





JAM 2015: General Instructions during Examination


1. Total duration of the JAM 2015 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 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 only your own **non-programmable calculator**.
6. The Question Palette displayed on the right side of screen will show the status of each question using one of the following symbols:

 You have not visited the question yet.

 You have not answered the question.

 You have answered the question.

 You have NOT answered the question, but have marked the question for review.

 You have answered the question, but marked it for review.

7. 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 :

8. 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 the answer for a multiple choice type question and for the multiple select type question. Use the virtual numeric keypad to enter the 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 and to mark for review your answer for the current question, 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.

9. 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.**

Answering a Question :

10. Procedure for answering a multiple choice question (MCQ):
 - a. Choose the answer by selecting **only one out of the 4 choices** (A,B,C,D) given below the question and click on the bubble placed before the selected choice.

- b. To deselect your chosen answer, click on the bubble of the selected choice again or click on the **Clear Response** button.
 - c. To change your chosen answer, click on the bubble of another choice.
 - d. To save your answer, you **MUST** click on the **Save & Next** button.
11. Procedure for answering a multiple select question (MSQ):
- a. Choose the answer by selecting **one or more than one out of the 4** choices (A,B,C,D) given below the question and click on the checkbox(es) placed before each of the selected choice (s).
 - b. To deselect one or more of your selected choice(s), click on the checkbox(es) of the choice(s) again. To deselect all the selected choices, click on the **Clear Response** button.
 - c. To change a particular selected choice, deselect this choice that you want to change and click on the checkbox of another choice.
 - d. To save your answer, you **MUST** click on the **Save & Next** button.
12. Procedure for answering a numerical answer type (NAT) 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.
13. To mark a question for review, click on the **Mark for Review & Next** button. *If an answer is selected (for MCQ and MSQ types) or entered (for NAT) for a question that is **Marked for Review**, that answer will be considered in the evaluation unless the status is modified by the candidate.*
14. To change your answer to a question that has already been answered, first select that question and then follow the procedure for answering that type of question as described above.
15. Note that **ONLY** those questions for which answers are **saved** or **marked for review after answering** will be considered for evaluation.

Choosing a Section :

- 16. Sections in this question paper are displayed on the top bar of the screen. **All sections are compulsory.**
- 17. Questions in a section can be viewed by clicking on the name of that section. The section you are currently viewing will be highlighted.
- 18. To select another section, simply click the name of the section on the top bar. You can shuffle between different sections any number of times.
- 19. When you select a section, you will only be able to see questions in this Section, and you can answer questions in the Section.
- 20. 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.
- 21. You can move the mouse cursor over the name of a section to view the answering status for that section.

JAM 2015 Examination**BL: Biological Sciences***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 coloured 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 **Question Paper** button in the screen.
3. This test paper has a total of 60 questions carrying 100 marks. The entire question paper is divided into three **sections, A, B and C**. All sections are compulsory. Questions in each section are of different types.
4. **Section – A** contains **Multiple Choice Questions (MCQ)**. Each MCQ type question has four choices out of which only one choice is the correct answer. This section has 30 Questions and carry a total of 50 marks. Q.1 – Q.10 carry 1 mark each and Questions Q.11 – Q.30 carry 2 marks each.
5. **Section – B** contains **Multiple Select Questions (MSQ)**. Each MSQ type question is similar to MCQ but with a difference that there may be one or more than one choice(s) that are correct out of the four given choices. The candidate gets full credit if he/she selects all the correct choices only and no wrong choices. This section has 10 Questions and carry 2 marks each with a total of 20 marks.
6. **Section – C** contains **Numerical Answer Type (NAT)** questions. For these NAT type questions, the answer is a real number which needs to be entered using the virtual numerical keypad on the monitor. No choices will be shown for these type of questions. This section has 20 Questions and carry a total of 30 marks. Q.1 – Q.10 carry 1 mark each and Questions Q.11 – Q.20 carry 2 marks each.
7. Depending upon the JAM test 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 Data** button that appears at the top, right hand side of the screen.
8. The computer allotted to you at the examination centre runs specialized software that permits only one choice to be selected as answer for multiple choice questions using a mouse, one or more than one choices to be selected as answer for multiple select questions using a mouse and to enter a suitable number for the numerical answer type questions using the virtual numeric keypad and mouse.
9. 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**.
10. Multiple choice questions (Section-A) will have four choices against A, B, C, D, out of which only **ONE** choice is the correct answer. The candidate has to choose the correct answer by clicking on the bubble (○) placed before the choice.
11. Multiple select questions (Section-B) will also have four choices against A, B, C, D, out of which **ONE OR MORE THAN ONE** choice(s) is /are the correct answer. The candidate has to choose the correct answer by clicking on the checkbox (☐) placed before the choices for each of the selected choice(s).
12. For numerical answer type questions (Section-C), 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 mouse and the virtual numerical keypad that appears on the monitor.
13. In all questions, questions not attempted will result in zero mark. In **Section – A** (MCQ), wrong answer will result in **NEGATIVE** marks. For all 1 mark questions, 1/3 marks will be deducted for each wrong answer. For all 2 marks questions, 2/3 marks will be deducted for each wrong answer. In **Section – B** (MSQ), there is **NO NEGATIVE** and **NO PARTIAL** marking provisions. There is **NO NEGATIVE** marking in **Section – C** (NAT) as well.

