# GATE 2022 Life Sciences XL

## GATE 2022 General Aptitude

**Q.1 – Q.5 Carry ONE mark each.**

| | |
|---|---|
| Q.1 | The movie was funny and I _____. |
| (A) | could help laughing |
| (B) | couldn't help laughed |
| (C) | couldn't help laughing |
| (D) | could helped laughed |

| | |
|---|---|
| Q.2 | $x : y : z = \frac{1}{2} : \frac{1}{3} : \frac{1}{4}$.<br>What is the value of $\frac{x+z-y}{y}$ ? |
| (A) | 0.75 |
| (B) | 1.25 |
| (C) | 2.25 |
| (D) | 3.25 |

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## GATE 2022 Life Sciences XL

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|---|---|
| Q.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.<br><br>What is the value of $x$? |
| (A) | 1 |
| (B) | 2 |
| (C) | 3 |
| (D) | 4 |

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|---|---|
| Q.4 | A survey of 450 students about their subjects of interest resulted in the following outcome.<br>• 150 students are interested in Mathematics.<br>• 200 students are interested in Physics.<br>• 175 students are interested in Chemistry.<br>• 50 students are interested in Mathematics and Physics.<br>• 60 students are interested in Physics and Chemistry.<br>• 40 students are interested in Mathematics and Chemistry.<br>• 30 students are interested in Mathematics, Physics and Chemistry.<br>• Remaining students are interested in Humanities.<br>Based on the above information, the number of students interested in Humanities is |
| (A) | 10 |
| (B) | 30 |
| (C) | 40 |
| (D) | 45 |

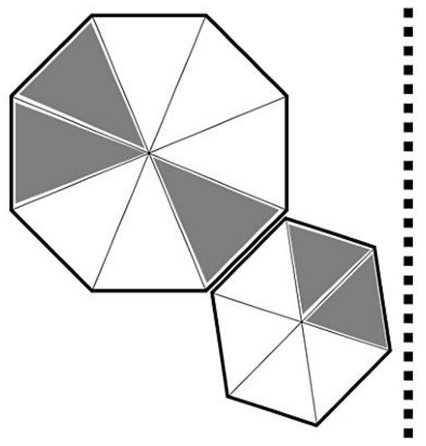
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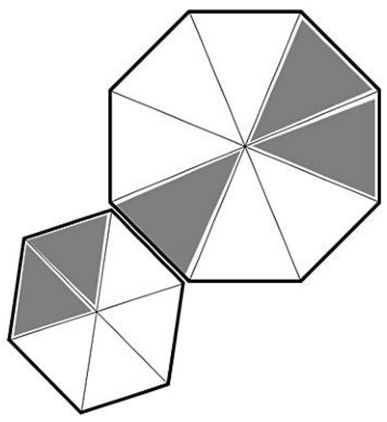
# GATE 2022 Life Sciences XL

Q.5

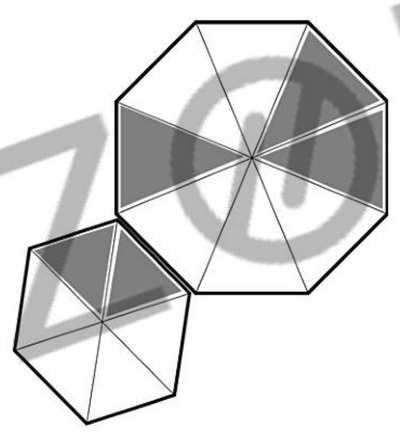


For the picture shown above, which one of the following is the correct picture representing reflection with respect to the mirror shown as the dotted line?

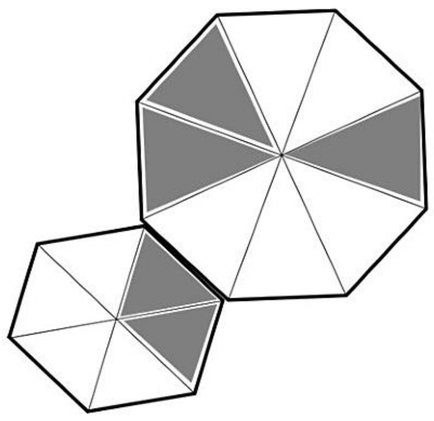
(A)



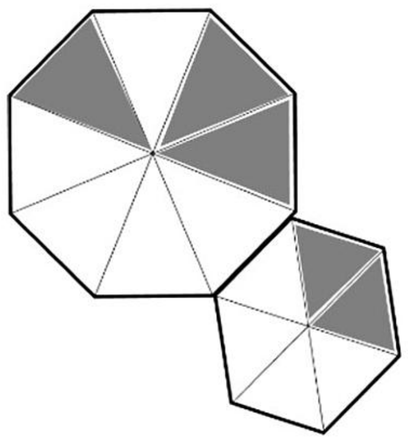
(B)



(C)



(D)



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**Q. 6 – Q. 10 Carry TWO marks each.**

| | |
|---|---|
| Q.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.<br><br>Which one of the following is the CORRECT logical inference based on the information in the above passage? |
| (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 |

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|---|---|
| Q.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.<br><br>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? |
| (A) | 22 : 23 : 24 |
| (B) | 22 : 33 : 50 |
| (C) | 33 : 46 : 60 |
| (D) | 63 : 86 : 110 |

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| | |
|---|---|
| Q.8 | Consider the following equations of straight lines:<br><br>Line L1: $2x - 3y = 5$<br>Line L2: $3x + 2y = 8$<br>Line L3: $4x - 6y = 5$<br>Line L4: $6x - 9y = 6$<br><br>Which one among the following is the correct statement? |
| (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 |

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| | |
|---|---|
| Q.9 | Given below are two statements and four conclusions drawn based on the statements.<br><br>Statement 1: Some soaps are clean.<br><br>Statement 2: All clean objects are wet.<br><br>Conclusion I: Some clean objects are soaps.<br><br>Conclusion II: No clean object is a soap.<br><br>Conclusion III: Some wet objects are soaps.<br><br>Conclusion IV: All wet objects are soaps.<br><br>Which one of the following options can be logically inferred? |
| (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 |

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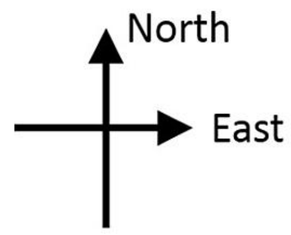
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## GATE 2022 Life Sciences XL

Q.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.

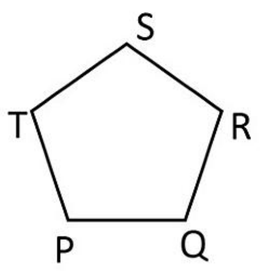
The ant first turns 72° anticlockwise at P, and then does the following two steps in sequence exactly FIVE times before halting.

1. moves forward for 10 cm.
2. turns 144° clockwise.



