

Test Centre : \_\_\_\_\_

Roll No. : \_\_\_\_\_

Name of the Candidate : \_\_\_\_\_

**S A U**

**Entrance Test for Ph.D. (Biotechnology) 2018**

**[ PROGRAMME CODE : 50001 ]**

**Question Paper Series Code : B**

**QUESTION PAPER**

Time : 3 hours

Maximum Marks : 70

**INSTRUCTIONS FOR CANDIDATES**

*Please read carefully the following instructions before attempting the Question Paper :*

- (i) Write your Name and Roll Number in the space provided for the purpose on the top of this Question Paper and in the OMR Sheet.
- (ii) **Please darken the appropriate circle of Question Paper Series Code on the Answer Sheet in the space provided.**
- (iii) This Question Paper has two Parts : Part—A has 20 questions and Part—B has 50 questions. Each question carries 1 mark. Attempt all questions.
- (iv) **A wrong answer will lead to the detection of one-fourth (1/4) of the marks assigned to that question.**
- (v) Answers written inside the Question Paper will not be evaluated.
- (vi) Pages at the end have been provided for Rough Work.
- (vii) Simple calculators are allowed. Mobile Phones are **NOT** allowed.
- (viii) **Return the Question Paper and the Answer Sheet to the Invigilator at the end of the Entrance Test.**
- (ix) **DO NOT FOLD THE OMR SHEET.**

**/2-B**

## INSTRUCTIONS FOR MARKING ANSWERS ON THE 'OMR SHEET'

Use **BLUE/BLACK** Ballpoint Pen Only

1. Please ensure that you have darkened the appropriate circle of 'Question Paper Series Code' and 'Programme Code' on the OMR Sheet in the space provided.

**Question Paper Series Code**

Write Question Paper Series Code **A** or **B** in the box and darken the appropriate circle.

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A or B

(A)



2. Use only Blue/Black Ballpoint Pen to darken the circle. Do not use Pencil to darken the circle for Final Answer.
3. Please darken the whole circle. ●
4. Darken ONLY ONE CIRCLE for each question as shown below in the example :

**Example :**

Wrong	Wrong	Wrong	Wrong	Correct
● (b) (c) ●	⊗ (b) (c) (d)	⊗ (b) (c) ⊗	⊙ (b) (c) ●	⊙ (a) (b) (c) ●

5. Once marked, no change in the answer is possible.
6. Please do not make any stray marks on the OMR Sheet.
7. Please do not do any rough work on the OMR Sheet.
8. Mark your answer only in the appropriate circle against the number corresponding to the question.
9. **A wrong answer will lead to the deduction of one-fourth of the marks assigned to that question.**
10. Write your seven-digit Roll Number in small boxes provided for the purpose; and also darken the appropriate circle corresponding to respective digits of your Roll Number as shown in the example below.

**Example :**

**ROLL NUMBER**

1	3	5	7	2	0	2
●	①	①	①	①	①	①
②	②	②	②	●	②	●
③	●	③	③	③	③	③
④	④	④	④	④	④	④
⑤	⑤	●	⑤	⑤	⑤	⑤
⑥	⑥	⑥	⑥	⑥	⑥	⑥
⑦	⑦	⑦	●	⑦	⑦	⑦
⑧	⑧	⑧	⑧	⑧	⑧	⑧
⑨	⑨	⑨	⑨	⑨	⑨	⑨
⑩	⑩	⑩	⑩	⑩	●	⑩

**PART—A**

1. Glycolytic reactions with a near-zero  $\Delta G^{\circ}$  can participate in the overall pathway of gluconeogenesis because
  - a. they are irreversible
  - b. they are reversible
  - c. they contradict the laws of thermodynamics
  - d. they have low energy of activation values
  
