

# Target IIT-JAM-2018

## Test Series-6

Full Length Test Series-3

Booklet Code: **F**

Duration: 3:00 Hours

BIOTECHNOLOGY-BT

Date: 31-01-2018

Maximum Marks: 100

Read the following instructions carefully:

- 1 Attempt all the questions.
- 2 **Section-A** contains **30** Multiple Choice Questions (MCQ). Each question has 4 choices (a), (b), (c) and (d), for its answer, out of which **ONLY ONE** is correct. From **Q.1 to Q.10** carries 1 Marks and **Q.11 to Q.30** carries 2 Marks each.
- 3 **Section-B** contains **10** Multiple Select Questions (MSQ). Each question has 4 choices (a), (b), (c) and (d) for its answer, out of which **ONE or MORE than ONE** is/are correct. For each correct answer you will be awarded **2 marks**.
- 4 **Section-C** contains **20** Numerical Answer Type (NAT) questions. From **Q.41 to Q.50** carries **1 Mark** each and **Q.51 to Q.60** carries **2 Marks** each. For each NAT type question, the value of answer is between 0 to 9.
- 5 In all sections, 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.

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## SECTION-A

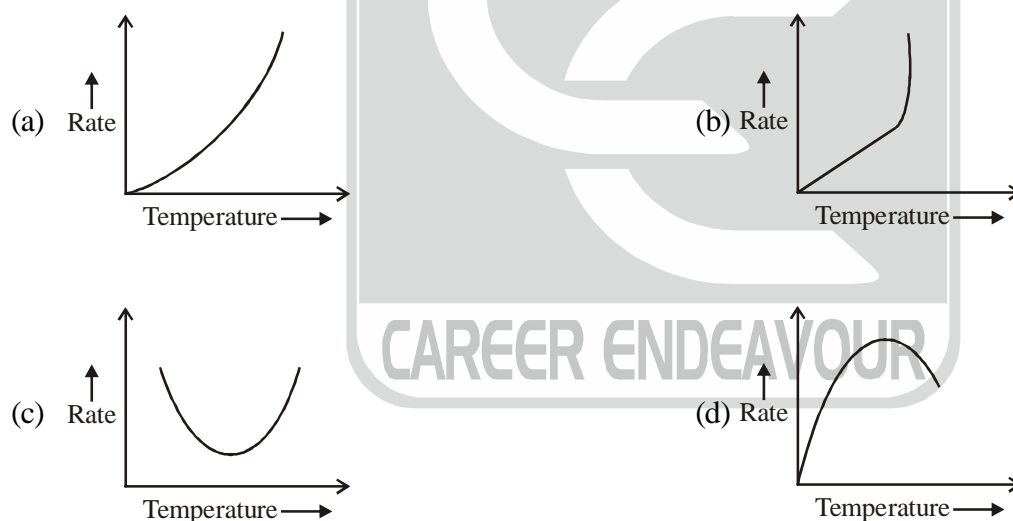
## [Multiple Choice Questions (MCQ)]

**Q. 1 – Q. 10 carry one mark each.**

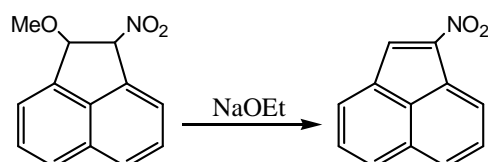
- The gene that determines maleness is
  - CRY gene
  - M1 gene
  - SRY gene
  - Pseudoautosomal region 1 of chromosome Y
- Statements correct about therians except
  - They are oviviparous
  - Opening for urogenital and digestive tract are separate
  - Divided into two infraclasses
  - Examples are *Macropus* and *Balaenoptera*
- Which of the following is true for reverse transcriptase?
  - It shows DNA polymerase activity only
  - It shows RNase H activity only
  - It shows both DNA polymerase and RNase H activity
  - It shows RNA polymerase activity only
- C-bands consist primarily of
  - Constitutive heterochromatin
  - Intercalary heterochromatin
  - Intercalary euchromatin
  - Euchromatin
- The correct IUPAC nomenclature of the  $K_2[Fe(CN)_5(NO)] \cdot 2H_2O$  complex is
  - Potassium pentacyanonitrosyliron(III) hydrate
  - Potassium nitrosylpentacyanoferrate(II) dihydrate
  - Potassium pentacyanonitrosylferrate(III) hydrate
  - Potassium pentacyanonitrosylferrate(II) dihydrate
- Complexes  $[Co(NH_3)_5Cl]SO_4$  and  $[Co(NH_3)_5(SO_4)]Cl$  can be distinguished by
  - Using barium chloride
  - Using silver nitrate
  - Conductance measurement
  - Using all
- Which compound has zero dipole moment?
  - $NF_3$
  - $OF_2$
  - $XeF_4$
  - $PH_3$
- A small object is placed at a distance of 3.6 cm from a magnifier of a focal length 4.0 cm. The position of the image is
  - 18 cm
  - 36 cm
  - 18 cm
  - 36 cm
- The equation of a wave travelling in  $x$ -direction on a string is
 