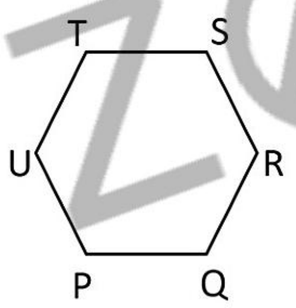

The pattern made by the trace left behind by the ant is

(A)



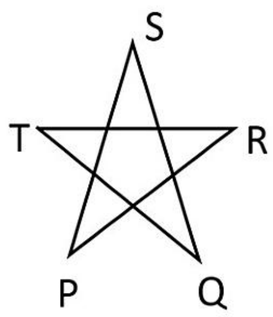

PQ = QR = RS = ST = TP = 10 cm

(B)



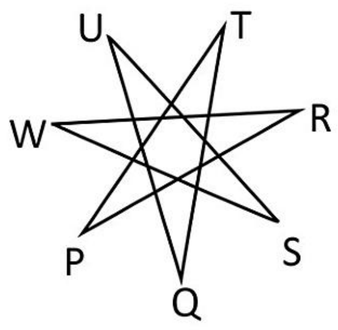

PQ = QR = RS = ST = TU = UP = 10 cm

(C)




SQ = QT = TR = RP = PS = 10 cm

(D)



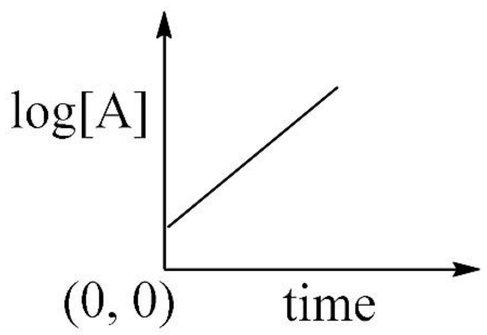
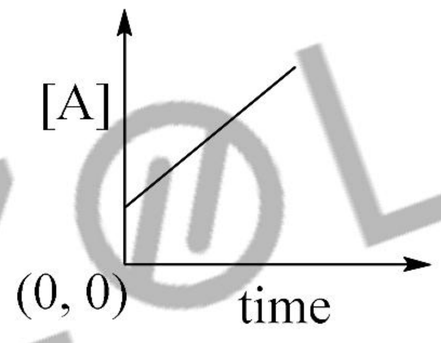
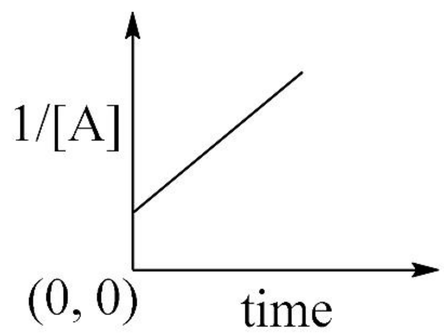
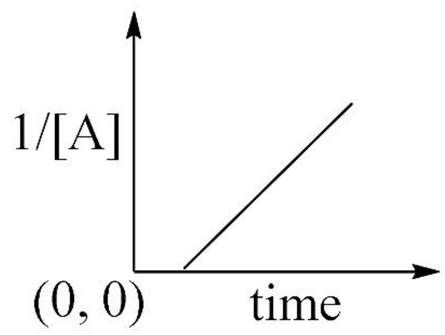

SW = WR = RP = PT = TQ = QU = US = 10 cm

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**GATE 2022 Life Sciences XL**
**Chemistry (XL-P) Q.11 – Q.19 Carry ONE mark Each**

| | |
|---|---|
| Q.11 | Consider a second order reaction, $2A \longrightarrow$ Product<br>The concentration of A is represented as [A].<br>Which of the following is the CORRECT plot for determining the rate constant for the above reaction? |
| (A) |  |
| (B) |  |
| (C) |  |
| (D) |  |
| | |

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## GATE 2022 Life Sciences XL

| | |
|---|---|
| Q. 12 | Which among the following has the least second ionization energy? |
| | |
| (A) | Al |
| (B) | Si |
| (C) | P |
| (D) | S |
| | |
| Q.13 | Which among the following metal ions has the highest enthalpy of hydration?<br>(Assume the given metal ions have the same counter ion.)<br>*Given*: Atomic numbers of Ti, V, Cr and Mn are 22, 23, 24 and 25, respectively. |
| | |
| (A) | $Ti^{2+}$ |
| (B) | $V^{2+}$ |
| (C) | $Cr^{2+}$ |
| (D) | $Mn^{2+}$ |
| | |

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# GATE 2022 Life Sciences XL

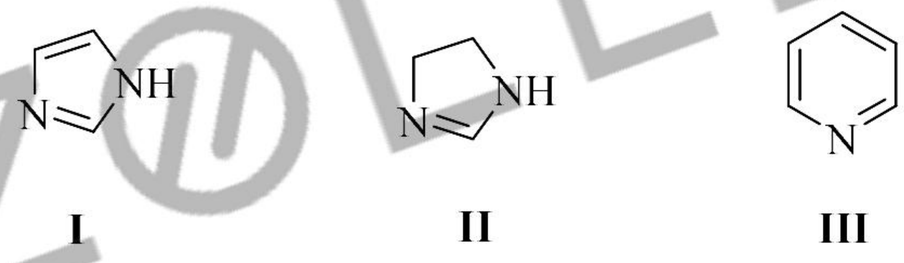
| | |
|---|---|
| Q.14 | Among the following, the one having smallest bond angle is |
| | |
| (A) | $PH_3$ |
| (B) | $PF_3$ |
| (C) | $NF_3$ |
| (D) | $NH_3$ |
| | |
| Q.15 | Which of the following is the CORRECT statement about hexoses? |
| | |
| (A) | D-mannose is C-4 epimer of D-glucose |
| (B) | 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 |
| | |

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# GATE 2022 Life Sciences XL

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|---|---|
| Q.16 | The bases present in DNA are |
| | |
| (A) | adenine, cytosine, guanine and thymine |
| (B) | adenine, guanine, thymine and uracil |
| (C) | adenine, cytosine, thymine and uracil |
| (D) | cytosine, guanine, thymine and uracil |
| | |
| Q.17 | The CORRECT order of basicity for the following compounds is  **I** **II** **III** |
| | |
| (A) | **I > II > III** |
| (B) | **II > III > I** |
| (C) | **II > I > III** |
| (D) | **III > I > II** |
| | |

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Q.18 Molar conductance of monobromoacetic acid at infinite dilution is calculated to be $\boldsymbol{x} \times 10^{-4}$ S m$^2$ mol$^{-1}$ at 25 °C.
The value of $\boldsymbol{x}$ 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 |

(A) 164

(B) 195

(C) 389

(D) 467

Q.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$^{-1}$

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**GATE 2022 Life Sciences XL**
**Q.20 – Q.27 Carry TWO marks Each**

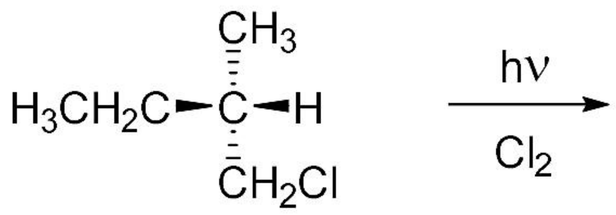
| | |
|---|---|
| Q.20 | Among the following statements about cobalt complexes, which is/are CORRECT?<br>*Given:* Atomic number of Co is 27 |
| | |
| (A) | $[Co(NH_3)_4]^{2+}$ exhibits square planar geometry |
| (B) | $[Co(en)_3]^{3+}$ does not show optical isomerism (en = ethylenediamine) |
| (C) | $[Co(H_2O)_6]^{3+}$ is paramagnetic in nature |
| (D) | $[Co(NH_3)_5Cl)]^{2+}$ shows ligand-to-metal charge transfer |
| | |

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## GATE 2022 Life Sciences XL

| | |
|---|---|
| Q.21 | Consider the following reaction:<br>  <br>The CORRECT statement(s) related to mono-chlorination at carbon-2 position is/are |
| | |
| (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 |
| | |

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## GATE 2022 Life Sciences XL

