GATE 2014: General Instructions during Examination

1. Total duration of the GATE examination is **180** minutes.
2. The clock will be set at the server. The countdown timer at the top right corner of screen will display the remaining time available for you to complete the examination. When the timer reaches zero, the examination will end by itself. You need not terminate the examination or submit your paper.
3. Any useful data required for your paper can be viewed by clicking on the **Useful Common Data** button that appears on the screen.
4. Use the scribble pad provided to you for any rough work. Submit the scribble pad at the end of the examination.
5. You are allowed to use a non-programmable type calculator, however, sharing of calculators is not allowed.
6. The Question Palette displayed on the right side of screen will show the status of each question using one of the following symbols:

1	You have not visited the question yet.
3	You have not answered the question.
5	You have answered the question.
7	You have NOT answered the question, but have marked the question for review.
9	You have answered the question, but marked it for review.

The **Marked for Review** status for a question simply indicates that you would like to look at that question again. *If a question is answered, but marked for review, then the answer will be considered for evaluation unless the status is modified by the candidate.*

Navigating to a Question :

7. To answer a question, do the following:
   a. Click on the question number in the Question Palette to go to that question directly.
   b. Select an answer for a multiple choice type question by clicking on the bubble placed before the 4 choices, namely A, B, C and D. Use the virtual numeric keypad to enter a number as answer for a numerical type question.
   c. Click on **Save & Next** to save your answer for the current question and then go to the next question.
   d. Click on **Mark for Review & Next** to save your answer for the current question and also mark it for review, and then go to the next question.

Caution: Note that your answer for the current question will not be saved, if you navigate to another question directly by clicking on a question number without saving the answer to the previous question.

You can view all the questions by clicking on the **Question Paper** button. This feature is provided, so that if you want you can just see the entire question paper at a glance.

<u>Answering a Question :</u>

8. Procedure for answering a multiple choice (MCQ) type question:
   a. Choose one answer from the 4 options (A,B,C,D) given below the question, click on the bubble placed before the chosen option.
   b. To deselect your chosen answer, click on the bubble of the chosen option again or click on the **Clear Response** button.
   c. To change your chosen answer, click on the bubble of another option.
   d. To save your answer, you MUST click on the **Save & Next** button.

9. Procedure for answering a numerical answer type question:
   a. To enter a number as your answer, use the virtual numerical keypad.
   b. A fraction (e.g. -0.3 or -.3) can be entered as an answer with or without '0' before the decimal point. As many as four decimal points, e.g. 12.5435 or 0.003 or -932.6711 or 12.82 can be entered.
   c. To clear your answer, click on the **Clear Response** button.
   d. To save your answer, you MUST click on the **Save & Next** button

10. To mark a question for review, click on the **Mark for Review & Next** button. *If an answer is selected (for MCQ) or entered (for numerical answer type) for a question that is* **Marked for Review**, *that answer will be considered in the evaluation unless the status is modified by the candidate.*

11. To change your answer to a question that has already been answered, first select that question for answering and then follow the procedure for answering that type of question.

12. Note that ONLY Questions for which answers are *saved* or *marked for review after answering* will be considered for evaluation.

<u>Choosing a Section :</u>

13. Sections in this question paper are displayed on the top bar of the screen. Questions in a Section can be viewed by clicking on the name of that Section. The Section you are currently viewing will be highlighted.

14. A checkbox is displayed for every optional Section, if any, in the Question Paper. To select the optional Section for answering, click on the checkbox for that Section.

15. If the checkbox for an optional Section is not selected, the **Save & Next** button and the **Mark for Review & Next** button will NOT be enabled for that Section. You will

only be able to see questions in this Section, but you will not be able to answer questions in the Section.

16. After clicking the **Save & Next** button for the last question in a Section, you will automatically be taken to the first question of the next Section in sequence.

17. You can move the mouse cursor over the name of a Section to view the answering status for that Section.

Changing the Optional Section :

18. After answering the chosen optional Section, partially or completely, you can change the optional Section by selecting the checkbox for a new Section that you want to attempt. A warning message will appear along with a table showing the number of questions answered in each of the previously chosen optional Sections and a checkbox against each of these Sections. Click on a checkbox against a Section that you want to reset and then click on the **RESET** button. Note that RESETTING a Section will DELETE all the answers for questions in that Section. Hence, if you think that you may want to select this Section again later, you will have to note down your answers for questions in that Section. If you do not want to reset the Section and want to continue answering the previously chosen optional Section, then click on the **BACK** button.

