ONE** of the following options? (GATE XL 2018)

(a) $+\Delta G, +\Delta H, +\Delta S$

(b) $+\Delta G, -\Delta H, -\Delta S$

(c) $-\Delta G, +\Delta H, +\Delta S$

(d) $+\Delta G, +\Delta H, -\Delta S$

13. In *Drosophila melanogaster*, a mutation in *Ultrabithorax* which defines the third segment of the thorax or T3 leads to development of four winged flies, as the halteres develop into a second pair of wings. Which **ONE** of the following phenotypes in fly will result from overexpression of Ultrabithorax in the second thoracic segment? (GATE XL 2018)

(a) Four winged flies

(b) Two wings and two halteres flies

(c) Flies with four halteres

(d) Flies with two halteres

14. Which **ONE** of the following is **TRUE** in case of respiratory acidosis? (GATE XL 2018)

(a) Increased rate of ventilation is a cause

(b) Blood pH more than 7

(c) Increased levels of carbon dioxide in blood

(d) Compensated by reducing bicarbonate in plasma

15. Match the proteins/molecules listed in Column I with the cellular location in Column II. (GATE XL 2018)

Column I	**Column II**
I) Galactosyl transferase	(i) Vesicles
II) Cytochrome oxidase	(ii) Cytosol
III) Clathrin	(iii) Golgi complex
IV) Tubulin	(iv) Mitochondria

(a) I-ii; II-iii; III-i; IV-iv

(b) I-iii; II-iv; III-i; IV-ii

(c) I-iii; II-iv; III-ii; IV-i

(d) I-iv; II-iii; III-ii; IV-i

16. In an experiment, nucleus from *Drosophila* oocyte was transplanted into the anterior part of another oocyte, at a region opposite to the existing nucleus. Which **ONE** of the following phenotypes will the developing egg show? (GATE XL 2018)

(a) A ventralized egg with no dorsal appendages

(b) A dorsalized egg with two dorsal appendages

(c) A ventralized egg with two dorsal appendages

(d) A dorsalized egg with four dorsal appendages

17. Match the organisms in Column I with features in Column II.
(GATE XL 2018)

Column I	**Column II**
I) Tapeworm	(i) Bioluminescence
II) Jellyfish	(ii) Viviparous
III) Trichinella	(iii) Lateral heart
IV) Earthworm	(iv) Microvilli on the body surface

(a) I-iii; II-i; III-iv; IV-ii
(b) I-ii; II-iv; III-i; IV-iii
(c) I-iv; II-i; III-ii; IV-iii
(d) I-iv; II-iii; III-ii; IV-i

18. Which **ONE** of the following statements is **NOT** part of the classical Darwinian theory of evolution by natural selection? (GATE XL 2018)

(a) A trait constantly used will get inherited
(b) Phenotypic variations exist in a population
(c) Fittest individuals are more likely to survive
(d) Each population acquires variations randomly

19. A population of rabbitswas determined to have a birth rate of 200 and mortality rate of 50 per year. If the initial population size is 4000 individuals, after 2 years of non-interfered breeding the final population size will be _____
(GATE XL 2018)

20. In a population in Hardy-Weinberg equilibrium m, the frequency of occurrence of a disorder caused by recessive allele (q) is 1 in 1100. The frequency of heterozygotes in the population will be _____
(GATE XL 2018)

END OF THE QUESTION PAPER

GATE 2018 - Food Technology (XL-U)

Q. 1 – Q. 10 carry one mark each. Q. 11 – Q. 20 carry two marks each.

1. Which of the following is an oil soluble pigment present in fruits and vegetables?

(GATE XL 2018)

(a) Flavonoids
(b) Carotenoids
(c) Anthocyanins
(d) Tannins

2. Which of the following represent the group of saturated fatty acids?

(GATE XL 2018)

(a) Lauric, Myristic, Arachidic
(b) Palmitic, Linoleic, Linolenic
(c) Capric, Stearic & Oleic
(d) Behenic, Caprylic, Arachidonic

3. The anti-nutritional factor present in fava bean is

(GATE XL 2018)

(a) Gossypol
(b) Curcine
(c) Vicine
(d) Cyanogen

4. Which of the following is a Gram positive bacteria?

(GATE XL 2018)

(a) Listeria monocytogenes
(b) Proteus vulgaris
(c) Salmonella typhi
(d) Shigella dysenteriae

5. Irradiation carried out to reduce viable non-spore forming pathogenic bacteria using a dose between 3 to 10 kGy is

(GATE XL 2018)

(a) Radurization
(b) Thermoradiation
(c) Radappertization
(d) Radicidation

6. Identify the correct statement related to the viscosity of Newtonian fluids from the following.

(GATE XL 2018)

(a) It is not influenced by temperature
(b) It increases with shearing rate
(c) It decreases with shearing rate

(d) It is not influenced by shearing rate

7. Adult male Wistar rats were fed with a protein based diet. Total 150 g of protein was ingested per animal. If the average weight increased from 110 g to 350 g after the end of experiment, the Protein efficiency ratio of the given protein would be _____ (up to two decimal points).