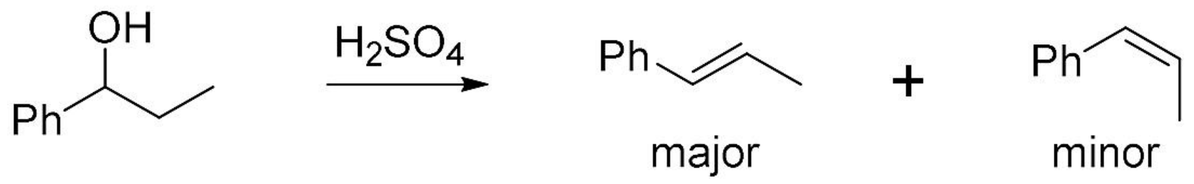
| | |
|---|---|
| Q.22 | Consider the following enzyme catalyzed reaction:<br><br>$E + S \underset{k_{-1}}{\overset{k_1}{\rightleftharpoons}} ES$<br><br>$ES \xrightarrow{k_2} P + E$<br><br>where E is enzyme, S is substrate, ES is enzyme-substrate complex and P is product.<br><br>The CORRECT statement(s) for the above reaction is/are |
| | |
| (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. |
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# GATE 2022 Life Sciences XL

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|---|---|
| Q.23 | Consider the following reaction:<br>  <br><br>The CORRECT pathway(s) involved in the reaction is/are |
| | |
| (A) | E2 followed by isomerization |
| (B) | E1 followed by isomerization |
| (C) | $S_N1$ followed by isomerization |
| (D) | Isomerization through carbocation |
| | |
| Q.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*).<br><br>*Given*: $K_a$ of aspirin is $3.98 \times 10^{-4}$ |
| | |
| Q.25 | The total number of 3-centre-2-electron bonds in $B_4H_{10}$ is _____ (*in integer*). |
| | |

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## GATE 2022 Life Sciences XL

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|---|---|
| Q.26 | The equilibrium constant for isomerization of 1-butene to *trans*-2-butene at 27 °C is _____ (*round off to one decimal place*).<br><br>*Given*: Gas constant = 8.314 J $K^{-1}$ $mol^{-1}$<br>$\Delta_f G^o$ of 1-butene = +71.39 kJ $mol^{-1}$<br>$\Delta_f G^o$ of *trans*-2-butene = +63.06 kJ $mol^{-1}$ |
| | |
| Q.27 | A 16 mW monochromatic light emits $4\times10^{16}$ photons in 1 second. When this light incidents on a metal strip, photoelectrons are emitted. The wavelength of the emitted photoelectrons (in Å) is _____ (*round off to one decimal place*).<br><br>*Given*: Work function of the metal = 2.0 eV<br>Charge of an electron = $1.6 \times 10^{-19}$ C<br>Mass of an electron = $9.1 \times 10^{-31}$ kg<br>Planck's constant = $6.626 \times 10^{-34}$ J s |
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# GATE 2022 Life Sciences XL

## Biochemistry XL (Q): Q.28 – Q.35 Carry ONE mark Each

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|---|---|
| Q.28 | Which of the immune cells listed below are agranular?<br><br>P. Eosinophils<br><br>Q. Mast cells<br><br>R. Monocytes<br><br>S. T-cells |
| (A) | P and Q only |
| (B) | Q and R only |
| (C) | R and S only |
| (D) | S and P only |
| | |
| Q.29 | Which one of the following enzymes is located in the outer mitochondrial membrane? |
| (A) | Citrate synthase |
| (B) | Fumarase |
| (C) | Monoamine oxidase |
| (D) | Succinate dehydrogenase |
| | |

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## GATE 2022 Life Sciences XL

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|---|---|
| Q.30 | Which one of the following statements about the DNA polymerase III of *E. coli* is NOT correct? |
| (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. |
| | |
| Q.31 | Which one of the following compounds is NOT a translation inhibitor? |
| (A) | Chloramphenicol |
| (B) | Cycloheximide |
| (C) | Puromycin |
| (D) | Rifampicin |
| | |
| Q.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 _____. |
| | |
| Q.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 _____. |
| | |

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## GATE 2022 Life Sciences XL

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|---|---|
| Q.34 | The number of ATP molecules required for the complete assimilation of one molecule of $CO_2$ in Calvin cycle is _____. |
| | |
| Q.35 | The absorbance of a $5 \times 10^{-4}\ M$ 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 _____. |
| | |

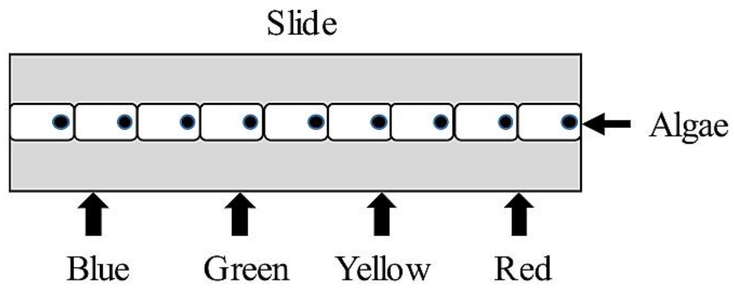
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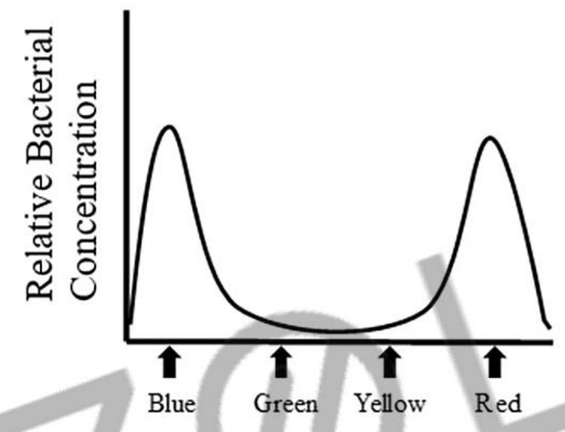
# GATE 2022 Life Sciences XL
## Q.36 – Q.46 Carry TWO marks Each

Q.36 Filamentous photosynthetic algae were placed on a microscopic slide and illuminated with light of different colors as illustrated.

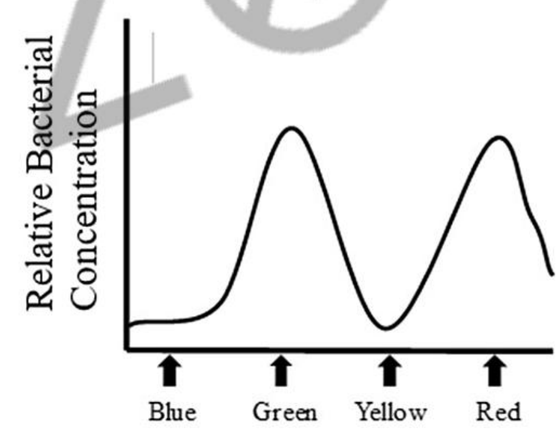



The bacteria that are known to migrate towards the region of high $O_2$ were also added uniformly on the slide. Which one of the following options illustrates the distribution of bacteria along the length of the microscopic slide after illumination?