14. **Non-programmable calculators** are allowed but sharing of calculators is not allowed.
15. Mobile phones, electronic gadgets other than calculators, charts, graph sheets, and mathematical tables are **NOT** allowed in the examination hall.
16. You can 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".

SECTION – A
MULTIPLE CHOICE QUESTIONS (MCQ)

Q. 1 – Q.10 carry one mark each.

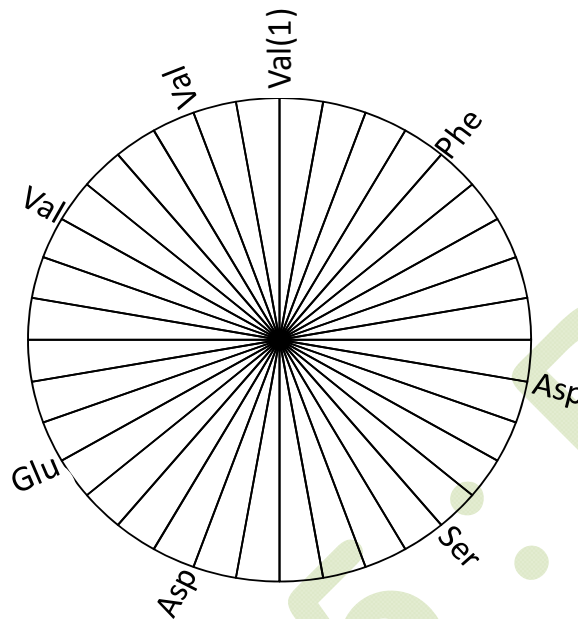
- Q.1 In the binding of oxygen to hemoglobin, a plot of the fractional saturation of hemoglobin versus the partial pressure of oxygen can best be described as
- (A) hyperbolic (B) sigmoidal
(C) linear with a negative slope (D) linear with a positive slope
- Q.2 A polypeptide chain is made up of 101 amino acid residues. The polypeptide has 200 bonds about which rotation can occur. Assume that three orientations are possible about each of these bonds. Based on these assumptions, how many random coil conformations are possible for the polypeptide chain?
- (A) 3^{200} (B) 200^3 (C) 101×3^{200} (D) 101×200^3
- Q.3 Which of the following acids can be used as one of the components in a buffer?
- (A) Nitric acid (B) Sulfuric acid (C) Acetic acid (D) Hydrochloric acid
- Q.4 The bacteria that require “specialized nutrients for growth”, which can be difficult to meet in the laboratory, are called
- (A) facultative (B) obligate (C) fastidious (D) non-fermentor
- Q.5 During urine formation, reabsorption of glucose and amino acids occurs from the glomerular filtrate in the “P” part of the nephron by the “Q” process. Choose the correct combination of P and Q.
- (A) P - distal convoluted tubule Q - primary active transport
(B) P - ascending loop of Henle Q - secondary active transport
(C) P - proximal convoluted tubule Q - secondary active transport
(D) P - descending loop of Henle Q - passive diffusion
- Q.6 Monoglycerides and long chain fatty acids are absorbed in the intestine. How are these molecules transported to the circulating capillary blood?
- (A) In the form of chylomicrons through lymphatic duct
(B) Direct and facilitated diffusion
(C) Primary active transport
(D) Secondary active transport *via* a carrier protein
- Q.7 An individual’s HLA haplotype is
- (A) one allele at each MHC Class I locus
(B) the individual’s Class I antigen type
(C) one allele at each MHC Class II locus
(D) the individual’s complete set of MHC alleles