(GATE XL 2018)

8. The initial moisture content of a food on wet basis is 50.76%. Its moisture content (%) on dry basis is _____ (up to two decimal points).

(GATE XL 2018)

9. The oxygen transmission rate through a 2.54×10^{-3} cm thick low density polyethylene film with air on one side and inert gas on the other side is 3.5×10^{-6} mL cm^{-2} s^{-1}. Oxygen partial pressure difference across the film is 0.21 atm. The permeability coefficient of the film to oxygen is _____ $\times 10^{-11}$ mL (STP) cm cm^{-2} s^{-1} (cm Hg)$^{-1}$.

(GATE XL 2018)

10. Ambient air at 30°C dry bulb temperature and 80% relative humidity was heated to a dry bulb temperature of 80°C in a heat exchanger by indirect heating. The amount of moisture gain (g kg^{-1} dry air) during the process would be _____.

(GATE XL 2018)

11. Match the commodity in Group I with the bioactive constituent in Group II:

Group I	**Group II**
P. Ginger	1. Lutein
Q. Green tea	2. Gingerol
R. Spinach	3. Curcumin
S. Turmeric	4. Epigallocatechin gallate

(GATE XL 2018)

(a) P-1, Q-2, R-3, S-4
(b) P-2, Q-4, R-1, S-3
(c) P-4, Q-1, R-3, S-2
(d) P-2, Q-3, R-1, S-4

12. Match the process operation in Group I with the separated constituent in Group II:

Group I	**Group II**
P. Extraction	1. Phospholipids
Q. Degumming	2. Free fatty acids
R. Neutralization	3. Pigments
S. Bleaching	4. Crude oil

(GATE XL 2018)

(a) P-3, Q-2, R-4, S-1
(b) P-4, Q-3, R-1, S-2
(c) P-4, Q-1, R-2, S-3
(d) P-4, Q-1, R-3, S-2

13. Match the spoilage symptom in Group I with the causative microorganism in Group II:

Group I	**Group II**
P. Green rot of eggs	1. Micrococcus spp.
Q. Putrid swell in canned fish	2. Serretia marcescens
R. Red bread	3. Pseudomonas fluorescens
S. Yellow discoloration of meat	4. Clostridium sporogens

(GATE XL 2018)

(a) P-4, Q-3, R-2, S-1
(b) P-2, Q-1, R-4, S-3
(c) P-3, Q-4, R-2, S-1
(d) P-1, Q-4, R-3, S-2

14. Match the fermented product in Group I with the base material in Group II:

Group I	**Group II**
P. Sake	1. Milk
Q. Chhurpi	2. Cabbage
R. Natto	3. Rice
S. Sauerkraut	4. Soybean

(GATE XL 2018)

(a) P-3, Q-1, R-4, S-2
(b) P-1, Q-3, R-4, S-2
(c) P-4, Q-1, R-3, S-2
(d) P-2, Q-4, R-1, S-3

15. Match the operation in Group I with the process in Group II:

Group I	**Group II**
P. Cleaning	1. Quality separation
Q. Grading	2. Clarification
R. Size reduction	3. Screening
S. Filtration	4. Comminution

(GATE XL 2018)

(a) P-1, Q-3, R-4, S-2
(b) P-4, Q-1, R-3, S-2
(c) P-2, Q-4, R-1, S-3
(d) P-3, Q-1, R-4, S-2

16. Out of 7 principles of HACCP system, 4 are listed below. Arrange these principles in the order in which they are applied: (P) Conduct a hazard analysis
(Q) Establish monitoring process
(R) Establish critical limit
(S) Establish record keeping and documentation process

(GATE XL 2018)

(a) P, R, Q, S
(b) Q, R, P, S
(c) P, Q, R, S
(d) R, S, P, Q

17. Identify an example of a classical diffusional mass transfer process without involving heat, among the following.

(GATE XL 2018)

(a) Drying of food grains
(b) Carbonation of beverages
(c) Distillation of alcohol
(d) Concentration of fruit juice

18. For an enzyme catalyzed reaction $S \rightarrow P$, the kinetic parameters are: $[S] = 40\ \mu$M, $V_0 = 9.6\ \mu\text{M s}^{-1}$, and $V_{\max} = 12.0\ \mu\text{M s}^{-1}$.
The K_m of the enzyme in μM will be _____ (up to one decimal point).

(GATE XL 2018)

19. A microbial sample taken at 10 AM contained 1×10^5 CFU/mL. The count reached to 1×10^{10} CFU/mL at 8 PM of the same day. The growth rate (h^{-1}) of the microorganism would be _____ (up to two decimal points).

(GATE XL 2018)

20. The rate of heat transfer per unit area from a metal plate is 1000 W m^{-2}. The surface temperature of the plate is 120°C and ambient temperature is 20°C. The convective heat transfer coefficient (W m^{-2} $°C^{-1}$) using the Newton's law of cooling will be _____. (GATE XL 2018)

END OF THE QUESTION PAPER