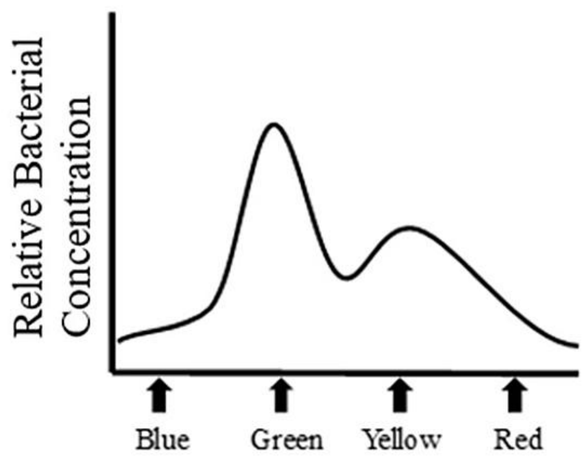
(A)



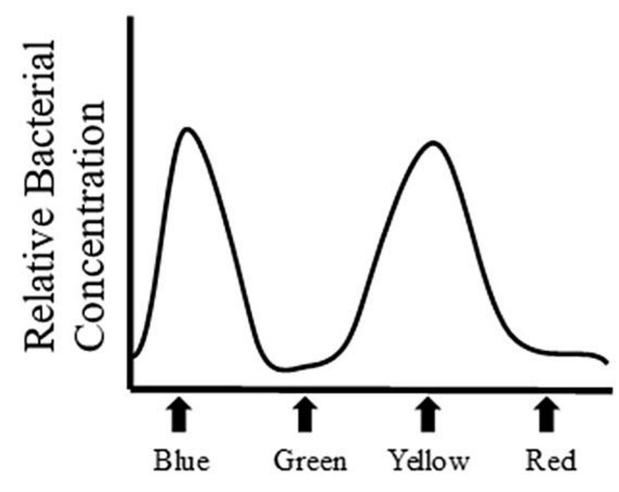

(B)




(C)




(D)




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## GATE 2022 Life Sciences XL

| | |
|---|---|
| Q.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.<br><br>$RNA_1$: $5' - (AG)_n - 3'$<br><br>$RNA_2$: $5' - (AAG)_n - 3'$<br><br>The $RNA_1$ translated product contained Arg and Glu.<br>The $RNA_2$ translated product contained Arg, Glu, and Lys.<br><br>Which one of the following codons directs the incorporation of Arg? |
| (A) | AAG |
| (B) | AGA |
| (C) | GAA |
| (D) | GAG |
| | |
| Q.38 | Which of the following statements about endogenous synthesis of insulin are correct?<br><br>P. Insulin is synthesized as preproinsulin.<br><br>Q. Preproinsulin is converted to proinsulin.<br><br>R. Single-site cleavage of proinsulin eliminates C chain.<br><br>S. Mature insulin consists of disulphide-linked A and B chains. |
| (A) | P, Q, and R |
| (B) | P, Q, and S |
| (C) | P, R, and S |
| (D) | Q, R, and S |

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## GATE 2022 Life Sciences XL

| | |
|---|---|
| Q.39 | Which one of the following enzymes converts testosterone to estradiol? |
| (A) | Aromatase |
| (B) | 3β-hydroxysteroid dehydrogenase |
| (C) | 5α-reductase |
| (D) | 17β-hydroxysteroid dehydrogenase |
| | |
| Q.40 | Purification of 6×His-tagged protein using Ni-NTA column is an example of _____ |
| (A) | affinity chromatography |
| (B) | hydrophobic-interaction chromatography |
| (C) | ion-exchange chromatography |
| (D) | size-exclusion chromatography |
| | |
| Q.41 | Which of the following carbohydrates has/have a $\beta 1 \rightarrow 4$ glycosidic linkage? |
| (A) | Cellulose |
| (B) | Chitin |
| (C) | Lactose |
| (D) | Maltose |

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## GATE 2022 Life Sciences XL

| | |
|---|---|
| Q.42 | Which of the following statements about IgA is/are correct? |
| (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. |
| | |
| | |
| Q.43 | The standard free energy changes for conversion of phosphoenol pyruvate ($PEP$) to pyruvate, and $ATP$ synthesis are shown below.<br>$PEP + H_2O \rightleftharpoons pyruvate + P_i$ $\quad \Delta G'^o = -61.9\ kJ \cdot mol^{-1}$<br>$ADP + P_i \rightleftharpoons ATP + H_2O$ $\quad \Delta G'^o = 30.5\ kJ \cdot mol^{-1}$<br>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 $J \cdot mol^{-1}K^{-1}$. The actual free energy change in $kJ \cdot mol^{-1}$ for the reaction<br>$PEP + ADP \rightarrow pyruvate + ATP$<br>carried out at 37 °C will be _____ (*rounded off to one place of decimal*). |
| | |
| | |
| Q.44 | The dissociation constant for a receptor-ligand pair is $0.25 \times 10^{-7} M$. 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 _____. |
| | |

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## GATE 2022 Life Sciences XL

| | |
|---|---|
| Q.45 | The half-maximal velocity of an enzyme catalyzed reaction was found at a substrate concentration of $0.5 \times 10^{-6}\ M$. This enzyme follows Michaelis-Menten kinetics. In the presence of a competitive inhibitor, the half-maximal velocity was found at a substrate concentration of $1.5 \times 10^{-6}\ M$. Given that the enzyme-inhibitor pair has a dissociation constant of $2 \times 10^{-7} M$, the concentration of the competitive inhibitor in $\mu M$, *rounded off to one place of decimal*, was_____. |
| | |
| Q.46 | A forty-times diluted sample of ssRNA gave an $A_{260}$ of 0.01. The concentration of the ssRNA before the dilution in $\mu g/mL$ was _____ (*correct to the nearest integer*). |
| | |

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**GATE 2022 Life Sciences XL**
**Botany XL (R): Q.47 – Q.54 Carry ONE mark Each**

| | |
|---|---|
| Q.47 | In Angiosperms, normally ‘Exarch Xylem’ occurs in |
| | |
| (A) | dicot stem |
| (B) | monocot stem |
| (C) | dicot root |
| (D) | dicot leaf |
| | |
| Q.48 | ‘Quiescent Center’ is present in |
| | |
| (A) | leaf meristem |
| (B) | root apical meristem |
| (C) | shoot apical meristem |
| (D) | floral meristem |
| | |

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## GATE 2022 Life Sciences XL

Q.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 |

(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**

Q.50 Anomalous secondary growth is observed in

(A) *Triticum*

(B) *Oryza*

(C) *Zea*

(D) *Dracaena*

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# GATE 2022 Life Sciences XL

| | |
|---|---|
| Q.51 | Which of the following plant diseases is/are caused by bacteria? |
| | |
| (A) | Angular leaf spot of cotton |
| (B) | Citrus canker |
| (C) | Apple scab |
| (D) | Leaf curl of papaya |
| | |
| Q.52 | Phylogenetic system of classification is/are proposed by |
| | |
| (A) | Carolus Linnaeus |
| (B) | John Hutchinson |
| (C) | Engler and Prantl |
| (D) | Bentham and Hooker |
| | |

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## GATE 2022 Life Sciences XL

| | |
|---|---|
| Q.53 | Which of the following is/are part of marine ecosystem? |
| | |
| (A) | Open ocean |
| (B) | Chaparral |
| (C) | Deep sea |
| (D) | Estuaries |
| | |
| Q.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*). |

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## GATE 2022 Life Sciences XL
## Q.55 – Q.65 Carry TWO marks Each

| | |
|---|---|
| Q.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.<br>Based on the typical ABC model of floral organ patterning, which among the following are mutated in this plant? |
| | |
| (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 |
| | |

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Q.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**. $\beta$-Farnesene | **II**. Cyanogenic glycoside |
| **R**. Amygdalin | **III**. Flavone |
| **S**. Nicotine | **IV**. Alkaloid |
| **T**. Luteolin | **V**. Monoterpene |

(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**

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## GATE 2022 Life Sciences XL

Q.57 Match **Group-I** (enzyme), **Group-II** (reaction catalyzed by the enzyme), and **Group-III** (subcellular localization of the enzyme and the associated metabolic process) in **CORRECT** combination.