19. If you deselect the checkbox for an optional Section in the top bar, the following warning message will appear: "Deselecting the checkbox will DELETE all the answers for questions in this Section. Do you want to deselect this Section?" If you want to deselect, click on the **RESET** button. If you do not want to deselect, click on the **BACK** button.

20. You can shuffle between different Sections or change the optional Sections any number of times.

GATE 2014 Examination

BT: Biotechnology

Duration: **180 minutes**   *Maximum Marks*: **100**

Read the following instructions carefully.

1. To login, enter your Registration Number and password provided to you. Kindly go through the various symbols used in the test and understand their meaning before you start the examination.
2. Once you login and after the start of the examination, you can view all the questions in the question paper, by clicking on the **View All Questions** button in the screen.
3. This question paper consists of **2 sections**, General Aptitude (GA) for **15 marks** and the subject specific GATE paper for **85 marks**. Both these sections are compulsory.
   The GA section consists of **10** questions. Question numbers 1 to 5 are of 1-mark each, while question numbers 6 to 10 are of 2-mark each.
   The subject specific GATE paper section consists of **55** questions, out of which question numbers 1 to 25 are of 1-mark each, while question numbers 26 to 55 are of 2-mark each.
4. Depending upon the GATE paper, there may be useful common data that may be required for answering the questions. If the paper has such useful data, the same can be viewed by clicking on the **Useful Common Data** button that appears at the top, right hand side of the screen.

5. The computer allotted to you at the examination center runs specialized software that permits only one answer to be selected for multiple-choice questions using a mouse and to enter a suitable number for the numerical answer type questions using the virtual keyboard and mouse.
6. Your answers shall be updated and saved on a server periodically and also at the end of the examination. The examination will **stop automatically** at the end of **180 minutes**.
7. In each paper a candidate can answer a total of 65 questions carrying 100 marks.
8. The question paper may consist of questions of **multiple choice type** (MCQ) and **numerical answer type**.
9. Multiple choice type questions will have four choices against A, B, C, D, out of which only **ONE** is the correct answer. The candidate has to choose the correct answer by clicking on the bubble (◯) placed before the choice.
10. For numerical answer type questions, each question will have a numerical answer and there will not be any choices**. For these questions, the answer should be entered**by using the virtual keyboard that appears on the monitor and the mouse.
11. All questions that are not attempted will result in zero marks. However, wrong answers for multiple choice type questions (MCQ) will result in **NEGATIVE** marks. For all MCQ questions a wrong answer will result in deduction of $\frac{1}{3}$ marks for a 1-mark question and $\frac{2}{3}$ marks for a 2-mark question.
12. There is **NO NEGATIVE MARKING** for questions of **NUMERICAL ANSWER TYPE**.

13. Non-programmable type Calculator is allowed. Charts, graph sheets, and mathematical tables are **NOT** allowed in the Examination Hall. You must use the Scribble pad provided to you at the examination centre for all your rough work. The Scribble Pad has to be returned at the end of the examination.

Declaration by the candidate:

"I have read and understood all the above instructions. I have also read and understood clearly the instructions given on the admit card and shall follow the same. I also understand that in case I am found to violate any of these instructions, my candidature is liable to be cancelled. I also confirm that at the start of the examination all the computer hardware allotted to me are in proper working condition".

Q. 1 – Q. 5 carry one mark each.

Q.1   Choose the most appropriate word from the options given below to complete the following sentence.

A person suffering from Alzheimer's disease _____ short-term memory loss.

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

Q.2   Choose the most appropriate word from the options given below to complete the following sentence.

_____ is the key to their happiness; they are satisfied with what they have.

(A) Contentment   (B) Ambition   (C) Perseverance   (D) Hunger

Q.3   Which of the following options is the closest in meaning to the sentence below?

"As a woman, I have no country."

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

Q.4   In any given year, the probability of an earthquake greater than Magnitude 6 occurring in the Garhwal Himalayas is 0.04. The average time between successive occurrences of such earthquakes is ____ years.