2. Galactosidase activity is NOT detected in which one of the following strains of bacteria despite the presence of allolactose in the media?
  - a.  $i^{-}z^{+}y^{+}$
  - b.  $i^{+}z^{-}y^{+} / F^{i^{-}z^{+}y^{+}}$
  - c.  $i^{S}z^{+}y^{+} / F^{i^{+}z^{+}y^{+}}$
  - d.  $o^{+}z_{1}^{-} / F_{O}^{C}z^{+}$
  
3. Natural rubber is a polymer, derived from
  - a. ethylene
  - b. propylene
  - c. isoprene
  - d. butadiene
  
4. Which one of the following stages would be the most convenient to count the chromosomes of the root-tips of onions?
  - a. Prophase
  - b. Anaphase
  - c. Telophase
  - d. Metaphase

5. Which one of the following plant-synthesized phenolic compounds is required by *Agrobacterium tumefaciens* to infect plant systems?
- a. Acetoacetone
  - b. Acetate
  - c. Acetyl-CoA
  - d. Acetosyringone
6. The availability of oxygen and other electron acceptors is the most important determinant of the types of metabolism in a habitat. Which of the following statements is NOT true about anaerobic environments?
- a. Respiration of organic compounds is highly dissimilatory, reducing them to CO<sub>2</sub>.
  - b. Their rates of dissimilation are slower compared to aerobic environments.
  - c. Microbes sometimes use minerals such as NO to oxidize organic compounds.
  - d. Anaerobic microbial communities far exceed those of oxygenated biospheres.
7. Which one of the following substances is not a cofactor of pyruvate dehydrogenase complex?
- a. Biotin
  - b. FAD
  - c. NAD
  - d. TPP
8. Glycogen synthase is directly regulated by GSK3 which is responsive to the high level of
- a. insulin
  - b. glucagon
  - c. epinephrine
  - d. nor-epinephrine

9. Which of the following does not affect the electrophoretic movement of a biomolecule in a gel electrophoresis?
- a. Size
  - b. Shape
  - c. Molecular weight
  - d. Stereochemistry
10. Which of the following radiations is positively charged?
- a. X-ray
  - b. Beta
  - c. Alpha
  - d. Gamma
11. The relationship between cold intensity and temperature is
- a. perfect positive correlation
  - b. partial negative correlation
  - c. partial positive correlation
  - d. perfect negative correlation
12. Variance is the
- a. square root of standard deviation
  - b. square of standard deviation
  - c. square of the standard error of the mean
  - d. square root of the standard error of the mean

13. Excess ammonia in tissues is added to which one of the following amino acids to transport it through the bloodstream to the liver?
- Glutamine
  - Glutamate
  - Alanine
  - Asparagine
14. In a cell-free extract containing DNA polymerase I,  $Mg^{2+}$ , dATP, dGTP, dCTP and dTTP(3H), DNA replication will occur for which one of the following substrates?
- Single-stranded closed circular DNA containing 824 nucleotides
  - Single-stranded closed circular DNA having 1578 nucleotides base paired with a linear single-stranded DNA of 824 nucleotides having a free 3' hydroxyl group
  - Double-stranded linear DNA molecule containing 1578 nucleotides having free 3'-OH group at both ends
  - Double-stranded closed circular DNA having 824 nucleotides
15. The loss of telomeres leads to
- increased cell proliferation
  - chromosomal segregation during meiosis
  - immortality for the cell
  - 'sticky' chromosomes
16. The two strands of DNA are held to each other through
- covalent bonds
  - ionic interactions
  - hydrogen bonds
  - disulfide bridges

17. The proofreading component of DNA polymerase I (polA) is due to
- 3' → 5' exonuclease activity
  - 5' → 3' polymerase activity
  - 5' → 3' exonuclease activity
  - complete holoenzyme structure
18. Puromycin is commonly used for the inhibition of
- DNA replication
  - transcription
  - translation
  - DNA supercoiling
19. Which of the following statements is NOT correct regarding fatty acid biosynthesis?
- It involves successive condensations of malonyl-ACP.
  - A dehydratase is used to generate a saturated bond.
  - It is regulated by the stringent response of carbon starvation.
  - NADPH is generally involved in hydrogenation.
20. What is lithotrophy?
- Breakdown of molecules using light energy
  - Oxidation of organic electron donors to CO<sub>2</sub> and H<sub>2</sub>O
  - Photolysis of H<sub>2</sub>S or H<sub>2</sub>O coupled to CO<sub>2</sub> fixation
  - Oxidation of inorganic electron donors such as Fe<sup>2+</sup> using O<sub>2</sub> or anaerobic electronic acceptors