| Group-I | Group-II | Group-III |
|---|---|---|
| **P.** PEP Carboxylase | **I.** 2 Glycolate + 2 $O_2$ = 2 Glyoxylate + 2 $H_2O_2$ | **a.** Cytosol – $C_4$ cycle |
| **Q.** Rubisco | **II.** Pyruvate + $NAD^+$ + CoA = Acetyl-CoA + $CO_2$ + NADH | **b.** Peroxisome – $C_2$ cycle |
| **R.** Glycolate oxidase | **III.** Phosphoenolpyruvate + $HCO_3^-$ = Oxaloacetate + Pi | **c.** Mitochondria – aerobic respiration |
| **S.** Pyruvate dehydrogenase | **IV.** 3 (Ribulose 1,5-bisphosphate) + 3 $CO_2$ + 3 $H_2O$ = 6 (3-phosphoglycerate) + 6 $H^+$ | **d.** Chloroplast – $C_3$ cycle |

(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**

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

| 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**

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

| 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**

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

| 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**

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## GATE 2022 Life Sciences XL

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

| 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**

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## GATE 2022 Life Sciences XL

| | |
|---|---|
| Q.62 | Which of the following matches is/are **CORRECT**? |
| | |
| (A) | Surface fibre – Cotton – *Gossypium hirsutum* |
| (B) | Bast fibre – Flax – *Corchorus capsularis* |
| (C) | Drying oil – Safflower oil – *Helianthus annuus* |
| (D) | Non-drying oil – Castor oil – *Ricinus communis* |
| | |
| Q.63 | Which of the following is/are phanerogamic parasite(s)? |
| | |
| (A) | *Cuscuta reflexa* |
| (B) | *Orobanche cernua* |
| (C) | *Ocimum sanctum* |
| (D) | *Santalum album* |
| | |
| Q.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*). |
| | |

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## GATE 2022 Life Sciences XL

| | |
|---|---|
| Q.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*). |

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**GATE 2022 Life Sciences XL**
**Microbiology XL (S): Q.66 – Q.73 Carry ONE mark Each**

| | |
|---|---|
| Q.66 | The terminal acceptor of electron during anaerobic respiration in *Methanococcus* is _____. |
| (A) | Nitrate ion |
| (B) | Sulfate ion |
| (C) | Carbon dioxide |
| (D) | Oxygen |
| | |
| | |
| Q.67 | Which one of the following mutagens convert DNA's adenine to hypoxanthine? |
| (A) | Ultraviolet light |
| (B) | Mitomycin C |
| (C) | Methyl methanesulfonate |
| (D) | Nitrous acid |
| | |
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## GATE 2022 Life Sciences XL

| | |
|---|---|
| Q.68 | Which one of the following leukocytes are present in the largest proportion in healthy human blood? |
| (A) | Neutrophils |
| (B) | Eosinophils |
| (C) | Basophiles |
| (D) | Monocytes |
| | |
| | |
| Q.69 | The site of photosynthesis in cyanobacteria is _____. |
| (A) | Chloroplast |
| (B) | Chromatophores |
| (C) | Thylakoids |
| (D) | Chlorosomes |
| | |
| | |
| | |
| | |

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## GATE 2022 Life Sciences XL

| | |
|---|---|
| Q.70 | The antimicrobial activity of vancomycin is due to the _____. |
| (A) | inhibition of nucleic acid synthesis |
| (B) | damage to the cytoplasmic membrane |
| (C) | inhibition of cell wall synthesis |
| (D) | regulation of DNA supercoiling |
| | |
| | |
| Q.71 | Phenolics act as disinfectant by _____. |
| (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 |
| | |
| | |
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## GATE 2022 Life Sciences XL

| | |
|---|---|
| Q.72 | Which of the following methods are used for the identification of microorganisms? |
| (A) | Nucleic acid hybridization |
| (B) | Southern blotting |
| (C) | 16s rRNA sequencing |
| (D) | Percentage G-C content |
| | |
| | |
| Q.73 | Which of the following are present in Gram-negative bacteria? |
| (A) | Lipopolysaccharide |
| (B) | Teichoic acid |
| (C) | Periplasm |
| (D) | Endotoxin |
| | |
| | |
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# GATE 2022 Life Sciences XL
## Q.74 – Q.84 Carry TWO marks Each

| | |
|---|---|
| Q.74 | Nonsense suppressor mutation is found in _____. |
| (A) | rRNA |
| (B) | tRNA |
| (C) | start codon of mRNA |
| (D) | stop codon of mRNA |
| | |
| | |
| Q.75 | Choose the correct match for structural components of bacteria to their function. |

| **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) |

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# GATE 2022 Life Sciences XL

| | |
|---|---|
| | |
| | |
| Q.76 | Match the pathogen with the appropriate disease.<br><br>**Pathogen** — **Disease**<br><br>(P) *Streptococcus pyogenes* — (i) Scarlet fever<br><br>(Q) *Brucella species* — (ii) Pott's disease<br><br>(R) *Mycobacterium tuberculosis* — (iii) Traveler's diarrhea<br><br>(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) |
| | |
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# GATE 2022 Life Sciences XL

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

**Bacteria**

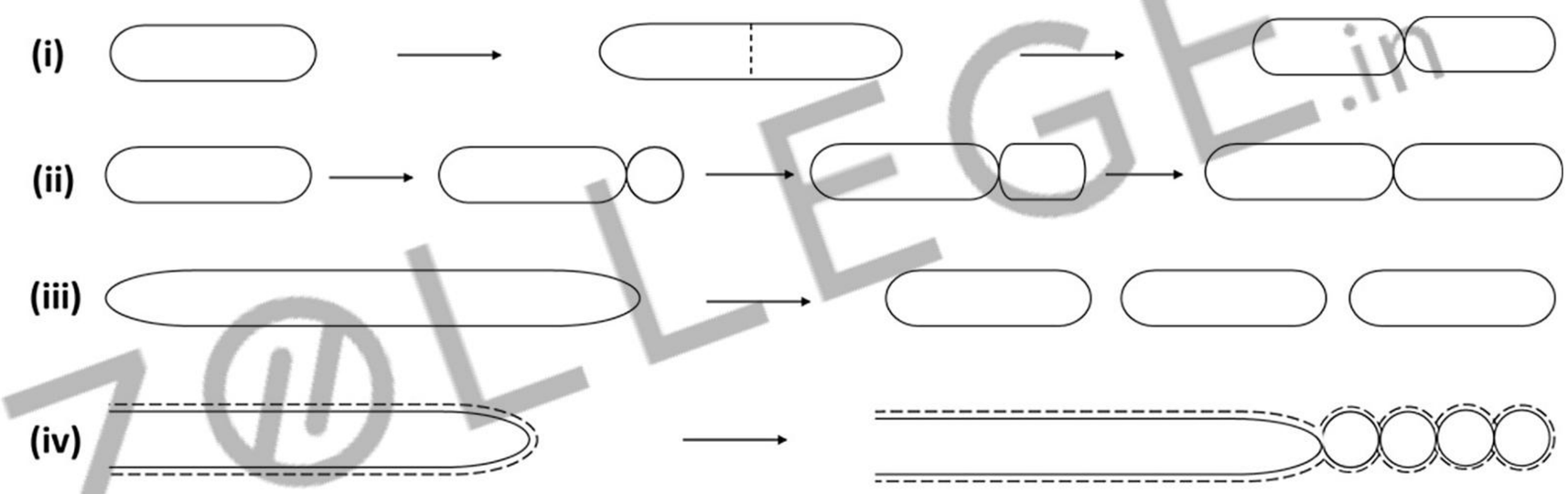
(P) *Streptomyces species*

(Q) *Rhodopseudomonas acidophila*

(R) *Bacillus subtilis*

(S) *Nocardia species*

**Mode of cell division**




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| | |
|---|---|
| (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) |
| | |
| | |
| | |
| | |