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

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

Q. 6 – Q. 10 carry two marks each.

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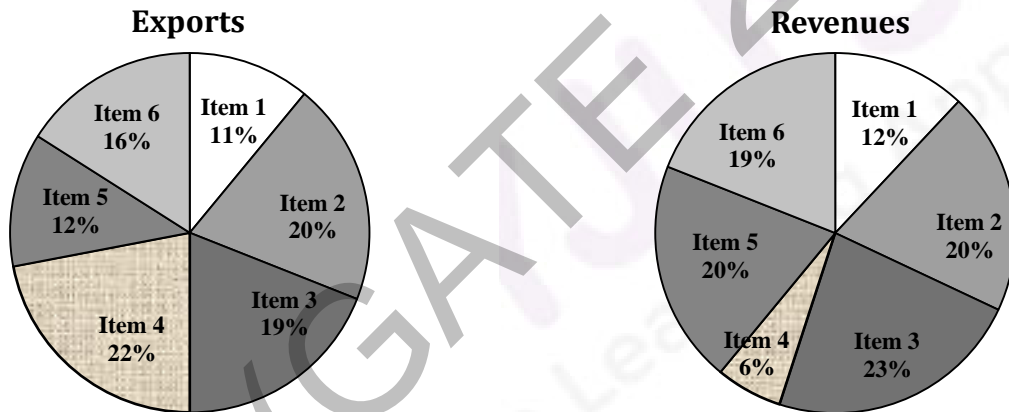**Statements**
      1.   Shiv is younger to Riaz.
      2.   Shiv is elder to Som.

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

Q.7   Moving into a world of big data will require us to change our thinking about the merits of exactitude. To apply the conventional mindset of measurement to the digital, connected world of the twenty-first century is to miss a crucial point. As mentioned earlier, the obsession with exactness is an artefact of the information-deprived analog era. When data was sparse, every data point was critical, and thus great care was taken to avoid letting any point bias the analysis.
From "BIG DATA" Viktor Mayer-Schonberger and Kenneth Cukier

The <u>main</u> point of the paragraph is:

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

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

Exports

Revenues

Item 6 16% Item 1 11% Item 2 20% Item 3 19% Item 4 22% Item 5 12%

Item 6 19% Item 1 12% Item 2 20% Item 3 23% Item 4 6% Item 5 20%

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

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

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

Q.10   10% of the population in a town is HIV^{+}. A new diagnostic kit for HIV detection is available; this kit correctly identifies HIV^{+} individuals 95% of the time, and HIV^{-} individuals 89% of the time. A particular patient is tested using this kit and is found to be positive. The probability that the individual is actually positive is _____

END OF THE QUESTION PAPER

Q. 1 – Q. 25 carry one mark each.

Q.1 The eigenvalues of $\mathbf{A} = \begin{bmatrix} 1 & -4 \\ 2 & -3 \end{bmatrix}$ are

(A) $2 \pm i$ (B) -1, -2

(C) $-1 \pm 2i$ (D) non-existent

Q.2 If an unbiased coin is tossed 10 times, the probability that all outcomes are same will be ___ x10^{-5}

Q.3 The solution for the following set of equations is,

$$5x + 4y + 10z = 13$$
$$x + 3y + z = 7$$
$$4x - 2y + z = 0$$

(A) x=2, y=1, z=1   (B) x=1, y=2, z=0

(C) x=1, y=0, z=2   (D) x=0, y=1, z=2

Q.4 The limit of the function $e^{-2t} sin\ (t)$ as t $\rightarrow \infty$, is _____

Q.5 The solution to the following set of equations is

$$2x + 3y = 4$$
$$4x + 6y = 0$$

(A) x=0, y=0   (B) x=2, y=0   (C) 4x= -6y   (D) No solution

Q.6 The unit for specific substrate consumption rate in a growing culture is

(A) $\frac{g}{L \cdot h}$ (B) $\frac{g}{h}$

(C) $\frac{g}{g \cdot h}$ (D) $\frac{gmoles}{L \cdot h}$

Q.7 If the dissociation constant for solute-adsorbent binding is K_D, the retention time of the solute in a chromatography column

(A) increases with increasing K_D
(B) decreases with increasing K_D
(C) passes through minimum with increasing K_D
(D) is independent of K_D

Q.8 In a batch culture of *Penicillium chrysogenum*, the maximum penicillin synthesis occurs during the

(A) lag phase
(B) exponential phase
(C) stationary phase
(D) death phase

Q.9   The most plausible explanation for a sudden increase of the respiratory quotient (RQ) of a microbial culture is that

(A) cells are dying
(B) yield of biomass is increasing
(C) the fermentation rate is increasing relative to respiration rate
(D) the maintenance rate is decreasing

Q.10   Which of the following is employed for the repeated use of enzymes in bioprocesses?

