ROYAL CIVIL SERVICE COMMISSION
BHUTAN CIVIL SERVICE EXAMINATION (BCSE) 2013
EXAMINATION CATEGORY: TECHNICAL

PAPER III: SUBJECT SPECIALIZATION PAPER for *MICROBIOLOGY*

Date	: 14 October 2013
Total Marks	: 100
Examination Time	: 150 minutes (2.5 hours)
Reading Time	: 15 Minutes (prior to examination time)

GENERAL INSTRUCTIONS:

1. Write your Roll Number clearly and correctly on the Answer Booklet.
2. The first 15 minutes is being provided to check the number of pages of Question Paper, printing errors, clarify doubts and to read the instructions. You are NOT permitted to write during this time.
3. This paper consists of **TWO SECTIONS**, namely SECTION A and SECTION B:
   - **SECTION A** has two parts: Part I - 30 Multiple-Choice Questions
     Part II - 4 Short Answer Questions
     All questions under SECTION A are COMPULSORY.
   - **SECTION B** consists of two Case Studies. Choose only ONE case study and answer the questions under your choice.
4. All answers should be written with correct numbering of Section, Part and Question Number in the Answer Booklet provided to you. Note that any answer written without indicating any or correct Section, Part and Question Number will NOT be evaluated and no marks would be awarded.
5. Begin each Section and Part in a fresh page of the Answer Booklet.
6. You are not permitted to tear off any sheet(s) of the Answer Booklet as well as the Question Paper.
7. Use of any other paper including paper for rough work is not permitted.
8. You are required to hand over the Answer Booklet to the Invigilator before leaving the examination hall.
9. This paper has **08** printed pages in all, including this instruction page.

GOOD LUCK!

SECTION A

PART I - Multiple Choice Questions (30 Marks)

Choose the correct answer and write down the letter of the correct answer chosen in the Answer Booklet against the question number. E.g. 31 (c). Each question carries ONE mark. Any double writing, smudgy answers or writing more than one choice shall not be evaluated.

1. Which of the following does NOT describe one of Koch's Postulates?
    a. Grow the agent in pure culture.
    b. Isolate the same agent from a new victim
    c. Isolate the suspected agent from a disease victim
    d. Characterize the Gram staining characteristic of the isolated agent

2. The important class of chemicals that limit radical pH changes in the body, medications, food, and also bacterial media are referred to as
    a. Enzymes
    b. Bases
    c. Buffers
    d. Acids

3. Chromosomes are
    a. Multiple units of genes in linear chains
    b. A newly discovered very large eukaryote
    c. A type of virus that attacks only prokaryotic cells
    d. A type of organelle that secretes material

4. ATP
    a. Is an important molecule for energy sources
    b. Contains three high energy phosphate bonds
    c. Is classified with other organic molecules that contain nucleotides
    d. All of the above

5. Microorganisms are involved in
    a. Production of medicinal products
    b. Food production
    c. Pollution cleanup
    d. All of the above

6. A DNA molecule does NOT contain the following
    a. Uracil
    b. Cytosine
    c. Adenine
    d. Thymine

7. AIDS can best be classed as
    a. Pandemic
    b. Epidemic

c. Endemic
d. Opportunistic infection

8. Which of these descriptions is NOT a characteristic of AGAR?
   a. An excellent food material for many different microbes
   b. Melts only at $100^{o}C$
   c. Toxic to many microbes
   d. E. Solidifies at $45^{o}C$

9. Which of the following is **NOT** a reason for using microorganisms to study metabolism?
   a. Microorganisms are rather boring and don't do many interesting things except cause diseases
   b. Microorganisms are generally inexpensive to grow and work with
   c. Microorganisms are often used to produce commercial products
   d. Microorganisms have a metabolism that is always similar to that of higher plants and animals

10. The most common source(s) of *SALMONELLOSIS* infections is/are
   a. Fish
   b. Human, particularly babies
   c. House hold pets like, cats & dogs
   d. Domestic animals like chickens, turkeys, & cattle

11. The oxygen in the air is lethal to
   a. Obligate thermophiles
   b. Photosynthetic microbes
   c. Microaerophilic microbes
   d. Obligate anaerobes

12. What is the color of gram -positive bacteria on a gram staining?
   a. Purple
   b. Pink
   c. Colorless
   d. Green

13. What are the intrinsic factors for the microbial growth?
   a. pH
   b. Moisture
   c. Oxidation-Reduction Potential
   d. All of these

14. Which of the following articles can be sterilized in an autoclave?
   a. Gloves
   b. Culture media
   c. Dressing material
   d. All of these

15. Which of the following is best used for long term storage of microbial samples when carried out properly?
    a. Storage in a freezer at -10°C
    b. Storage in a freezer at ultra low temperatures (-70°C)
    c. Storage in a refrigerator on an agar slant
    d. Storage on a petri plate at room temperature

16. Which is the most important surface active disinfectants?
    a. Amphoteric compounds
    b. Cationic compounds
    c. Non-ionic compounds
    d. Anionic compounds

17. Preservation of foods by using salts and sugars works by
    a. Raising pH
    b. Lowering osmotic pressure
    c. Creating a hypertonic environment
    d. Creating a hypotonic environment