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## GATE 2022 Life Sciences XL

| | |
|---|---|
| Q.78 | The correct sequence of overall biochemical reaction which expresses the process of denitrification is ____ |
| (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) | $2NO_3^- \rightarrow N_2O \rightarrow 2NO \rightarrow 2NO_2^- \rightarrow N_2$ |
| | |
| | |
| Q.79 | Which of the following diseases are caused by family of DNA viruses? |
| (A) | Hepatitis B |
| (B) | Smallpox |
| (C) | Influenza |
| (D) | Rabies |
| | |
| | |
| | |
| | |

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## GATE 2022 Life Sciences XL

| | |
|---|---|
| Q.80 | Which of the following Gram-positive cocci are found in biofilm of dental plaque? |
| (A) | *Gonococcus* |
| (B) | *Streptococcus mutans* |
| (C) | *Streptococcus sobrinus* |
| (D) | *Fusobacterium species* |
| | |
| | |
| Q.81 | Which of the following statements are TRUE for archaea? |
| (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 |
| | |
| | |
| | |
| | |
| | |

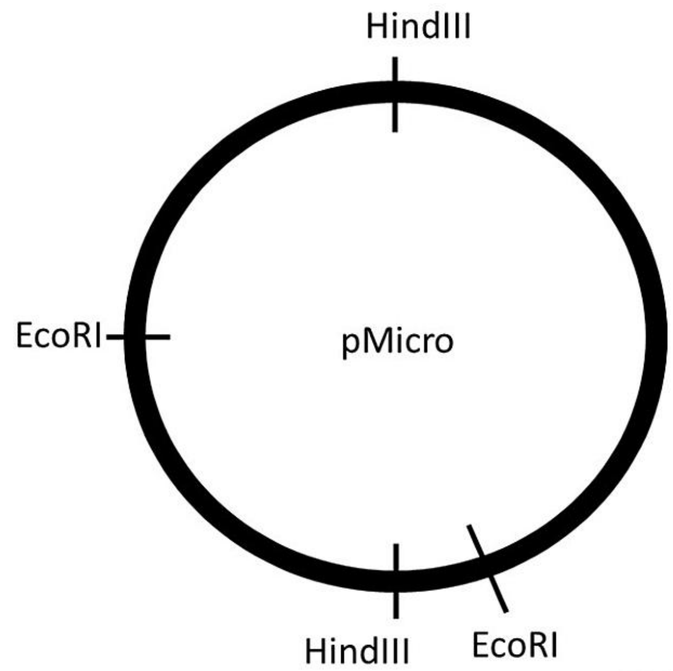
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# GATE 2022 Life Sciences XL

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




| | |
|---|---|
| | |
| | |
| Q.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)* |
| | |
| | |
| Q.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)*<br><br>*Consider Sin 58° = 0.85 and refractive index of immersion oil used is = 1.50.* |
| | |
| | |

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# GATE 2022 Life Sciences XL

## Zoology (XL-T) Q.85 – Q.92 Carry ONE mark each

| | |
|---|---|
| Q.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? |
| (A) | Nucleoside |
| (B) | Nucleotide |
| (C) | Base |
| (D) | Nucleic acid |

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| | |
|---|---|
| Q.86 | Which one of the following animals develops adaptive predator avoidance morphology because of the presence of high predator number in its habitat? |
| (A) | *Daphnia sp.* |
| (B) | *Scaphiopus sp.* |
| (C) | *Wolbachia sp.* |
| (D) | *Rhodnius sp.* |



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# GATE 2022 Life Sciences XL

| | |
|---|---|
| Q.87 | To which class of Drosophila developmental genes does *fushi tarazu* (*ftz*) belong? |
| (A) | Gap genes |
| (B) | Segment polarity genes |
| (C) | Pair rule genes |
| (D) | Maternal effect genes |

| | |
|---|---|
| Q.88 | The action of which class of enzyme inhibitors can be reversed by adding an excess of substrate? |
| (A) | Uncompetitive inhibitors |
| (B) | Competitive inhibitors |
| (C) | Non-specific inhibitors |
| (D) | Allosteric inhibitors |

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## GATE 2022 Life Sciences XL

| | |
|---|---|
| Q.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? |
| (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 |

**Q.90 – Q.92 Multiple Select Question (MSQ) carry ONE mark each (no negative marks)**

| | |
|---|---|
| Q.90 | Which of the following is/are responsible for reversible receptor–ligand interaction? |
| (A) | Ionic interactions |
| (B) | Hydrogen bonding |
| (C) | Peptide bonding |
| (D) | Hydrophobic interactions |

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# GATE 2022 Life Sciences XL

| | |
|---|---|
| Q.91 | In the human body, which of the following is/are involved in processing of a foreign antigen? |
| (A) | B-cells |
| (B) | Macrophages |
| (C) | Red blood cells |
| (D) | Platelets |

| | |
|---|---|
| Q.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? |
| (A) | Raccoon |
| (B) | Panda |
| (C) | Polar Bear |
| (D) | Koala Bear |

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**GATE 2022 Life Sciences XL**

**Q.93 – Q.103 Multiple Choice Questions (MCQ) carry TWO marks each (for each wrong answer: - 2/3)**

<table>
<tr><td>Q.93</td><td>Match the drug/chemicals listed in Column I with the developmental/physiological defects listed in Column II.<br><br>Column I — Column II<br>P. Veratrum alkaloids — (i) Obesity<br>Q. Thalidomide — (ii) Minamata syndrome<br>R. Methylmercury — (iii) Cyclopia<br>S. Diethylstilbesterol — (iv) Phocomelia</td></tr>
<tr><td>(A)</td><td>P-(iii); Q-(iv); R-(ii); S-(i)</td></tr>
<tr><td>(B)</td><td>P-(i); Q-(iv), R-(iii), S-(ii)</td></tr>
<tr><td>(C)</td><td>P-(ii), Q-(iv), R-(iii), S-(i)</td></tr>
<tr><td>(D)</td><td>P-(ii), Q-(iii), R-(iv), S-(i)</td></tr>
</table>

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## GATE 2022 Life Sciences XL

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

| 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)

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

| 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

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

| 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-(iii), R-(i), S-(ii)

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

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

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Q.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

| 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

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**GATE 2022 Life Sciences XL**

**Q.98 – Q.100 Multiple Select Questions (MSQ) carry TWO marks each (no negative marks)**

| | |
|---|---|
| Q.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? |
| (A) | Hexokinase |
| (B) | Glucose 6-phosphate isomerase |
| (C) | Glucose-6 phosphate dehydrogenase |
| (D) | Phosphofructokinase |

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| | |
|---|---|
| Q.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? |
| (A) | Magnification of the objective lens |
| (B) | Intensity of incident light |
| (C) | Wavelength |
| (D) | Numerical aperture of the objective lens |



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## GATE 2022 Life Sciences XL

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

| 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

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**GATE 2022 Life Sciences XL**

**Q.101 – Q.103 Numerical Answer Type (NAT), carry TWO marks each (no negative marks).**

| | |
|---|---|
| Q.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*). |
| | |

| | |
|---|---|
| Q.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*) |
| | |