**PART—B**

- 21.** Which one of the following cellular compartments follows transmembrane and vesicular transport system for protein trafficking?
- a. ER
  - b. Nucleus
  - c. Mitochondria
  - d. Golgi apparatus
- 22.** Which one of the following protein complexes helps to insert porins into the lipid bilayer of mitochondria?
- a. TOM complex
  - b. TIM23 complex
  - c. TIM22 complex
  - d. SAM complex
- 23.** Which one of the following junctions connects a cell to the extracellular matrix via intermediate filament?
- a. Occludin junction
  - b. Desmosome junction
  - c. Hemidesmosome junction
  - d. Gap junction
- 24.** The phenotypic variation, i.e., modification at the protein level rather than genetic level, can be brought about by the action of which one of the following enzymes?
- a. dsRNA adenosine deaminase
  - b. DNA-dependent DNA polymerase
  - c. RNA-dependent DNA polymerase
  - d. DNA photolyase



25. Which one of the following statements best describes why intermediate filaments cannot participate in the generation of force for cell motility?
- They are not intrinsically polar and hence cannot utilize motor proteins.
  - The cells are unable to control their assembly.
  - They cannot disassemble.
  - They are found only in association with certain cell junctions.
26. Which one of the following is a cell surface carbohydrate-binding protein?
- Cadherin
  - Integrin
  - Selectin
  - Elastin
27. Which of the following cyclins and cyclin-dependent kinases initiate centrosomes duplication during cell cycle?
- E/CDK2
  - D/CDK4/6
  - A/CDK2
  - B/CDC2
28. The gradient of which ion is responsible for ATP synthesis during light reaction of photosynthesis?
- $\text{Na}^+$
  - $\text{K}^+$
  - $\text{Cl}^-$
  - $\text{H}^+$
29. In  $\text{C}_4$  photosynthesis,  $\text{CO}_2$  is fixed to 4-carbon molecule at
- mesophyll cells
  - bundle sheath cells
  - xylem
  - phloem

30. In photorespiration
- RuBisCO fixes  $\text{CO}_2$  not  $\text{O}_2$
  - RuBisCO fixes  $\text{O}_2$  not  $\text{CO}_2$
  - RuBisCO fixes both  $\text{O}_2$  and  $\text{CO}_2$
  - RuBisCO removes  $\text{CO}_2$
31. In a binary vector system, the
- vir genes and T-DNA are in the same plasmid
  - plant selectable marker is outside the T-DNA region
  - bacterial selection marker is within the T-DNA region
  - plant selectable marker are within the T-DNA region
32. Compatible solutes (osmolytes) are
- neutrally charged at physiological pH, either non-ionic or zwitterionic
  - positively charged at physiological pH, ionic
  - lipid soluble hydrophobic
  - negatively charged at physiological pH, ionic
33.  $\text{Na}^+$ - $\text{H}^+$ -antiporter moves  $\text{Na}^+$  from
- vacuole to cytoplasm
  - cytoplasm to vacuole
  - cytoplasm to mitochondria
  - mitochondria to cytoplasm
34. Which one of the following model plant species do the most plant molecular biologist uses?
- Arabidopsis thaliana*
  - Daucus carota*
  - Triticum aestivum*
  - Thale cress*