(A) polymerization   (B) immobilization   (C) ligation   (D) isomerization

Q.11   Since mammalian cells are sensitive to shear, scale-up of a mammalian cell process must consider, among other parameters, the following (given N = rotations/time, D=diameter of impeller)

(A) πND (B) $\pi N^2 D$

(C) πND^2 (D) none of these

Q.12   The degree of reduction of ethanol is _____

Q.13   Gram-positive bacteria are generally resistant to complement-mediated lysis because

(A) thick peptidoglycan layer prevents insertion of membrane attack complex into the inner membrane
(B) Gram-positive bacteria import the membrane attack complex and inactivate it
(C) membrane attack complex is degraded by the proteases produced by the Gram-positive bacteria
(D) Gram-positive bacteria cannot activate the complement pathway

Q.14   A bacterium belonging to cocci group has a diameter of 2 μm. The numerical value of the ratio of its surface area to volume (in μm^{-1}) is _____

Q.15   Which of the following essential element(s) is/are required as major supplement to enhance the bioremediation of oil spills by the resident bacteria?

(A) Sulfur   (B) Nitrogen and phosphorus

(C) Iron   (D) Carbon

Q.16   The 4-amino or 4-keto group of pyrimidine bases is located in the

(A) major groove of the double stranded DNA
(B) minor groove of the double stranded DNA
(C) minor groove of the B form DNA but not the A form DNA
(D) major groove of the B form DNA but not the A form DNA

Q.17   The product(s) resulting from the hydrolysis of maltose is/are

(A) a mixture of α-D-Glucose and β-D-Glucose
(B) a mixture of D-Glucose and L-Glucose
(C) α-D-Glucose only
(D) β-D-Glucose only

Q.18   Amino acid residue which is most likely to be found in the interior of water-soluble globular proteins is

      (A) Threonine   (B) Aspartic acid   (C) Valine   (D) Histidine

Q.19   The 5' ends of the mature forms of the prokaryotic mRNAs and tRNAs are

      (A) a triphosphate group in mRNAs and a monophosphate group in tRNAs
      (B) triphosphate groups in both mRNAs and tRNAs
      (C) monophosphate groups in both mRNAs and tRNAs
      (D) a monophosphate group in mRNAs and a triphosphate group in tRNAs

Q.20   Prior exposure of plants to pathogens is known to increase resistance to future pathogen attacks. This phenomenon is known as

      (A) systemic acquired resistance   (B) hypersensitive response

      (C) innate immunity   (D) antibody mediated response

Q.21   Reactions between antibodies and antigens that are detected by precipitate formation in an agar gel are referred as

      (A) immunoprecipitation assay   (B) immunodiffusion assay

      (C) immunoaggregation assay   (D) immunofixation assay

Q.22   The algorithm for BLAST is based on

      (A) Dynamic Programming   (B) Hidden Markov Model

      (C) k-tuple analysis   (D) Neural Network

Q.23   The statistical frequency of the occurrence of a particular restriction enzyme cleavage site that is 6 bases long can be estimated to be

      (A) once every 24 bases   (B) once every 256 bases

      (C) once every 1024 bases   (D) once every 4096 bases

Q.24   The reactions leading to the formation of amino acids from the TCA cycle intermediates are

      (A) carboxylation   (B) isomerization   (C) transamination   (D) decarboxylation

Q.25   The growth medium for mammalian cells contains serum. One of the major functions of serum is to stimulate cell growth and attachment. However, it must be filter sterilized to

      (A) remove large proteins
      (B) remove collagen only
      (C) remove mycoplasma and microorganisms
      (D) remove foaming agents

Q. 26 – Q. 55 carry two marks each.

Q.26 The concentration profile of a chemical at a location x and time t, denoted by $c(x, t)$, changes as per the following equation,

$$c(x, t) = \frac{c_0}{\sqrt{2\pi D t}} \, exp[-\frac{x^2}{2Dt}]$$

where D and c_0 are assumed to be constant. Which of the following is correct?