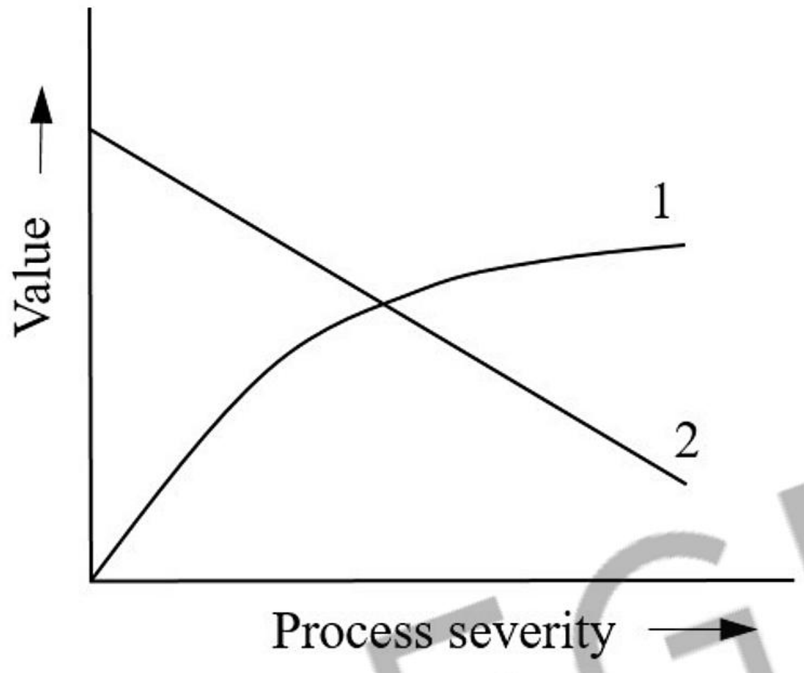
| | |
|---|---|
| Q.103 | The average body length of *Drosophila nasuta* collected from Andaman and Nicobar Islands is 2 mm. From this population, a few males and females having a body length of 3 mm were selected and interbred. The average body length of the resultant progeny was 2.5 mm. The heritability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

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**GATE 2022 Life Sciences XL**
**Food Technology XL (U) Q.104 – Q.111 Carry ONE mark Each**

| | |
|---|---|
| Q.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?<br>  <br> |
| (A) | 1-Safety, 2-Quality |
| (B) | 1-Yield, 2-Safety |
| (C) | 1-Yield, 2-Quality |
| (D) | 1-Quality, 2-Safety |
| | |
| Q.105 | Homogenization of milk leads to disintegration of fat globules by |
| (A) | Turbulence and pasteurization |
| (B) | Pasteurization and cavitation |
| (C) | Pasteurization and pressurization |
| (D) | Turbulence and cavitation |

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# GATE 2022 Life Sciences XL

| | |
|---|---|
| | |
| Q.106 | The lowest water activity ($a_w$) supporting the growth of *Staphylococcus aureus* in food under aerobic condition is |
| (A) | 0.98 |
| (B) | 0.91 |
| (C) | 0.89 |
| (D) | 0.86 |
| | |
| Q.107 | Cultures used in industrial production of yogurt are |
| (A) | *Lactococcus lactis subsp. lactis* |
| (B) | *Streptococcus thermophilus* |
| (C) | *Leuconostoc mesenteroides subsp. cremoris* |
| (D) | *Lactobacillus delbrueckii subsp. bulgaricus* |
| | |

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## GATE 2022 Life Sciences XL

| | |
|---|---|
| Q.108 | In a dairy plant, spray drying technology is used to produce whey powder. The rate of spray drying depends on |
| (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 |
| | |
| Q.109 | The parboiling of paddy results into |
| (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 |
| | |
| Q.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*). |
| | |
| Q.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*). |
| | |

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# GATE 2022 Life Sciences XL

## Q.112 – Q.122 Carry TWO marks Each

| | |
|---|---|
| Q.112 | Match the edible oil refining stages given in Column I with their respective functions in Column II<br><br>Column I<br>P. Degumming<br>Q. Neutralization<br>R. Bleaching<br>S. Winterization<br><br>Column II<br>1. Separation of waxes<br>2. Removal of pigments<br>3. Removal of phosphatides<br>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 |
| | |

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## GATE 2022 Life Sciences XL

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

| 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) 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

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## GATE 2022 Life Sciences XL

| | |
|---|---|
| Q.114 | Which of the following is not a caramel flavour producing compound? |
| (A) | 3-Hydroxy-2-methylpyran-4-one |
| (B) | 2H-4-Hydroxy-5-methylfuran-3-one |
| (C) | 3-Hydroxy-2-acetylfuran |
| (D) | p-Amino benzoicacid |
| | |
| Q.115 | Match the size reduction equipment in Column I with the method of operation in Column II.<br><br>Column I — Column II<br><br>P. Hammer mill — 1. Compression<br><br>Q. Burr mill — 2. Impact<br><br>R. Crushing rolls — 3. Cutting<br><br>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 |
| | |

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## GATE 2022 Life Sciences XL

| | |
|---|---|
| Q.116 | Most commonly used refrigerant in direct immersion freezing of food is |
| (A) | Monochlorodifluoromethane |
| (B) | Dichlorodifluoromethane |
| (C) | Liquid nitrogen |
| (D) | Freon |
| | |
| Q.117 | Which among the following are ω-6 poly unsaturated essential fatty acids? |
| (A) | 18:2 Linoleic acid |
| (B) | 18:3 α-Linolenic acid |
| (C) | 18:3 γ-Linolenic acid |
| (D) | 20:4 Arachidonic acid |
| | |
| Q.118 | Which among the following statements are true with respect to protein denaturation? |
| (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 |

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| | |
|---|---|
| | |
| Q.119 | Identify the correct pair(s) of milling equipment and the grain for which it is used. |
| (A) | Mist polisher–Rice |
| (B) | Break roll–Wheat |
| (C) | Rubber roll–Pigeon pea |
| (D) | Beall degermer–Maize |
| | |
| Q.120 | Which among the following expression(s) is/are correct? |
| (A) | Reynolds number = $\frac{Density \times Velocity \times Characteristic\ dimension}{Viscosity}$ |
| (B) | Nusselt number = $\frac{Convective\ heat\ transfer\ coefficient \times Characteristic\ dimension}{Thermal\ conductivity\ of\ solid}$ |
| (C) | Schmidt number = $\frac{Kinematic\ viscosity\ of\ fluid}{Diffusivity}$ |
| (D) | Biot number = $\frac{Convective\ heat\ transfer\ coefficient \times Characteristic\ dimension}{Thermal\ conductivity\ of\ fluid}$ |
| | |

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|---|---|
| | |
| Q.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*).<br><br>Given: $\pi = 3.14$ |
| | |
| | |
| | |
| Q.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*).<br><br>Given: Molecular weight of water vapour and dry air are 18.02 g $mol^{-1}$ and 28.97 g $mol^{-1}$, respectively. |
| | |