- Q.8 Biomedical importance of specialized transduction in bacteria is due to the
- (A) acquisition of Hfr plasmid
 - (B) transfer of genes for toxin production
 - (C) transfer of genes for capsule formation
 - (D) incorporation of jumping genes
- Q.9 Which of the following pairs of cellular organelles is involved in the energy generation as well as metabolite production in a typical eukaryotic cell?
- (A) Chloroplast and Lysosome
 - (B) Mitochondrion and Golgi body
 - (C) Endoplasmic reticulum and Mitochondrion
 - (D) Mitochondrion and Chloroplast
- Q.10 The “symplast pathway” of transport in a typical plant system does **NOT** involve
- (A) plasmodesmata
 - (B) transport proteins in plasma membrane
 - (C) cell wall and intercellular space
 - (D) cytoplasm

Q. 11 – Q. 30 carry two marks each.

- Q.11 Estimate the net charge of a peptide **Ser-Glu-Pro-Ile-Met-Ala-Pro-Val-Glu-Tyr-Pro-Lys** at pH 7.0 and at pH 12.0. Typical ranges observed for pK_a values of groups in protein: α -carboxyl 3.5 – 4.0; side chain carboxyl 4.0 – 4.8; α -amino 8.0 – 9.0; phenolic (tyrosine) 9.5–10.5; side chain amino (Lys) 9.8–10.4.
- (A) -1, -4 (B) -4, -1 (C) -4, -4 (D) -1, -1

- Q.12 A stretch of C-terminal region of adenylate kinase forms a right handed α -helix. The top view of the helical wheel representation of the C-terminal α -helical region is shown below. Val(1) is the first residue of the peptide sequence and each division in the wheel is 10° . Which of the following sequences is correct?



- (A) Val(1)-Asp-Asp-Val-Phe-Ser-Glu-Val
 (B) Val(1)-Phe-Asp-Ser-Asp-Glu-Val-Val
 (C) Val(1)-Val-Asp-Asp-Val-Glu-Ser-Phe
 (D) Val(1)-Val-Val-Glu-Asp-Ser-Asp-Phe

- Q.13 Match the bacteria in Column I with the corresponding disease in Column II.

| Column I | Column II |
|--------------------------------|-------------------------|
| P. <i>Yersinia pestis</i> | i. Whooping cough |
| Q. <i>Brodetella pertussis</i> | ii. Congenital syphilis |
| R. <i>Treponema pallidum</i> | iii. Lyme disease |
| S. <i>Borrelia burgdoferi</i> | iv. Plague |

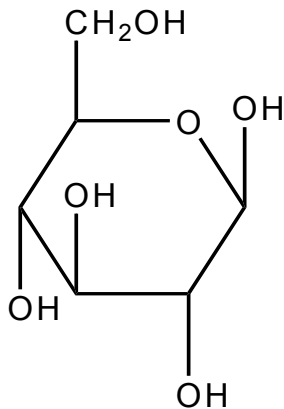
- (A) P-iv, Q-i, R-ii, S-iii
 (B) P-i, Q-ii, R-iv, S-iii
 (C) P-ii, Q-i, R-iii, S-iv
 (D) P-iii, Q-iv, R-i, S-ii
- Q.14 What is the ratio of $[S]$ to K_M when the velocity of an enzyme catalyzed reaction is 80% of V_{max} ?
- (A) 4:1 (B) 1:4 (C) 1:8 (D) 8:1

- Q.15 Which of the following enzymes is responsible for the crosslink formation between two adjacent N-acetyl muramic acid residues of the nascent peptidoglycan?

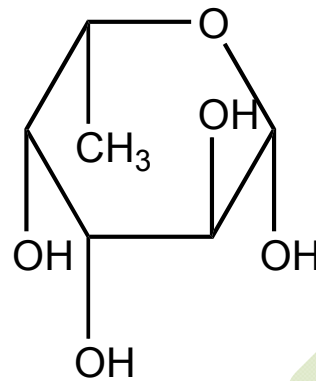
- (A) Transacetylase (B) Transpeptidase (C) Transaminase (D) Endopeptidase

Q.16 Which one of the following sugar molecules will bind to a highly specific galactose-binding protein?