$$y = (3.0 \text{ cm}) \sin \left[ (3.14 \text{ cm}^{-1})x - (314 \text{ s}^{-1})t \right]$$
 The maximum velocity of a particle of the string is
  - $9.4 \text{ ms}^{-1}$
  - $4.7 \text{ ms}^{-1}$
  - $2.35 \text{ ms}^{-1}$
  - $18.8 \text{ ms}^{-1}$
- If the cube roots of unity be  $1, \omega, \omega^2$ , then the roots of the equation  $(x-1)^3 + 8 = 0$  are
  - $-1, 1+2\omega, 1-2\omega^2$
  - $-1, 1-2\omega, 1-2\omega^2$
  - $-1, 1, -1$
  - None of these

**Q. 11 – Q. 30 carry two marks each.**

11. When lungs are over-inflated during inhalation, a reflex is initiated to prevent further over-inhalation during large inspirations. The reflex is called  
 (a) Deflation reflex (b) Startle reflex  
 (c) Pulmonary reflex (d) Hering-Breuer reflex
12. If radioactive carbondioxide ( $^{14}\text{CO}_2$ ) is used in calvin cycle then which carbon atom of 3-phosphoglycerate will appear radioactive  
 (a) Carbon-3 (b) Carbon-1  
 (c) Carbon-2 (d) None
13. The series that corresponds to transition from higher energy level to  $n = 3$  in the hydrogen spectrum is  
 (a) Paschen (b) Balmer (c) Brackett (d) Pfund
14. For a spontaneous process, the total entropy change ( $\Delta S_{\text{system}} + \Delta S_{\text{surrounding}}$ ) is  
 (a) Equal to zero  
 (b) Greater than zero  
 (c) Less than zero for endothermic process  
 (d) Less than zero for exothermic process
15. For an enzyme catalyzed reaction, the plot that correctly represents the relationship between the rate and temperature is

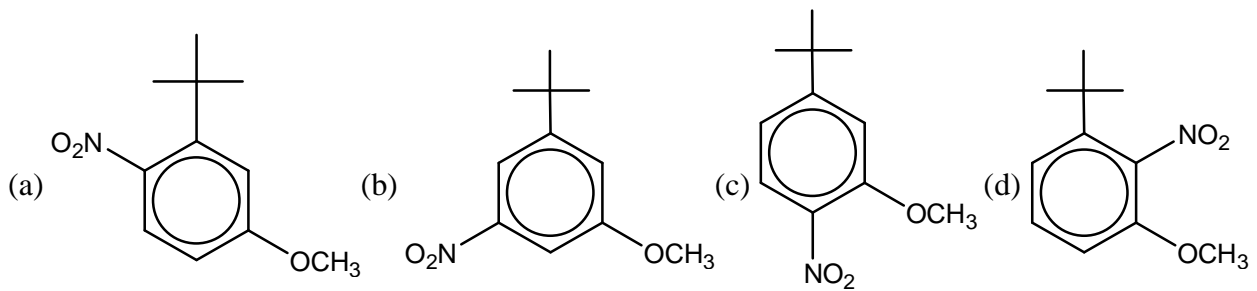


16. The reaction given below is an example of



- (a)  $E_2$ -elimination (b)  $E_1$ -elimination  
 (c) syn-elimination (d)  $E_1\text{CB}$ -elimination