(A) $\frac{\partial c}{\partial t} = D \, \frac{\partial^2 c}{\partial x^2}$

(B) $\frac{\partial c}{\partial t} = \frac{D}{2} \frac{\partial^2 c}{\partial x^2}$

(C) $\frac{\partial^2 c}{\partial t^2} = D \, \frac{\partial^2 c}{\partial x^2}$

(E) $\frac{\partial^2 c}{\partial t^2} = \frac{D}{2} \frac{\partial^2 c}{\partial x^2}$
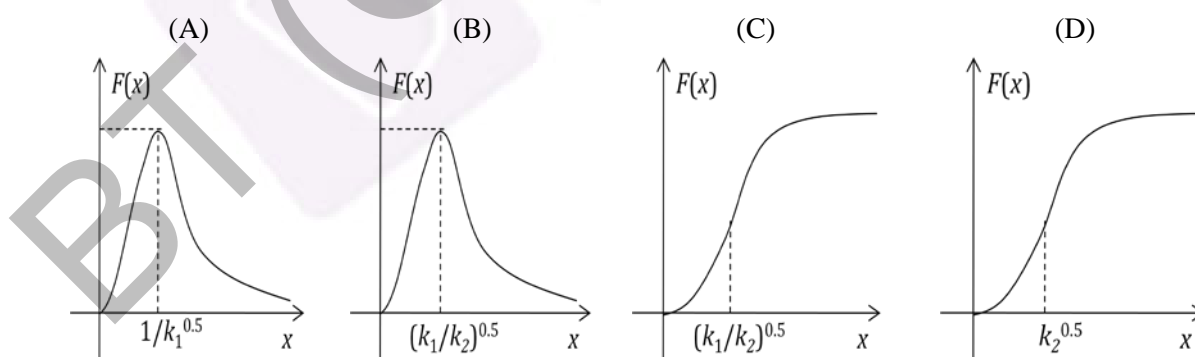
Q.27 If $y = x^x$, then $\frac{dy}{dx}$ is

(A) $x^x(x - 1)$

(B) x^{x-1}

(C) $x^x(1 + logx)$

(D) $e^x(1 + logx)$

Q.28 Which of the following statements is true for the series given below?

$$s_n = 1 + \frac{1}{\sqrt{2}} + \frac{1}{\sqrt{3}} + \frac{1}{\sqrt{4}} + \cdots + \frac{1}{\sqrt{n}}$$

(A) s_n converges to log(√n)

(B) s_n converges to √n

(C) s_n converges to exp(√n)

(D) s_n diverges

Q.29 The graph of the function $F(x) = \frac{x}{k_1 x^2 + k_2 x + 1}$ for $0 < x < \infty$ is

Q.30 A T-flask is seeded with 10^5 anchorage-dependent cells. The available area of the T-flask is 25 cm^2 and the volume of the medium is 25 ml. Assume that the cells are rectangles of size 5 µm × 2 µm. If the cells grow to monolayer confluence after 50 h, the growth rate in number of cells/(cm^2.h) is _____ x10^5.

Q.31   Consider a continuous culture provided with a sterile feed containing 10 mM glucose. The steady state cell density and substrate concentration at three different dilution rates are given in the table below.

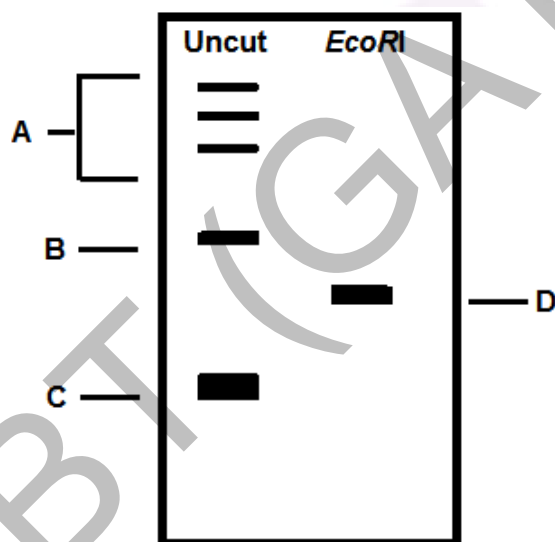| Dilution rate (h^{-1})	Cell density (g L^{-1})	Substrate concentration (mM)
0.05	0.248	0.067
0.5	0.208	1.667
5	0	10

The maximum specific growth rate μ_m (in h^{-1}), will be _____.