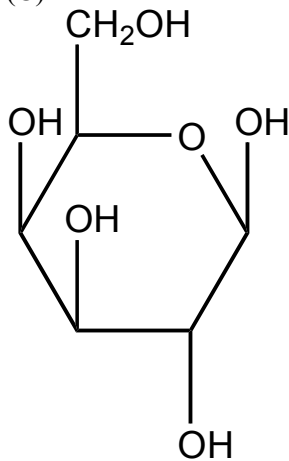
(A)



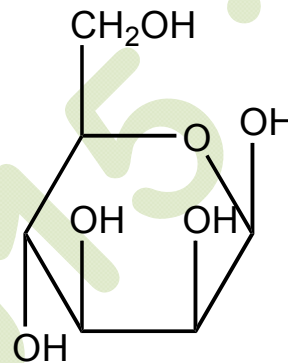
(B)



(C)



(D)



Q.17 During the bacterial DNA replication, simultaneous synthesis of both the leading and lagging strand are catalyzed by “P”, and during translation, peptidyl transferase reaction is catalyzed by “Q”. Choose the correct combination of P and Q.

- | | |
|------------------------------------------------|------------------------|
| (A) P – homodimer of DNA polymerase III | Q – 16S rRNA |
| (B) P – asymmetric dimer of DNA polymerase III | Q – 23S rRNA |
| (C) P – monomer of DNA polymerase III | Q – 5S rRNA |
| (D) P – asymmetric dimer of DNA polymerase III | Q – ribosomal proteins |

Q.18 Match the items of Column I and Column II.

| Column I | Column II |
|---------------------------------------|---------------------------------|
| P. Diethylaminoethyl (DEAE) sepharose | i. Imidazole |
| Q. Nickel sepharose | ii. Maltose |
| R. Carboxymethyl (CM) sepharose | iii. Negatively charged protein |
| S. Amylose resin | iv. Cation exchange |

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

Q.19 Which of the following statements are TRUE for the action of lipophilic hormones?

- P. They readily cross the cell membrane
 Q. They bind to extracellular part of the receptor
 R. They interact with the receptors in the cytoplasm or nucleus
 S. They stimulate synthesis of second messenger cAMP
 T. Hormone receptor complex binds to specific hormone response element in the DNA to activate or repress transcription of specific gene

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

Q.20 Bacteria at the species level is accurately identified by

- (A) Gram staining (B) biochemical analysis
 (C) electron microscopy (D) rRNA gene sequence analysis

Q.21 Column I lists the vitamins and Column II lists the diseases due to the deficiency of vitamins. Match Column I and Column II.

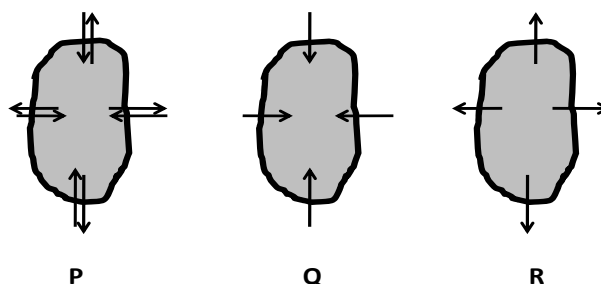
| Column I | Column II |
|----------------------------|------------------------|
| P. Ascorbic acid | i. Macrocytic anemia |
| Q. Folic acid | ii. Pellagra |
| R. Niacin | iii. Pernicious anemia |
| S. Vitamin B ₁₂ | iv. Scurvy |

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

Q.22 Choose the correct chronological order of the “Era of Earth’s Geological History”.

- (A) Precambrian → Paleozoic → Cenozoic → Mesozoic
 (B) Precambrian → Paleozoic → Mesozoic → Cenozoic
 (C) Precambrian → Mesozoic → Cenozoic → Paleozoic
 (D) Paleozoic → Mesozoic → Cenozoic → Precambrian

Q.23 Look at the following diagram. Cells with cell wall are placed in solutions of different osmolarity P, Q and R. Arrows indicate the net direction of water diffusion. Identify the osmolarity of the solutions P, Q and R with respect to the cells.