17. Which is obtained as the main product upon reaction of *m*-*t*-butylanisole (1-*t*-butyl-3-methoxybenzene) with conc. ( $\text{HNO}_3 + \text{H}_2\text{SO}_4$ )



18. The order of carbonyl stretching frequency in the IR spectra of ketone, amide and anhydride is:
- (a) Anhydride > amide > ketone (b) Ketone > amide > anhydride  
 (c) Amide > anhydride > ketone (d) Anhydride > ketone > amide
19. According to foraging theory, if two food items are commonly available and equally abundant, an optimal forager should choose the item that
- (a) Takes less time to digest (b) Is seen first by the forager  
 (c) Contains larger energy (d) Yields larger net energy
20. Two particles of equal mass go round a circle of radius  $R$  under the action of their mutual gravitational attraction. The speed of each particle is
- (a)  $\sqrt{\frac{2GM}{R}}$  (b)  $\sqrt{\frac{GM}{4R}}$  (c)  $\sqrt{\frac{GM}{R}}$  (d)  $\sqrt{\frac{GM}{2R}}$
21. A particle executes a simple harmonic motion of time period  $T$ . The time taken by the particle to go directly from its mean position to half the amplitude is
- (a)  $\frac{T}{12}$  (b)  $\frac{T}{4}$  (c)  $\frac{T}{3}$  (d)  $\frac{T}{6}$
22. A water tank is constructed on the top of a building. Assume steady flow and that the pressure above the water level is equal to the atmospheric pressure. The speed at which the water will come out of a tap 6.0 m below the water level in the tank is (Take  $g = 9.8 \text{ ms}^{-2}$ )
- (a)  $5 \text{ ms}^{-1}$  (b)  $11 \text{ ms}^{-1}$  (c)  $40 \text{ ms}^{-1}$  (d)  $22 \text{ ms}^{-1}$
23. Induced systemic resistance is
- (a) Systemic resistance naturally present in plants (b) It is induced on exposure to antigen  
 (c) It releases salicylic acid in response (d) It is independent of plant genotype
24. Let  $a > 0, b > 0$  and  $c > 0$ . Then both the roots of the equation  $ax^2 + bx + c = 0$
- (a) are real and negative (b) have negative real parts  
 (c) are rational number (d) none
25. How many ways are there to arrange the letters in the word GARDEN with the vowels in alphabetical order?
- (a) 360 (b) 240 (c) 120 (d) 480

26. Let  $f : [-5, 5] \rightarrow \mathbb{R}$  is defined as  $f(x) = \begin{cases} x & \text{if } x \in \mathbb{Q} \cap [-5, 5] \\ -x & \text{if } x \in \mathbb{Q}^c \cap [-5, 5] \end{cases}$