Q.32   Cholera toxin increases cAMP levels by

(A) modifying G_i protein
(B) modifying G_s protein
(C) binding to adenylate cyclase
(D) activating cAMP phosphodiesterase

Q.33   Triose phosphate isomerase converts dihydroxy acetone phosphate (DHAP) to glyceraldehyde-3-phosphate (G-3-P) in a reversible reaction. At 298 K and pH 7.0, the equilibrium mixture contains 40 mM DHAP and 4 mM G-3-P. Assume that the reaction started with 44 mM DHAP and no G-3-P. The standard free-energy change in kJ/mol for the formation of G-3-P [R = 8.315 J/mol.K] is _____.

Q.34   The plasmid DNA was subjected to restriction digestion using the enzyme *EcoR*I and analysed on an agarose gel. Assuming digestion has worked (the enzyme was active), match the identity of the DNA bands shown in the image in **Group I** with their identity in **Group II**.

Group I

P. Bands labeled as A
Q. Band labeled as B
R. Band labeled as C
S. Band labeled as D

Group II

1. Nicked
2. Supercoiled
3. Concatemers
4. Linear

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

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

Q.35　In a relatively large but finite and closed population of sexually reproducing diploid organisms, the frequency of homozygous genotype PP changes from 0.40 to 0.50 and that of pp changes from 0.40 to 0.41 in a span of 10 generations. Which of the following is the most likely cause for the above change in frequency of the PP genotype?

(A) Non-random mating

(B) Random genetic drift

(C) Selection

(D) Combination of non-random mating and random genetic drift

Q.36　Topological winding number of a 2.0 kb covalently closed circular DNA was found to be 191 with a writhing number of -4. Hence, its LINKING NUMBER and the NUMBER OF BASE PAIR PER TURN when the molecule is laid flat on the surface is _____ and_____, respectively.

(A) 187, 10.69　　　　(B) 195, 10.25　　　　(C) 200, 10.00　　　　(D) 187, 10.50

Q.37　Consider a population of 10,000 individuals, of which 2500 are homozygotes (PP) and 3000 are heterozygotes (Pp) genotype. The frequency of allele p in the population is _____ .

Q.38　Match the following photoreceptors with their prosthetic groups and spectral specificity

Photoreceptor		Moiety that absorbs light		Absorption (nm)	
P.	Phototropin	1.	Chromobilin	a.	400-500
Q.	Cryptochrome	2.	FAD	b.	600-800
R.	Phytochrome	3.	FMN	c.	500-600

(A) P-3-a, Q-2-a, R-1-b

(B) P-1-b, Q-1-a, R-3-b

(C) P-3-a, Q-1-a, R-1-c

(D) P-2-c, Q-1-c, R-1-a

Q.39　Match the following plant sources with their secondary metabolites and medical uses

Source plant	Secondary metabolites	Medical use
P. Belladona	1. Menthol	a. Cancer treatment
Q. Foxglove	2. Atropine	b. Heart disease
R. Pacific yew	3. Digitalin	c. Eye examination
S. Eucalyptus	4. Taxol	d. Cough

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

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

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

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

Q.40　The pungency of mustard seeds is primarily due to secondary metabolites such as isothiocyanate and nitrile. The pungency is usually felt only when the seeds are crushed. This is because of

(A) the coat of the intact seeds blocks the pungent volatiles from being released
(B) the pungent chemicals are stored as inactive conjugates and compartmentalized from the enzymes that convert them into active chemicals
(C) the pungent chemicals are formed only after the reaction with atmospheric oxygen
(D) the pungent chemicals are formed only after the reaction with atmospheric carbondioxide

Q.41　In a mouse genome, the numbers of functional $V\alpha$, $J\alpha$, $V\beta$, $D\beta$, $J\beta$ gene segments are 79, 38, 21, 2 and 11, respectively. The total number of possible combinations for $\alpha\beta$ T cell receptors are _____$x10^6$.