- (A) P = isotonic Q = hypotonic R = hypertonic
 (B) P = isotonic Q = hypertonic R = hypotonic
 (C) P = hypertonic Q = isotonic R = hypotonic
 (D) P = hypotonic Q = hypertonic R = isotonic

- Q.24 Antigen-binding site of an antibody molecule consists of
- (A) N-terminal domain of heavy chain and C-terminal domain of light chain
 (B) C-terminal domain of heavy chain and C-terminal domain of light chain
 (C) N-terminal domain of heavy chain and N-terminal domain of light chain
 (D) C-terminal domain of heavy chain and N-terminal domain of light chain
- Q.25 In a viable plate count of bacterial population each ___ i ___ represents a ___ ii ___ from the sample population
- (A) i) cell, ii) colony
 (B) i) hour, ii) generation
 (C) i) cell, ii) generation
 (D) i) colony, ii) cell

- Q.26 Secondary immune response is characterized by
- P) short lag period
 Q) low level of antibody production
 R) switching of isotype from IgM to IgG
 S) rapid declining of antibody titre
- (A) P and S
 (B) P and R
 (C) Q and S
 (D) Q and R

- Q.27 Choose the correct combination by matching Column I with Column II.

| Column I | Column II |
|----------------------------------------------|-----------------------------|
| P. Noncyclic electron flow in photosynthesis | i. produces only ATP |
| Q. Glycolysis | ii. produces only NADPH |
| | iii. produces ATP and NADPH |
| | iv. produces ATP and NADH |

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

- Q.28 Choose the correct answer by matching Column I with Column II.

| Column I | Column II |
|--------------------|---------------------------------------|
| P. Salicylic acid | i. promotes pollen tube elongation |
| Q. Gibberelic acid | ii. triggers defense against pathogen |
| R. Abscisic acid | iii. ends seed dormancy |
| S. Brassinosteroid | iv. maintains seed dormancy |

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

- Q.29 Choose the correct combination by matching Column I with Column II.

| Column I | Column II |
|----------------------------------------|-----------------------------------|
| P. Autosomal recessive genetic disease | i. Hemophilia |
| Q. X-linked recessive genetic disease | ii. Duchenne's muscular dystrophy |
| | iii. Phenylketonuria |
| | iv. Cystic fibrosis |

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

- Q.30 Generally, living organisms belonging to the same ____ are more closely related than those that are in the same ____.
- (A) order, family (B) class, phylum (C) family, genus (D) kingdom, phylum

SECTION - B

MULTIPLE SELECT QUESTIONS (MSQ)

Q. 1 – Q. 10 carry two marks each.

- Q.1 Which of the following statements are TRUE for Ramachandran plot?
- (A) It can be used to describe the backbone conformation of any polypeptide residue
(B) It can be used to describe simple secondary structures of proteins
(C) It is plotted with coordinates of ϕ and ψ of a polypeptide chain
(D) It is used to describe side chain conformation of the amino acid residues in a polypeptide chain
- Q.2 In case of vertebrates, which of the following statements are TRUE for the fate of the embryonic germ layer?
- (A) Brain and nervous system are developed from the ectoderm
(B) Skeletal system is originated from the mesoderm
(C) Circulatory system is of ectodermal origin
(D) Liver and pancreas are developed from the endoderm
- Q.3 Treatment of a 0.2 mM functionally active pepsin solution with 8M urea will lead to
- (A) increase in enzymatic activity of pepsin
(B) unfolding of pepsin
(C) reduction of disulfide bonds
(D) increase in entropy of pepsin
- Q.4 Which of the following statements are TRUE for trypsin, chymotrypsin and elastase?
- (A) They have similar three-dimensional structure
(B) They use ATP for catalysis
(C) They are serine proteases
(D) They have similar substrate specificity
- Q.5 Which of the following statements are **TRUE** for parasympathetic nerves?
- (A) Arise from the brain and sacral segments of spinal cord
(B) Arise from the thoracic and lumbar segments of the spinal cord
(C) Release acetyl choline from the nerve endings
(D) Post ganglionic neurons are situated within or close to innervated organs
- Q.6 Retrovirus contains three major genes - *gag*, *pol* and *env* in its single stranded RNA genome. Which of the following proteins involved in viral replication are encoded by the *pol* gene?
- (A) Reverse transcriptase (B) RNase A
(C) Integrase (D) Protease

