

**ROYAL CIVIL SERVICE COMMISSION  
CIVIL SERVICE COMMON EXAMINATION (CSCE) 2008  
EXAMINATION CATEGORY: TECHNICAL**

**PAPER III: SUBJECT SPECIALIZATION PAPER FOR M. Sc. MICROBIOLOGY**

**Date: 20/12/2008**

**Total Marks: 100**

**Examination Time: 2.5 hours**

**Reading Time: 15 minutes**

**General Directions:**

- 1. This question paper contains 6 pages. You will be given 15 minutes to read the questions before you write the answers.**
- 2. Section A, Part A should be answered on the question paper itself. Answers for Section A, Part B and Section B should be written on the separate answer sheets provided.**

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**SECTION A**

**PART A. MULTIPLE CHOICE QUESTIONS**

**Directions:**

In this part there are thirty multiple choice questions each carrying 1 mark.

Each question is followed by four suggested answers. Tick/Circle the **ONE** that best answers the question

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1. Dendritic cells (DC) of the innate immunity are
  - a. Toll like receptors
  - b. Antigen presenting cells
  - c. Cytokines
  - d. None of the above
2. The process of degradation of proteins are mediated by
  - a. Enzymes
  - b. Ubiquitin (Ub)
  - c. Chemical degradation
  - d. Apoptosis
3. In the process of DNA replication, genetic information of the cell is carried by
  - a. tRNA
  - b. sRNA
  - c. mRNA
  - d. all of the above
4. The translation of amino acid sequence to proteins is carried out by
  - a. DNA polymerase
  - b. Taq polymerase

- c. Ribosome
  - d. RNase
5. Which of the following bacterium is used in transfection to create genetically modified plants or transgenic plants
- a. *Escherichia coli*
  - b. *Agrobacterium tumefaciens*
  - c. *Pseudomonas aeruginosa*
  - d. *Enterococci* spp.
6. Which of the following cells contain nuclear membrane
- a. Prokaryotic cells
  - b. Eukaryotic cells
  - c. None of the above
  - d. Both a and b
7. The following nucleic acids are double stranded
- a. DNA
  - b. RNA
  - c. mRNA
  - d. None of the above
8. In conventional polymerase chain reaction (PCR), the *Taq polymerase* enzyme is obtained from a thermophilic bacteria called
- a. *Borkhoderia pseudomaliae*
  - b. *Thermus aquaticus*
  - c. *Acinetobacter baumannii*
  - d. None of the above
9. The restriction enzymes that digest the DNA sequences from the terminal ends (3' or 5' end) are called as
- a. Exonucleases
  - b. Endonucleases
  - c. Polymerases
  - d. RNase
10. Which of the following divalent cation is most important for the efficiency of thermostable polymerase in PCR reaction
- a.  $\text{Ca}^{++}$
  - b.  $\text{Na}^{++}$
  - c.  $\text{Mg}^{++}$
  - d.  $\text{Zn}^{++}$
11. In a PCR reaction, the temperature at which the primer bind to the template DNA is called as
- a. Denaturation temperature
  - b. Boiling temperature
  - c. Annealing temperature
  - d. Extension time

12. The electrophoretic separation of DNA is based on the principle of differences in
  - a. Molecular charge of DNA
  - b. Valency
  - c. Shape of DNA
  - d. None of the above
  
13. Which of the following immune cells produce antibodies
  - a. Macrophage
  - b. T-cells
  - c. B-cells
  - d. Natural Killer (NK) cells
  
14. Which of the following is the first immunoglobulins to appear following an infection
  - a. IgG
  - b. IgM
  - c. IgD
  - d. IgE
  
15. Which of the following leads to memory cells
  - a. T-cells
  - b. Macrophages
  - c. B-cells
  - d. Neutrophils
  
16. Which of the following is not an auto-immune disease
  - a. Systemic lupus erythematous (SLE)
  - b. Rheumatoid arthritis (RF)
  - c. Bovine serum encephalopathy (BSE)
  - d. Rheumatic heart disease (RHD)
  
17. lipopolysaccharides (LPS) which are responsible for the production of endotoxin are produced by the following groups of bacteria
  - a. Gram positive bacteria
  - b. Gram negative bacteria
  - c. *Clostridium tetani*
  - d. *Bacillus anthracis*
  
18. Clavulanic acid, tazobactam and sulbactam are inhibitors of
  - a.  $\beta$ -lactam antibiotics
  - b.  $\beta$ -lactamase enzymes
  - c. DNA polymerase
  - d. DNA gyrase
  