18. If a canning procedure is not properly followed, which type of microbe is most likely to grow in the canned food?
    a. Obligate Aerobe
    b. Acidophil
    c. Mesophile
    d. Obligate Anaerobe

19. The process of making an object free from living organisms including bacterial and fungal spores and viruses is known as
    a. Pasteurization
    b. Antisepsis
    c. Disinfection
    d. Sterilization

20. Which of the following was the first widely used antiseptic and disinfectant?
    a. Chlorine
    b. Phenol
    c. Iodine
    d. Alcohol

21. Microbes can be removed from a liquid solution by the process of
    a. Filtration
    b. Freeze-drying
    c. Osmosis
    d. Desiccation

22. Which of the following is caused by a member of the genus staphylococcus?
    a. Bubonic plague
    b. Food poisoning
    c. Leprosy
    d. Typhus fever

23. Evolutionary relationships between groups of organisms are determined using which of the following type of information?
    a. Comparisons of nucleotide sequences
    b. Comparisons of biochemical pathways
    c. Comparisons of structural features
    d. All of the above

24. Which of the following is considered the most unifying concept in biology?
    a. Taxonomy
    b. Anatomy
    c. Genetics
    d. Evolution

25. Who was the inventor of the Petri dish?
    a. R.J. Petri, an assistant of R. Koch
    b. A famous French cook
    c. Italian glass blower from Petri, Italy
    d. None of the above

26. Which one is not studied in microbiology?
    a. Bacteria
    b. Animal behavior
    c. Fungi
    d. Algae

27. The foundation for the germ theory of disease was set down by
    a. Robert Koch
    b. Ronald Ross
    c. Louis Pasteur
    d. Walter Reed

28. The individual best remembered for bringing microbes to the world is
    a. Robert Hooke
    b. Antony Van Leeuenhoek
    c. Robert Koch
    d. Masaki Ogata

29. The flow of genetic material in microbial cells usually takes place from
    a. RNA through DNA to proteins
    b. Proteins through RNA to DNA
    c. DNA through RNA to proteins
    d. None of these

30. The template for PCR is
    a. RNA
    b. Single stranded DNA
    c. Double stranded DNA
    d. None of these

PART – II : Short Answer Questions (20 marks)

Answer ALL the questions. Each question carries 5 marks.

1. What are the main ecological roles of bacteria?

2. What are the uses of fungi for some industries?

3. A person has antibodies against the measles virus. Identify three ways in which these antibodies could be acquired.

4. Skin has some characteristics that make it a good nonspecific defense mechanism. Name them and tell how each works.

SECTION B
Case Study

Choose either Case 1 or Case 2 from this Section. Each Case carries 50 marks. Mark for each sub-question is indicated in the brackets.

CASE 1

Food Safety Inspectors from Punakha Dzongkhags report to their central food safety laboratory at Yusipang concerning several individuals with severe gastroenteritis problem after dinning out in the restaurant at Khuruthang. Stool samples of affected individuals tested positive for *E. coli* O157:H7. The food safety laboratory at Yusipang launches an investigation into the cause of illnesses.

As a microbiologist with food safety testing laboratory, it is your job to determine how widespread the outbreak has become, the source of infection, and means to halt the outbreak.

This involves interviewing food borne illness victims, determining common exposures, determining what potential vehicles (food, individuals, environmental samples, other) should be tested, interpreting laboratory results, helping to determine necessary actions to stop the outbreak, and helping to determine actions necessary to prevent future outbreaks.

Meanwhile, additional cases of severe gastroenteritis have been reported in the region. More people may become sick if you cannot identify the source quickly and recommend actions necessary to stop the outbreak. The public is counting on you to solve this case.

QUESTION 1 (20 marks)

Aside from talking with individuals who contracted *E. coli* O157:H7 infection, who else should you interview and what further steps you would take to help determine what could have been the source of the illness versus what did *not* cause illness?

QUESTION 2 (10 marks)

One of the individuals whose stool sample tested positive for E. coli O157:H7 is a food handler in a restaurant.

What additional measures should be taken to protect the public? In brief, state some microbiological methods you would employ to reconfirm that cause of illness is indeed due to *E. coli 0157:H7*?

QUESTION 3 (10 marks x 2 = 20 marks)

After this outbreak, various groups with stake in this issue met to discuss appropriate actions for consumer protection with this type of product. Two alternatives were discussed as shown below.

Which of these do you favor? State the reason(s) for your opinion.

(i) Label product with a warning that it might contain microorganisms that can cause illness.
(ii) Require treatment to kill pathogenic bacteria prior to distribution to the consumer.

CASE 2

Doctors in India aren't surprised that the Super Bug probably originated there. Drug control there is poor and common antibiotics have become ineffective in India. Some reasons may be because people can buy powerful antibiotics over the counter, leading to overuse. They also take small doses and discontinue treatment in order to save money. There are no current antibiotics, nor any in development, that can kill New Delhi Super Bug on their own.

QUESTION 1 (20 marks)
What do you think could allow some of the bacteria to live even in the presence of antibiotics? (Hint: Are all the bacteria in a population the same? How might they differ?)

QUESTION 2 (20 marks)
What are the biological, social, or cultural factors that may have influenced the increased resistance of this strain of bacteria to antibiotics?

QUESTION 3 (10 marks)
What measures could you think of to prevent overuse of antibiotics?