Then

- (a)  $f(x)$  is continuous at every  $x$  except  $x = 0$       (b)  $f(x)$  is discontinuous at every  $x$  except  $x = 0$   
 (c)  $f(x)$  is continuous everywhere      (d)  $f(x)$  is discontinuous everywhere
27. In a class of 100 students there are 70 boys whose average marks in a subject are 75. If the average marks of the complete class is 72, then what is the average of the girls?  
 (a) 73      (b) 65      (c) 68      (d) 74
28. Which of the following describes the function of nucleolus?  
 (a) Produces ATP  
 (b) Synthesizes DNA polymerase  
 (c) Stores genetic information for protein synthesis  
 (d) Produces ribosomal subunits
29. Match the technique with its appropriate application from the list of options given below:
- | Technique                         | Application   |
|-----------------------------------|---|
| (A) Foot printing                 | (P) DNA-DNA interaction                                     |
| (B) ChIP Assay                    | (Q) Helix confirmation                                      |
| (C) ELISA                         | (R) Molecular weight determination                          |
| (D) Gel filtration chromatography | (S) Quantification of transgene expression                  |
|                                   | (T) Identification of binding sites of transcription factor |
| (a) A-T, B-Q, C-S, D-R            | (b) A-T, B-T, C-S, D-R                                      |
| (c) A-S, B-T, C-Q, D-R            | (d) A-Q, B-S, C-R, D-T                                      |
30. Which one of the following is the correct sequence of electron transport in Mitochondria?  
 (a)  $\text{NADH} \rightarrow \text{UQ} \rightarrow \text{Cyt b} \rightarrow \text{Cyt } c_1 \rightarrow \text{Cyt c} \rightarrow \text{Cyt a} \rightarrow \text{Cyt } a_3 \rightarrow \text{O}_2$   
 (b)  $\text{NADH} \rightarrow \text{Cyt a} \rightarrow \text{Cyt } a_3 \rightarrow \text{UQ} \rightarrow \text{Cyt b} \rightarrow \text{Cyt } c_1 \rightarrow \text{Cyt c} \rightarrow \text{Cyt a} \rightarrow \text{O}_2$   
 (c)  $\text{NADH} \rightarrow \text{UQ} \rightarrow \text{Cyt b} \rightarrow \text{Cyt a} \rightarrow \text{Cyt } a_3 \rightarrow \text{Cyt c} \rightarrow \text{Cyt } c_1 \rightarrow \text{O}_2$   
 (d)  $\text{NADH} \rightarrow \text{Cyt b} \rightarrow \text{Cyt } c_1 \rightarrow \text{UQ} \rightarrow \text{Cyt a} \rightarrow \text{Cyt } a_3 \rightarrow \text{O}_2$

## SECTION-B

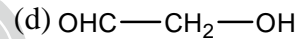
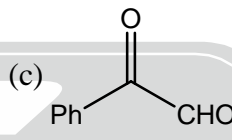
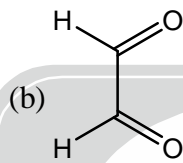
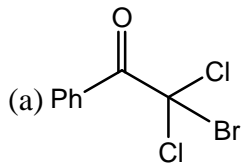
### [Multiple Select Questions (MSQ)]

**Q. 31 – Q. 40 carry two marks each.**

31. Which of the following ion(s) is/are involved in photolysis of water  
 (a)  $\text{Ca}^{2+}$       (b)  $\text{Mn}^{2+}$       (c)  $\text{Cl}^-$       (d)  $\text{K}^+$
32. In case of dsDNA, which of the following base ratios is always equal to one?  
 (a)  $(\text{A}+\text{T}) / (\text{G}+\text{C})$       (b)  $\text{A}/\text{T}$   
 (c)  $(\text{G}+\text{T}) / (\text{A}+\text{C})$       (d)  $(\text{A}+\text{G}) / (\text{C}+\text{T})$



33. Autonomous nervous system has sympathetic and parasympathetic branches. Which of the following statements are applicable to it
- Sympathetic nerves do not originate from cervical and sacral regions of spinal cord
  - Parasympathetic nerves do not originate from cervical, thoracic and lumbar regions of spinal cord
  - Sympathetic nerves are cholinergic as well as adrenergic
  - Parasympathetic nerves are cholinergic only
34. Incorrect statements from following are
- Allelic exclusion ensures monospecific B-cell
  - V-(D)-J recombination operates during maturation of B-cells and T-cells both
  - V-(D)-J recombination operates during maturation of B-cells but not in case of T-cells
  - Affinity maturation happens during formation of immunocompetent, naive-B-cells
35. The species contains minimum number of lone pairs on central atom is / are
- $\text{ClO}_3^-$
  - $\text{XeF}_4$
  - $\text{SF}_4$
  - $\text{I}_3^-$
36. Select the compounds undergoing inter or intra molecular Cannizzaro reaction



37. The change in frequency due to Doppler effect depends on
- the speed of the source
  - the speed of the observer
  - the frequency of the source
  - separation between the source and the observer
38. Inside a uniform spherical shell
- the gravitational potential is zero
  - the gravitational field is zero
  - the gravitational potential is same everywhere
  - the gravitational field is same everywhere
39. Which of the following is correct?
- $\sin 1^\circ > \sin 1$
  - $\sin 1^\circ < \sin 1$
  - $\cos 1^\circ > \cos 1$
  - $\cos 1^\circ < \cos 1$
40. The area of the origin bounded by the curves  $y = |x - 1|$  and  $y = 3 - |x|$  is