19. The most common cause of severe diarrhea in infants throughout the world is:
  - a. *E. coli*
  - b. *Cryptosporidium*
  - c. *Shigella*
  - d. *Rotavirus*

20. Which of the following environments are more conducive for developing multi drug resistance by *Pseudomonas aeruginosa* following a surgical procedure
- Local Community
  - Surgical wards
  - None of the above
  - All of the above
21. Gram stain is used to differentiate between
- Gram negative and Gram positive bacteria
  - Acid fast and non-acid fast bacilli
  - Diphtheroids
  - None of the above
22. Ziehl-Neelsen stain is used to identify the following
- Mycobacterium* spp.
  - Staphylococcus* spp.
  - Streptococcal* spp.
  - None of the above
23. The bacteria that causes “rice water stool”, a type of diarrhea, is called
- Vibrio cholerae*
  - Klebsiella pneumoniae*
  - Acinetobacter baumannii*
  - Pseudomonas aeruginosa*
24. Which of the following are typing methods for determining the genetic relatedness of bacterial epidemics
- Pulsed Field Gel Electrophoresis (PFGE)
  - Oxidase test
  - Nitrate utilization
  - None of the above
25. Plague is caused by
- Bordetella pertussis*
  - Yersinia pestis*
  - Clostridium tetani*
  - Listeria monocytogenes*
26. Penicillin/ $\beta$ -lactams antimicrobial agents inhibit the growth of bacteria by
- Inhibiting penicillin binding proteins (PBP)
  - Inhibiting DNA polymerase
  - Decreases outer membrane proteins
  - Increased efflux due to efflux pumps
27. Quinolones, a group of antimicrobial agents like ciprofloxacin and levofloxacin, inhibit bacterial growth by
- Inhibiting cells wall synthesis

- b. Interfering with DNA gyrase and topoisomerase subunit
  - c. Inhibiting protein synthesis
  - d. Inhibiting DNA polymerase
28. The following antibiotics compete with para-amino benzoic acid (PABA) for nucleic acid synthesis
- a. Penicillins
  - b. Sulfonamides
  - c. Trimethoprim
  - d. Vancomycin
29. Which of the following antibiotics are last resort agents for treating MDR Gram negative bacterial infections
- a. Penicillin
  - b. Vancomycin
  - c. Carbapenems
  - d. Teicoplanin
30. The following plasmid is a vector used for cloning DNA sequences in the multiple cloning sites
- a. pDrive
  - b. Competent *E. coli* cells
  - c. DNA ligases
  - d. Ti Plasmids

**PART B. WRITE SHORT ANSWERS**

(20 marks)

General Direction:

In this part there are four short answer questions each carrying 5 marks. All the questions must be attempted.

31. What are the post streptococcal complications? Describe each one briefly
32. What are the major types of dengue viruses? What are they? Explain why secondary dengue viral infection is more fatal than the initial infections.
33. Write down the full forms of the following abbreviations
- a. MDR-TB     :
  - b. H5N1 virus   :
34. Suppose you hypothesize that gene A is responsible for the pathogenicity of *Pseudomonas aeruginosa* infections isolated from a wound of a patient admitted in surgical ward. Design your own experimental set up to prove your hypothesis?

## SECTION B

(50 marks)

### General Direction:

*In this section there are two questions based on case studies. Choose ANY one question from the questions below and write your answer to the chosen question very carefully.*

1. There is an outbreak of avian influenza (AI) in the country and you were asked to design an appropriate diagnostic tool (using PCR) for the detection of AI infection. Using bioinformatics tools, explain how you would design a primer for H5 and N1 determinants and explain your methodology.
  
2. A 72 year-old man admitted over the last 3 months in a surgical ward presents with repeated infection of the ambulatory wound in the right leg. Treatment with various broad spectrum antimicrobial agents did not resolve the infections. Pus culture from the wound swab showed glucose non-fermentative colonies on MacConkey agar. Biochemical characterization showed oxidase positive with green pigmentation. Antibiotic susceptibility testing showed that it is resistant to most of the drugs including 3<sup>rd</sup> generation cephalosporins like ceftriaxone. Based on the data available, which of the following etiologic agent do you think poses threat to this man's health?
  - a. *Escherichia coli*
  - b. *Klebsiella pneumoniae*
  - c. *Pseudomonas aeruginosa*
  - d. *Neisseria gonorrhoeae*

Give your own explanation as to why this organism developed resistance to broad spectrum antimicrobial agents.