- Q.7 Waggle dance of honey bee conveys information about the
- (A) circadian rhythms of the organism
 - (B) distance of the food source from the hive
 - (C) color of the flower to be looked for
 - (D) direction of food source relative to the direction of the sun
- Q.8 Guanyl nucleotide-binding proteins (G-proteins)
- (A) bind GMP in their inactivated state
 - (B) are integral membrane proteins that bind hormone(s)
 - (C) have an intrinsic GTPase activity
 - (D) can be activated by a single activated membrane receptor
- Q.9 In a normal human cell, 92 nuclear DNA molecules are present in the
- (A) metaphase of mitosis
 - (B) metaphase I of meiosis
 - (C) anaphase I of meiosis
 - (D) metaphase II of meiosis
- Q.10 The interaction between plant's resistance gene '**R**' and pathogen's avirulence gene '**Avr**' plays a crucial role in 'gene-for-gene resistance' mechanism. The plant usually develops disease symptoms in presence of
- (A) dominant **R** allele and dominant **Avr** allele
 - (B) dominant **R** allele and recessive **avr** allele
 - (C) recessive **r** allele and dominant **Avr** allele
 - (D) recessive **r** allele and recessive **avr** allele

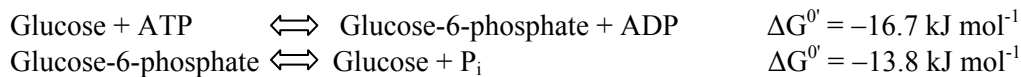
SECTION – C

NUMERICAL ANSWER TYPE (NAT)

Q. 1 – Q. 10 carry one mark each.

- Q.1 A rabbit and a tortoise are running a race. Rabbit runs at 10 m/s, while tortoise runs at 1 m/s. Because the tortoise is slower, it is placed 100 meters ahead of the rabbit. After the race starts, the time (in seconds) after which the rabbit overtakes the tortoise is _____.
- Q.2 The largest equilateral triangle that can be inscribed inside a circle of radius 1 cm has a side (in cm) of _____.
- Q.3 The value of $\int_0^4 \sqrt{x} dx$ is _____.
- Q.4 Two trains are running in opposite directions at 60 km/hr. Each train has a length of 500 meters. The time (in seconds) that it takes to completely cross each other is _____.

Q.5 The standard free energy change (ΔG^0 , in kJ mol^{-1}) of ATP hydrolysis obtained from the following reactions is _____.



Q.6 DNA in solution shows maximum absorbance at a wavelength (in nm) of _____.

Q.7 The maximum number of hydrogen bonds that one water molecule in liquid water can form is _____.

Q.8 The maximum number of genetically different sperms that can be produced by an individual with the genotype *PPQqRrTt* is _____.

Q.9 The number of amino acids in a peptide that can bind to MHC class I molecules is _____.

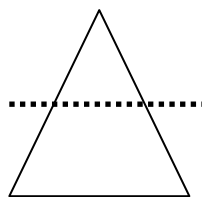
Q.10 Average molecular weight of a nucleotide pair in DNA is 620. The number of complete helical turns formed by a double stranded DNA molecule of molecular weight 3.1×10^5 is _____.

Q. 11 – Q. 20 carry two marks each.

Q.11 A caterpillar is sitting at one corner of a cube of side 1 meter, and wants to crawl to the diagonally opposite corner. The minimum distance (in meters) that the caterpillar needs to travel is _____.

Q.12 Equal volumes of two solutions of pH 5.0 and 7.0 are mixed together. The pH of the resulting solution is _____.

Q.13 A cone of volume 1 cubic meter (m^3) is cut from the middle (as shown in the figure by a dotted line). The volume (m^3) of the bottom portion is _____.



Q.14 A fair coin is flipped three times. The probability of obtaining at least one tails is _____.

Q.15 The energy of oxidation of glucose to H_2O and CO_2 is $-2870 \text{ kJ mol}^{-1}$. The number of 700 nm photons that must be absorbed to fix one mole of CO_2 to glucose is _____.

[Given, the Planck's constant (h) = $6.63 \times 10^{-34} \text{ Js}$, the speed of the light in vacuum (c) = $2.998 \times 10^8 \text{ ms}^{-1}$, Avogadro's number (N) = 6.02×10^{23}].