(a)  $2 \int_{-1}^0 (1+x) dx + \int_0^1 2 dx + 2 \int_1^2 (2-x) dx$

(b)  $2 \int_0^1 y dy + \int_1^2 2 dy - 2 \int_2^3 y dy$

(c)  $2 \int_{-1}^0 (1+x) dx + \int_0^1 2 dx - 2 \int_1^2 (2-x) dx$

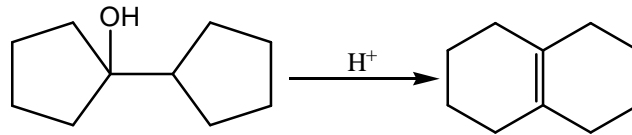
(d)  $2 \int_0^1 y dy + \int_1^2 2 dy + 2 \int_2^3 y dy$

## SECTION-C

## [Numerical Answer Type (NAT)]

Q. 41 – Q. 50 carry one mark each.

41. Reducing SDS PAGE of IgM will produce how many bands in autoradiogram \_\_\_\_\_
42. The sum of bond order of NO and NO<sup>+</sup> molecule is \_\_\_\_\_
43. Reaction,



How many intermediate (carbocations) will be form in above conversion. \_\_\_\_\_

44. If the radius of first Bohr orbit is 0.53 Å, then the radius of third Bohr orbit is \_\_\_\_\_ Å.  
(Correct upto one decimal place)
45. Number of electrons involved in the reduction of nitrate to ammonia is \_\_\_\_\_
46. The wavelength of sodium light in air is 589 nm. Its frequency in water is \_\_\_\_\_ × 10<sup>14</sup> Hz. (Given data: refractive index of water = 1.33)
47. A magnetic field of  $(4.0 \times 10^3 \hat{k})$  T exerts a force of  $(4.0 \hat{i} + 30 \hat{j}) \times 10^{-10}$  N on a particle having a charge of  $1.0 \times 10^{-9}$  C and going in the  $x$ - $y$  plane. The velocity of the particle is  $(-\alpha \hat{i} + \beta \hat{j})$  m/s. The ratio  $\frac{\alpha}{\beta}$  is \_\_\_\_\_.
48. Following data was obtained for an enzyme catalyzed reaction

[S] (m <sup>M</sup> )	V(m mol ml <sup>-1</sup> min <sup>-1</sup> )
0.1	3.33
0.2	5.00
0.5	7.14
0.8	8.00
1.0	8.33
2.0	9.09

[S] = Concentration of substrate  
V = Velocity of reaction

If the concentration of enzyme is 10<sup>-6</sup>M, then its turn over number is \_\_\_\_\_ min<sup>-1</sup>

49. If the sum of first  $n$  positive integers is  $\frac{1}{5}$  times the sum of their squares, then  $n =$  \_\_\_\_\_
50. The angle between  $\vec{a} \times \vec{b}$  and  $\vec{b} \times \vec{a}$  is \_\_\_\_\_ degree.