35. The telodendritic zone of neurons is responsible for
- receiving signals
  - processing signals
  - conducting signals
  - transmitting signals
36. Which one of the following cofactors involved in amino acid degradation is correctly matched to the one-carbon group it transfers?
- Biotin : CHO
  - Tetrahydrofolate : CHOH
  - S-adenosylmethionine : CH<sub>2</sub>OH
  - Pyridoxal phosphate : CH<sub>3</sub>
37. Which one of the following proteins present in blood helps to transport free fatty acids from adipocytes to hepatocytes?
- Perilipin A
  - Albumin
  - Apolipoprotein
  - Insulin
38. Short-term eating behavior is controlled by
- ghrelin
  - albumin
  - leptin
  - perilipin
39. Which one of the following amino acids is the precursor for the synthesis of the neurotransmitter serotonin?
- Phenylalanine
  - Tryptophan
  - Tyrosine
  - Cysteine

40. Which one of the following enzymes is inhibited by allopurinol, a structural analogue of hypoxanthine?
- Hypoxanthine oxidase
  - Xanthine oxidase
  - Dihydrofolate reductase
  - Adenosine deaminase
41. Fluorescent antibody staining works well for clinical diagnosis on which one of the following types of antigen?
- Ribosomal
  - Cytoplasmic
  - Nuclear
  - Capsular
42. Which one of the following class of antibiotics prevents the synthesis of tetrahydrofolic acid within the bacterial cell?
- Translation inhibitor
  - Cell wall inhibitor
  - Bacterial membrane inhibitor
  - DNA synthesis inhibitor
43. Phosphofructokinase involved in glycolysis pathway is activated by
- high ATP/AMP ratio
  - low ATP/AMP ratio
  - citrate
  - low ATP/AMP ratio and high citrate
44. In flow cytometry, forward scatter is related to which property of the cells?
- Cell size
  - Cell granularity
  - Cell viability
  - Rate of cell metabolism

45. Cytoplasmic domain of Toll like receptor Tlr-4 is analogous to which one of the following?
- Cytoplasmic domain of IL1 receptor
  - Cytoplasmic domain of TNF receptor
  - Gamma chain of T cell receptor
  - Alpha chain of the complement 4 protein
46. Which of the following proteins needs to be degraded for signaling through NFkB pathway?
- P50 of the nuclear factor kB
  - P65 of the nuclear factor kB
  - Cytoplasmic Ikb subunit
  - Ikb kinase
47. During the rearrangement of immunoglobulin genes, differential nicks in blunt ends of the rearranging genes results in generation of diversity
- in the 3' end of the constant heavy chain genes
  - of light chains alone
  - of heavy chains alone
  - of light as well as heavy chains
48. A fully differentiated B-cell exiting the bone marrow would have which one of the following Ig type receptors?
- IgG and IgE
  - IgM and IgA
  - IgD and pre-BCR
  - IgD and IgM

49. Arf-1 is a monomeric G-protein that helps in the formation of COPI-coated vesicles at the Golgi membrane by inserting a hydrophobic tail in the Golgi membrane that then recruits other necessary adapter proteins to start bud formation. The hydrophobic tail of Arf-1 is exposed when Arf-1 is bound to GTP and is retracted when Arf-1 hydrolyses the bound GTP to GDP. If there is a mutation in Arf-1 so that it cannot hydrolyse GTP then all of the following can be expected to happen except that
- COPI-coated vesicles will readily form but may form at places other than Golgi
  - COPI-coated vesicles will disassemble quickly
  - transport mediated by COPI-coated vesicles will be inhibited
  - it would be lethal for the cell
50. X-ray diffraction and phase-contrast microscopy both involve
- wave interference
  - observation of living specimens
  - differential stains
  - simple stains
51. Highly active antiretroviral therapy is used for the treatment of
- HBV infection
  - HCV infection
  - HIV infection
  - H1N1 infection
52. The drug amantadine inhibits the influenza virus during
- transcription
  - translation
  - uncoating of virus
  - virus entry

