

1. Write your Registration Number clearly and correctly on the Answer Booklet.
2. The first 15 minutes is 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 & 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 of your choice.

4. All answers should be written on the Answer Booklet provided to you. Candidates are not allowed to write anything on the question paper. If required, ask for additional Answer Booklet.
5. 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 the Section, Part and Question Number will NOT be evaluated and no marks will be awarded.
6. Begin each Section and Part in a fresh page of the Answer Booklet.
7. You are not permitted to tear off any sheet(s) of the Answer Booklet as well as the Question Paper.
8. Use of any other paper including paper for rough work is not permitted.
9. You must to hand over the Answer Booklet to the Invigilator before leaving the examination hall.
10. This paper has **11 printed pages**, including this instruction page.

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SECTION A

PART I: Multiple Choice Questions [30 marks]

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

1. The gold standard laboratory test for diagnosis of leptospirosis is
 - a) Microscopic agglutination test
 - b) Enzyme-linked immunosorbent assays
 - c) Polymerase chain reaction
 - d) All the above
2. All the following are correct statement regarding electron microscope **EXCEPT**:
 - a) Electrons beam is a source of illumination
 - b) Offers the highest resolution and magnification
 - c) First invented by Zacharias Janssen
 - d) employ electromagnetic lenses
3. Choose the correct group of pathogens not linked with zoonosis:
 - a) Mycobacterium tuberculosis & Salmonella
 - b) Measles virus and Corynebacterium Diphtheria
 - c) Anthrax & vibrio cholera
 - d) Brucella & Staphylococcus
4. Identify the incorrect statement regarding Viruses:
 - a) Virus has only either RNA or DNA.
 - b) They are the smallest living organism
 - c) They are obligate intracellular parasites
 - d) They are without metabolic mechanism
5. The most vulnerable to the heat and chemical sterilization is:
 - a) Tubercle bacilli
 - b) Viruses
 - c) Spores
 - d) Prions
6. Most accurate method of diagnosis of dengue during the first week of infection is:
 - a) RT-PCR
 - b) IgG only
 - c) IgM only
 - d) IgG & IgM
7. The body's response to measles is example of:
 - a) Artificial active immunity
 - b) Artificial passive immunity
 - c) Natural passive immunity
 - d) Adaptive immunity

8. Normal fasting blood sugar level in human adult is:
 - a) 100-125 mg/dl
 - b) 80-100 mg/dl
 - c) 100-150 mg/dl
 - d) 150-200 mg/dl
9. The Primary Component of Gram Stain:
 - a) Eosin
 - b) Iodine
 - c) Alcohol
 - d) crystal violet
10. Which of the following is not a Romanowsky stain:
 - a) Leishman's stain
 - b) Giemsa stain
 - c) Jenner's stain
 - d) Gram Stain
11. Which of the following types of microscopy is valuable in the identification of cells and tissue layers?
 - a) Compound bright field
 - b) Dark field
 - c) Polarizing
 - d) Phase-contrast
12. Choose the incorrect functions of fixatives for tissues and cells:
 - a) Arrests cell autolysis
 - b) Protect cells and tissues from osmotic damage
 - c) Hardening of the tissue
 - d) Enhance tissue impermeability
13. What is the optimum concentration of the formalin used as fixatives:
 - a) 5%
 - b) 10%
 - c) 15%
 - d) 20%
14. Which of the following is the best site for venipuncture:
 - a) basilica vein
 - b) cephalic vein
 - c) medial cubital vein
 - d) femoral vein
15. A blood specimen collected in plain tube is centrifuged. It will separate into:
 - a) Serum and clot
 - b) Plasma and clot
 - c) Serum and plasma
 - d) Plasma, buffy coat, RBC