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| Q.No. | Session | Question Type | Section Name | Key/Range | Mark |
|---|---|---|---|---|---|
| 1 | 6 | MCQ | GA | C | 1 |
| 2 | 6 | MCQ | GA | B | 1 |
| 3 | 6 | MCQ | GA | C | 1 |
| 4 | 6 | MCQ | GA | D | 1 |
| 5 | 6 | MCQ | GA | A | 1 |
| 6 | 6 | MCQ | GA | B | 2 |
| 7 | 6 | MCQ | GA | D | 2 |
| 8 | 6 | MCQ | GA | D | 2 |
| 9 | 6 | MCQ | GA | D | 2 |
| 10 | 6 | MCQ | GA | C | 2 |
| 11 | 6 | MCQ | XL-P | C | 1 |
| 12 | 6 | MCQ | XL-P | B | 1 |
| 13 | 6 | MCQ | XL-P | B | 1 |
| 14 | 6 | MCQ | XL-P | A | 1 |
| 15 | 6 | MCQ | XL-P | D | 1 |
| 16 | 6 | MCQ | XL-P | A | 1 |
| 17 | 6 | MCQ | XL-P | C | 1 |
| 18 | 6 | MCQ | XL-P | C | 1 |
| 19 | 6 | NAT | XL-P | 0.11 to 0.13 | 1 |
| 20 | 6 | MCQ | XL-P | D | 2 |
| 21 | 6 | MSQ | XL-P | A, D | 2 |
| 22 | 6 | MSQ | XL-P | A, B, D | 2 |
| 23 | 6 | MSQ | XL-P | B, D | 2 |
| 24 | 6 | NAT | XL-P | 9700 to 10000 | 2 |
| 25 | 6 | NAT | XL-P | 4 to 4 | 2 |
| 26 | 6 | NAT | XL-P | 28.2 to 28.3 | 2 |
| 27 | 6 | NAT | XL-P | 17.3 to 17.5 | 2 |
| 28 | 6 | MCQ | XL-Q | C | 1 |
| 29 | 6 | MCQ | XL-Q | C | 1 |
| 30 | 6 | MCQ | XL-Q | A | 1 |
| 31 | 6 | MCQ | XL-Q | D | 1 |
| 32 | 6 | NAT | XL-Q | 0.25 to 0.25 | 1 |
| 33 | 6 | NAT | XL-Q | 5.65 to 5.65 | 1 |
| 34 | 6 | NAT | XL-Q | 3 to 3 | 1 |
| 35 | 6 | NAT | XL-Q | 1500 to 1500 | 1 |
| 36 | 6 | MCQ | XL-Q | A | 2 |
| 37 | 6 | MCQ | XL-Q | B | 2 |
| 38 | 6 | MCQ | XL-Q | B | 2 |
| 39 | 6 | MCQ | XL-Q | A | 2 |
| 40 | 6 | MCQ | XL-Q | A | 2 |
| 41 | 6 | MSQ | XL-Q | A, B, C | 2 |
| 42 | 6 | MSQ | XL-Q | A, B, C | 2 |
| 43 | 6 | NAT | XL-Q | -28.1 to -27.8 | 2 |
| 44 | 6 | NAT | XL-Q | 25 to 25 | 2 |

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| | | | | | |
|---|---|---|---|---|---|
| 45 | 6 | NAT | XL-Q | 0.4 to 0.4 | 2 |
| 46 | 6 | NAT | XL-Q | 16 to 16 | 2 |
| 47 | 6 | MCQ | XL-R | C | 1 |
| 48 | 6 | MCQ | XL-R | B | 1 |
| 49 | 6 | MCQ | XL-R | B | 1 |
| 50 | 6 | MCQ | XL-R | D | 1 |
| 51 | 6 | MSQ | XL-R | A, B | 1 |
| 52 | 6 | MSQ | XL-R | B, C | 1 |
| 53 | 6 | MSQ | XL-R | A, C, D | 1 |
| 54 | 6 | NAT | XL-R | 5 to 5 | 1 |
| 55 | 6 | MCQ | XL-R | B | 2 |
| 56 | 6 | MCQ | XL-R | D | 2 |
| 57 | 6 | MCQ | XL-R | A | 2 |
| 58 | 6 | MCQ | XL-R | A | 2 |
| 59 | 6 | MCQ | XL-R | D | 2 |
| 60 | 6 | MCQ | XL-R | C | 2 |
| 61 | 6 | MCQ | XL-R | C | 2 |
| 62 | 6 | MSQ | XL-R | A, D | 2 |
| 63 | 6 | MSQ | XL-R | A, B, D | 2 |
| 64 | 6 | NAT | XL-R | 18.75 to 18.75 | 2 |
| 65 | 6 | NAT | XL-R | 64.2 to 64.3 | 2 |
| 66 | 6 | MCQ | XL-S | C | 1 |
| 67 | 6 | MCQ | XL-S | D | 1 |
| 68 | 6 | MCQ | XL-S | A | 1 |
| 69 | 6 | MCQ | XL-S | C | 1 |
| 70 | 6 | MCQ | XL-S | C | 1 |
| 71 | 6 | MCQ | XL-S | A | 1 |
| 72 | 6 | MSQ | XL-S | A, B, C | 1 |
| 73 | 6 | MSQ | XL-S | A, C, D | 1 |
| 74 | 6 | MCQ | XL-S | B | 2 |
| 75 | 6 | MCQ | XL-S | B | 2 |
| 76 | 6 | MCQ | XL-S | C | 2 |
| 77 | 6 | MCQ | XL-S | C | 2 |
| 78 | 6 | MCQ | XL-S | B | 2 |
| 79 | 6 | MSQ | XL-S | A, B | 2 |
| 80 | 6 | MSQ | XL-S | B, C | 2 |
| 81 | 6 | MSQ | XL-S | C, D | 2 |
| 82 | 6 | NAT | XL-S | 4 to 4 | 2 |
| 83 | 6 | NAT | XL-S | 7.1 to 7.2 | 2 |
| 84 | 6 | NAT | XL-S | 1.2 to 1.3 | 2 |
| 85 | 6 | MCQ | XL-T | B | 1 |
| 86 | 6 | MCQ | XL-T | A | 1 |
| 87 | 6 | MCQ | XL-T | C | 1 |
| 88 | 6 | MCQ | XL-T | B | 1 |
| 89 | 6 | MCQ | XL-T | C | 1 |
| 90 | 6 | MSQ | XL-T | A, B, D | 1 |

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| | | | | | |
|---|---|---|---|---|---|
| 91 | 6 | MSQ | XL-T | A, B | 1 |
| 92 | 6 | MSQ | XL-T | B, C, D | 1 |
| 93 | 6 | MCQ | XL-T | A | 2 |
| 94 | 6 | MCQ | XL-T | D | 2 |
| 95 | 6 | MCQ | XL-T | D | 2 |
| 96 | 6 | MCQ | XL-T | B | 2 |
| 97 | 6 | MCQ | XL-T | C | 2 |
| 98 | 6 | MSQ | XL-T | A, B | 2 |
| 99 | 6 | MSQ | XL-T | C, D | 2 |
| 100 | 6 | MSQ | XL-T | B | 2 |
| 101 | 6 | NAT | XL-T | 1100 to 1100 | 2 |
| 102 | 6 | NAT | XL-T | 0.04 to 0.04 | 2 |
| 103 | 6 | NAT | XL-T | 0.5 to 0.5 | 2 |
| 104 | 6 | MCQ | XL-U | A | 1 |
| 105 | 6 | MCQ | XL-U | D | 1 |
| 106 | 6 | MCQ | XL-U | D | 1 |
| 107 | 6 | MSQ | XL-U | B, D | 1 |
| 108 | 6 | MSQ | XL-U | A, C, D | 1 |
| 109 | 6 | MSQ | XL-U | B, C | 1 |
| 110 | 6 | NAT | XL-U | 5.5 to 6.0 | 1 |
| 111 | 6 | NAT | XL-U | 25 to 28 | 1 |
| 112 | 6 | MCQ | XL-U | C | 2 |
| 113 | 6 | MCQ | XL-U | A | 2 |
| 114 | 6 | MCQ | XL-U | D | 2 |
| 115 | 6 | MCQ | XL-U | A | 2 |
| 116 | 6 | MCQ | XL-U | C | 2 |
| 117 | 6 | MSQ | XL-U | A, C, D | 2 |
| 118 | 6 | MSQ | XL-U | A, C | 2 |
| 119 | 6 | MSQ | XL-U | A, B, D | 2 |
| 120 | 6 | MSQ | XL-U | A, C | 2 |
| 121 | 6 | NAT | XL-U | 1700 to 1800 | 2 |
| 122 | 6 | NAT | XL-U | 0.017 to 0.021 | 2 |

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