53. Which one of the following enzymes do (-) RNA viruses use during genome replication?
- RNA-dependent RNA polymerase
  - DNA-dependent RNA polymerase
  - Reverse transcriptase
  - RNA-dependent DNA polymerase
54. When an individual is infected while in hospital or health care facility, the infection is called
- nosocomial
  - iatrogenic
  - vertical
  - horizontal
55. The speciation in which a population splits into two geographically isolated populations, experiences dissimilar selective pressure and undergoes genetic drift is known as
- sympatric speciation
  - parapatric speciation
  - peripatric speciation
  - allopatric speciation
56. The ABO blood group system is based on the differences in the expression of
- glycerophospholipids
  - glycosphingolipids
  - glycoproteins
  - proteoglycans

57. Change in the order of genes located in a genetic map without altering their linkage group can be achieved through
- translocation
  - transposition
  - inversion
  - recombination
58. Fluorouracil is used as a chemotherapeutic agent due to its ability to
- inhibit folic acid regeneration
  - inhibit formation of dTMP from dUMP
  - convert UMP to dUMP
  - prevent synthesis of 5-phosphoribosyl-1-pyrophosphate (PRPP)
59. Which one of the following events does NOT facilitate the maternal-to-zygotic transition in the development of an embryo?
- Titration of zygotic gene repressors
  - Degradation of maternal transcripts by Smaug
  - Degradation of maternal mRNA by miRNAs
  - Increase in maternal DNA replication initiation factors
60. The phenomenon of position effect variegation is observed when a gene is present
- closer to the centromere
  - at the centre of the chromatid
  - within the inactivated X chromosome
  - within the plasmid
61. Polyploidy can be induced through colchicine which acts by interfering with which of the following mechanisms?
- G0 to G1 transition
  - G1 to S phase
  - S phase
  - Chromosomal segregation



62. Leber's hereditary optic neuropathy is a rare disease affecting the optic nerves causing bilateral loss of vision in early adulthood. The disease is caused by a single base change in the mitochondrial gene ND4 that results in a His residue, instead of Arg, in a polypeptide of complex I. The disease is acquired through
- autosomal dominant inheritance
  - autosomal recessive inheritance
  - spontaneous exposure to mutagens
  - maternal inheritance
63. The origins of replication are usually rich in
- AG
  - AT
  - GC
  - CT
64. In order to study active transcription within a cell, which one of the following radioisotopes should be used that will allow its detection in the isolated mRNA?
- $[\alpha - P^{32}]$  ATP
  - $[\beta - P^{32}]$  ATP
  - $[\gamma - P^{32}]$  ATP
  - $[\gamma - P^{32}]$  GTP
65. The presence of non-specific bands in a polymerase chain reaction (PCR) can be avoided by
- reducing the denaturation temperature
  - increasing the annealing temperature
  - increasing the annealing time
  - increasing the number of cycles

66. Expression of a gene placed under the regulatory control of the *lac* operator will occur when
- lactose and glucose are absent in the media
  - lactose is absent while glucose is present
  - lactose is present while glucose is absent
  - both lactose and glucose are present
67. Melting of the DNA refers to
- disruption of ionic interactions between DNA and histones
  - disruption of non-covalent interactions between the bases of the DNA
  - disruption of covalent bonds between the sugar and phosphate groups
  - precipitation of DNA upon ethanol treatment
68. The design of primers for a polymerase chain reaction should NOT follow which one of the following conditions?
- Primers should be 17–25 bases long
  - Primers should have a %GC content of 50–60
  - Primers should be self-complementary
  - $T_m$  should be in the range of 55 °C–70 °C
69. An example of a cationic detergent used for isolation of DNA is
- saponin
  - sodium deoxycholate
  - CTAB
  - CHAPS
70. Hyperpolarization of the neuron refers to increased
- $[Na^+]$  influx
  - $[Na^+]$  efflux
  - $[K^+]$  influx
  - $[K^+]$  efflux

SPACE FOR ROUGH WORK

SPACE FOR ROUGH WORK

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20

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