**Q. 51 – Q. 60 carry two marks each.**

51. In a human population, the genotypic frequencies are 0.1BB, 0.4Bb, 0.5bb. Then the frequency of  $b$  allele is \_\_\_\_\_
52. 2 mol of an ideal gas at  $27^\circ\text{C}$  temperature is expanded reversibly from 2L to 20L. Entropy change ( $R = 2 \text{ cal/mol K}$ ), correct upto one decimal place in  $\text{cal K}^{-1}$  is \_\_\_\_\_
53. The rate law of a chemical reaction  $2\text{NO} + \text{O}_2 \longrightarrow 2\text{NO}_2$  is given as  $\text{rate} = k[\text{NO}]^2 [\text{O}_2]$ . The ratio of rate of reaction, when volume of reaction vessel is reduced to  $\frac{1}{4}$  of its initial value ( $r_2$ ) to that of original ( $r_1$ ) is \_\_\_\_\_.
54. Apart from the 20 naturally occurring amino acids, 700 unnatural amino acids have been reported. If all the 720 were to be accommodated in the genetic code, what is the minimum number of bases needed in a codon? \_\_\_\_\_
55. A coil of resistance  $100 \Omega$  is connected across a battery of emf 6.0 V. Assume that the heat developed in the coil is used to raise its temperature. If the coil is  $4.0 \text{ J/K}$ , then the time taken to raise the temperature of the coil by  $15^\circ\text{C}$  is \_\_\_\_\_ min.
56. The electric field between the plates of a parallel-plate capacitor of capacitance  $2.0 \mu\text{F}$  drops to one third of its initial value of  $4.4 \mu\text{s}$  when the plates are connected by a thin wire. The resistance of the wire is \_\_\_\_\_  $\Omega$ .
57. A microorganism has specific growth rate of  $2.8 \text{ h}^{-1}$ , then its doubling time will be \_\_\_\_\_ minutes.
58. The sum of series  $\frac{1}{30} + \frac{1}{42} + \frac{1}{56} + \frac{1}{72} + \dots$  is \_\_\_\_\_
59. Let  $a, b, c$  be any real numbers. Suppose that there are real numbers  $x, y, z$  not all zero such that  $x = cy + bz$ ,  $y = az + cx$  and  $z = bx + ay$ . Then  $a^2 + b^2 + c^2 + 2abc$  is equal to \_\_\_\_\_
60. Consider the following biochemical reaction.
- Glucose-1-Phosphate  $\xrightleftharpoons{\text{Mutase}}$  Glucose-6-Phosphate
- The concentration of Glucose-1-Phosphate and Glucose-6-Phosphate at equilibrium are 1mM and 19mM respectively. The value of Gibb's free energy will be \_\_\_\_\_ kJ/mol.
- [Hint : Value of natural  $\log[19] = 2.94$ ]

**END OF THE QUESTION PAPER**





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**SPACE FOR ROUGH WORK**





## IIT-JAM BIOTECHNOLOGY - BT

### TEST SERIES - 6

(Full Length Test Series - 3)

Time : 3 Hours

Date : 31-01-2018

M.M. : 100

## ANSWER KEY

### SECTION-A

#### [Multiple Choice Questions (MCQ)]

- |         |         |         |         |         |
|---------|---------|---------|---------|---------|
| 1. (c)  | 2. (a)  | 3. (c)  | 4. (a)  | 5. (d)  |
| 6. (d)  | 7. (c)  | 8. (d)  | 9. (a)  | 10. (b) |
| 11. (d) | 12. (b) | 13. (a) | 14. (b) | 15. (d) |
| 16. (d) | 17. (c) | 18. (d) | 19. (d) | 20. (b) |
| 21. (a) | 22. (b) | 23. (a) | 24. (b) | 25. (a) |
| 26. (b) | 27. (b) | 28. (d) | 29. (b) | 30. (a) |

### SECTION-B

#### [Multiple Select Questions (MSQ)]

- |            |               |                  |               |
|------------|---------------|------------------|---------------|
| 31. (b, c) | 32. (b, c, d) | 33. (a, b, c, d) | 34. (c, d)    |
| 35. (a, c) | 36. (a, b, c) | 37. (a, b, c)    | 38. (b, c, d) |
| 39. (b, c) | 40. (a, b)    |                  |               |

### SECTION-C

#### [Numerical Answer Type (NAT)]

- |                    |                    |                    |                        |
|--------------------|--------------------|--------------------|------------------------|
| 41. (3)            | 42. (5.5)          | 43. (3)            | 44. (4.7)              |
| 45. (8 to 8)       | 46. (5.08 to 5.10) | 47. (0.75 to 0.76) | 48. (10 <sup>7</sup> ) |
| 49. (7)            | 50. (180)          | 51. (0.7)          | 52. (9.2)              |
| 53. (64)           | 54. (5)            | 55. (2.7 to 2.9)   | 56. (2 to 2.2)         |
| 57. (14.7 to 14.9) | 58. (0.20)         | 59. (1)            | 60. (-7.3)             |