Q.42 The percentage SIMILARITIES and IDENTITIES, respectively, between the two peptide sequences given below will be _____% and _____%.

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Peptide I : Ala-Ala-Arg-Arg-Gln-Trp-Leu-Thr-Phe-Thr-Lys-Ile-Met-Ser-Glu
Peptide II: Ala-Ala-Arg-Glu-Gln-Tyr-Ile-Ser-Phe-Thr-Lys-Ile-Met-Arg-Asp
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(A) 80, 80   (B) 80, 60   (C) 60, 60   (D) 90, 60

Q.43 In an affine gap penalty model, if the gap opening penalty is -20, gap extension penalty is -4 and gap length is 8, the gap score is _____.

Q.44 For their efficient translation, eubacterial mRNAs possess a Shine-Dalgarno sequence for its recognition by an anti-Shine-Dalgarno sequence (ASD) in the ribosomes. The correct statement is

(A) ASD is present in 5S rRNA
(B) ASD is present in 23S rRNA
(C) ASD is present in 16S rRNA
(D) ASD is formed by the interaction of the 16S rRNA with the 23S rRNA upon docking of the 50S subunit on the 30S subunit of the ribosomes

Q.45 Match the items in **Group I** with **Group II**

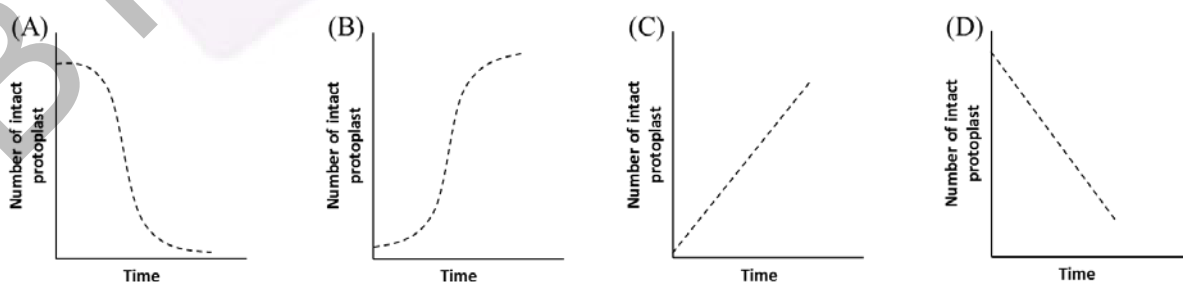|	**Group I**		**Group II**
P	Receptor tyrosine kinase	1	Inactivation of G-proteins
Q	Cyclic GMP (cGMP)	2	Reception of insulin signal
R	GTPase activating protein (GAP)	3	Thyroid hormone
S	Nuclear receptor	4	Receptor guanylyl cyclase

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

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

Q.46 Match the immunoglobulin class in **Group I** with its properties in **Group II**

Group I	**Group II**
P. IgG	1. Major antibody in external secretions such as bronchial mucus
Q. IgA	2. Protects against parasites
R. IgE	3. Antibody that appears first in serum after exposure to an antigen
S. IgM	4. Antibody present in highest concentration in serum

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

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

Q.47   In a genetic cross between the genotypes WWXX and wwxx, the following phenotypic distributions were observed among the F_2 progeny: WX, 562; wx, 158; Wx, 38; and wX, 42. Likewise, a cross between XXYY and xxyy yielded the following results: XY, 675; xy, 175; Xy, 72; and xY, 78. Similarly, a cross between WWYY and wwyy yielded: WY, 292; wy, 88; Wy, 12; and wY, 8. In all the genotypes, capital letters denote the dominant allele. Assume that the F_1 progeny were self-fertilized in all three crosses. Also, double cross-over does not occur in this species. Which of the following is correct?