Q.16 In a population of eukaryotic species, the number of heterozygotes is six times the number of homozygous recessive. If the population follows Hardy-Weinberg equilibrium, the frequency of dominant allele is _____.

- Q.17 In a plant species, purple color of flower is dominant to white color. Self-fertilization of a particular purple-flowered plant produces a total of 83 progeny; amongst them 62 are purple-flowered and rests are white-flowered. The number of pure line plants within the purple-flowered progeny is _____.
- Q.18 Protein content of a crude cell-free extract of *E. coli* cells is 40 mg/ml. Ten microliters of the extract catalyzes a reaction at a rate of 0.28 $\mu\text{mol}/\text{min}$. Specific activity (unit/mg) of the crude cell-free extract is _____.
- Q.19 In a bacterial growth experiment, 5×10^6 cells of *E. coli* were inoculated in 750 ml medium and incubated for 6 hours at 37 °C. After one hour of lag period followed by 5 hours of exponential growth, the cell population reached 5.4×10^9 . The generation time (in minutes) of this *E. coli* is _____.
- Q.20 A eukaryotic gene of 1000 base pairs containing several introns encodes a protein of 11 kDa. Assuming that the average molecular weight of one amino acid is 110 Da, the total length (in base pairs) of all the introns of the gene is _____.

END OF THE QUESTION PAPER

JAM 2015

Answer Keys for the Test Paper: Biological Sciences (BL)

| Section A - MCQ Multiple Choice Questions | | | Section B - MSQ Multiple Select Questions | | | Section C - NAT Numerical Answer Type Questions | | |
|-------------------------------------------------|-----|-------|-------------------------------------------------|-------|-------|-------------------------------------------------------|----------------|-------|
| Q. No. | Key | Marks | Q. No. | Key | Marks | Q. No. | Range | Marks |
| 1 | B | 1 | 1 | A;B;C | 2 | 1 | 10.5 to 11.5 | 1 |
| 2 | A | 1 | 2 | A;B;D | 2 | 2 | 1.70 to 1.75 | 1 |
| 3 | C | 1 | 3 | B;D | 2 | 3 | 5.3 to 5.4 | 1 |
| 4 | C | 1 | 4 | A;C | 2 | 4 | 30 to 30 | 1 |
| 5 | C | 1 | 5 | A;C;D | 2 | 5 | -30.5 to -30.5 | 1 |
| 6 | A | 1 | 6 | A;C;D | 2 | 6 | 255 to 265 | 1 |
| 7 | D | 1 | 7 | B;D | 2 | 7 | 4 to 4 | 1 |
| 8 | B | 1 | 8 | C;D | 2 | 8 | 8 to 8 | 1 |
| 9 | D | 1 | 9 | A;B;C | 2 | 9 | 8 to 10 | 1 |
| 10 | C | 1 | 10 | B;C;D | 2 | 10 | 41 to 50 | 1 |
| 11 | A | 2 | | | | 11 | 2.2 to 2.3 | 2 |
| 12 | A | 2 | | | | 12 | 5.2 to 5.4 | 2 |
| 13 | A | 2 | | | | 13 | 0.87 to 0.88 | 2 |
| 14 | A | 2 | | | | 14 | 0.87 to 0.88 | 2 |
| 15 | B | 2 | | | | 15 | 2.7 to 2.9 | 2 |
| 16 | C | 2 | | | | 16 | 0.75 to 0.75 | 2 |
| 17 | B | 2 | | | | 17 | 19 to 22 | 2 |
| 18 | D | 2 | | | | 18 | 0.7 to 0.7 | 2 |
| 19 | C | 2 | | | | 19 | 29 to 31 | 2 |
| 20 | D | 2 | | | | 20 | 697 to 697 | 2 |
| 21 | B | 2 | | | | | | |
| 22 | B | 2 | | | | | | |
| 23 | A | 2 | | | | | | |
| 24 | C | 2 | | | | | | |
| 25 | D | 2 | | | | | | |
| 26 | B | 2 | | | | | | |
| 27 | C | 2 | | | | | | |
| 28 | B | 2 | | | | | | |
| 29 | D | 2 | | | | | | |
| 30 | B | 2 | | | | | | |