(A) Relative position: W-X-Y Distances: W-X = 5 map units, X-Y = 17 map units
(B) Relative position: X-Y-W Distances: X-Y = 15 map units, Y-W = 11 map units
(C) Relative position: Y-W-X Distances: Y-W = 5 map units, W-X = 11 map units
(D) Relative position: X-W-Y Distances: X-W = 5 map units, W-Y = 10 map units

Q.48   The length of the minimum unique stretch of DNA sequence that can be found only once in a 3 billion base pairs long genome is

(A) 14   (B) 15   (C) 16   (D) 18

Q.49   Lysine is being produced in a lab-scale reactor by a threonine auxotroph. After 2 weeks of operation it was observed that the concentration of lysine in the reactor was gradually decreasing. Microbiological assays of reactor samples showed absence of contamination and recorded data showed no change in the operating conditions. The most probable reason for decrease in lysine concentration may be attributed to

(A) accumulation of ethanol   (B) growth of revertants

(C) production of citric acid   (D) unutilized phosphoenol pyruvate

Q.50   If a plant is shifted to cold temperature, which of the following changes would take place in its membrane?

(A) Ratio of unsaturated to saturated fatty acids would increase
(B) Ratio of unsaturated to saturated fatty acids would decrease
(C) Absolute amount of both fatty acids would increase keeping the ratio same
(D) Absolute amount of both fatty acids would remain unchanged

Q.51   If protoplasts are placed in distilled water, they swell and burst as a result of endosmosis. The plot representing the kinetics of burst is

Q.52   Which of the following statements with respect to the orientation of the nitrogenous bases to the pentose sugars, and the puckering of the sugar, is correct?

(A) Anti, and 2'-endo in A form DNA   (B) Anti, and 2'-endo in B form DNA

(C) Syn, and 3'-endo in A form DNA   (D) Syn, and 3' -endo in B form DNA

Q.53   A dioecious plant has XX sexual genotype for female and XY for male. After double fertilization, what would be the genotype of the embryos and endosperms?

(A) 100% ovules will have XXX endosperm and XX embryo
(B) 100% ovules will have XXY endosperm and XY embryo
(C) 50% ovules will have XYY endosperm and XY embryo, while other 50% will have XXY endosperm and YY embryo
(D) 50% ovules will have XXX endosperm and XX embryo, while the other 50% will have XXY endosperm and XY embryo

Q.54   The amino acid substitution matrices in decreasing order of stringency for comparing protein sequences are

(A) PAM250, PAM120, PAM100
(B) PAM100, PAM120, PAM250
(C) PAM250, PAM100, PAM120
(D) PAM120, PAM250, PAM100

Q.55   The active site in the alpha/beta barrel structures is usually located

(A) inside the barrel   (B) at the amino side of the strands

(C) at the carboxy side of the strands   (D) at any arbitrary site

END OF THE QUESTION PAPER

GATE 2014
Answer Keys for BT - Biotechnology

Section	Q. No.	Key / Range	Marks	Section	Q. No.	Key / Range	Marks
GA	1	D	1	BT	25	C	1
GA	2	A	1	BT	26	B	2
GA	3	C	1	BT	27	C	2
GA	4	25 to 25	1	BT	28	D	2
GA	5	A	1	BT	29	A	2
GA	6	A	2	BT	30	2 to 2	2
GA	7	C	2	BT	31	0.795 to 0.805	2
GA	8	D	2	BT	32	B	2
GA	9	C	2	BT	33	2.46 to 2.50	2
GA	10	0.48 to 0.49	2	BT	34	A	2
BT	1	C	1	BT	35	C	2
BT	2	191 to 199	1	BT	36	A	2
BT	3	B	1	BT	37	0.6 to 0.6	2
BT	4	0 to 0	1	BT	38	A	2
BT	5	D	1	BT	39	A	2
BT	6	C	1	BT	40	B	2
BT	7	B	1	BT	41	1.38 to 1.40	2
BT	8	C	1	BT	42	B	2
BT	9	C	1	BT	43	-52 to -52	2
BT	10	B	1	BT	44	C	2
BT	11	A	1	BT	45	D	2
BT	12	6 to 6	1	BT	46	A	2
BT	13	A	1	BT	47	C	2
BT	14	3 to 3	1	BT	48	C	2
BT	15	B	1	BT	49	B	2
BT	16	A	1	BT	50	A	2
BT	17	A	1	BT	51	A	2
BT	18	C	1	BT	52	B	2
BT	19	A	1	BT	53	D	2
BT	20	A	1	BT	54	B	2
BT	21	B	1	BT	55	C	2
BT	22	C	1				
BT	23	D	1				
BT	24	C	1				