16. All the following causes hemolysis during blood collection EXCEPT:
- a) Using a 25-gauge needle on an adult
 - b) Vigorously shaking the blood specimen
 - c) Wrong concentration of anticoagulant
 - d) Using preservatives
17. Platelet rich plasma is prepared in how much hour after collection?
- a) 24 hrs
 - b) 8 hrs
 - c) 6 hrs
 - d) Any time but should be refrigerate
18. To make a 1:5 dilution of serum sample, dilute:
- a) 1.0 mL of serum + 5.0 mL of diluent
 - b) 1.0 mL of serum + 4.0 mL of diluent
 - c) 1.0 mL of serum + 6.0 mL of diluent
 - d) 5.0 mL of serum + 1.0 mL of diluent
19. What is the normality of a solution of sodium hydroxide (molecular weight=40) containing 20 grams in 100 mL of solution?
- a) 5.0N
 - b) 1.0N
 - c) 0.5N
 - d) 0.4N
20. Spreading of disease Worldwide is called as?
- a) Epidemic
 - b) Endemic
 - c) Pandemic
 - d) Infection
21. Sodium is responsible for the maintenance of:
- a) Blood coagulation
 - b) Osmotic pressure of body fluids
 - c) Cardiac muscle contractions
 - d) Salt intake
22. Method of sterilization used for glass wares and test tubes is:
- a) Autoclave
 - b) Hot air oven
 - c) Pasteurization
 - d) None of the above

23. Which type of urine sample is preferred for bacterial examination?
- First-morning urine sample
 - Midstream clean-catch urine sample
 - Random urine sample
 - Last-night urine sample
24. All the following causes systemic errors in the laboratory quality control system EXCEPT:
- Calibration errors
 - Change in the reagent lot
 - Inappropriate pipetting
 - Expiring of reagents
25. Choose the incorrect characteristic of lyophilized serum used as quality control material:
- It is in solidified and powder form.
 - It needs to be reconstituted.
 - It is stable for longer period at 2-8°C
 - Easy to prepare like frozen serum
26. All the following causes random errors in laboratory analysis EXCEPT:
- Electrical fluctuation
 - Change in laboratory personal
 - Pipetting errors
 - Clog formation in the tubing of the analyzers.
27. Kinetic method of measurement involves:
- Recording of absorbance at the certain interval of time during the chemical reactions.
 - Recording of absorbance at the fixed time when the reaction is about to be completed.
 - Recording of absorbance at the fixed time when the reaction is completed.
 - Recording of absorbance at the beginning of the reaction.
28. Which type of blood cell is reduced by Dengue virus?
- Neutrophils
 - Platelets
 - Monocytes
 - Eosinophils
29. Which of the following enzymes is responsible for the breakdown of starch into glucose?
- Lipase
 - Amylase
 - Protease
 - Lactase
30. Which of the following parameters can be used to calculate standard deviation in the Laboratory IQC?
- Variance and mean
 - Median and variance
 - Standard deviation and the mean
 - Square root of Variance

PART II – Short Answer Questions [20 marks]

This part has 4 Short Answer Questions. Answer ALL the questions. Each question carries 5 marks.

1. Explain the types of specimens, time for specimen collection and laboratory tests performed for diagnosis of Leptospirosis.
2. Define and describe the principle of Ziehl–Neelsen (ZN) staining technique and provide the interpretation and grading of the AFB bacilli seen on the smear using the WHO grading scale.
3. Explain the principle of Leshman staining technique and describe the steps of staining. For each part of the following cell or cell organelle, provide the colour interpretation:
 - a) Red cells
 - b) Nuclei of leucocytes
 - c) Cytoplasm of neutrophil
 - d) Eosinophil
 - e) Basophils
 - f) Monocyte cytoplasm
 - g) Small lymphocytes
 - h) Large lymphocytes
4. Explain all the Human Blood Group Systems.

SECTION B: Case Study [50 marks]

Choose either CASE I or CASE II from this section. Each case study carries 50 marks.

CASE I

In one of the laboratories in Bhutan, Laboratory staff repeatedly receive samples from the Emergency Department (ED) of the hospital that are inappropriately labeled, tubes and sample tray stained with blood, hemolyzed blood, drawn in the wrong tube for the test requested or with insufficient quantity of blood specimen. When laboratory staff call to talk to the nurse who drew the blood to ask for a resample, they occasionally experienced hostility. In one instance, a ward boy delivered a tray of blood samples with three tubes and a requisition form, but the tubes were not labelled. When the laboratory technicians called the ED, the incharge told them to trust that the blood tubes belonged to that patient with requisition. The laboratory incharge explained that the laboratory unit could not accept the specimen due to sampling issues. The nurse hung up the phone.

Based on the above case statement, answer the following questions:

1. In the above case, laboratory technician has reported 5 important problems in collecting blood sample by the staff of the emergency department. In the following table, list down the problems and against each problem, choose 2-3 key words of major risk of these unprofessional practices to the patients and hospital staff (Nurses & laboratory staff). Choose the appropriate risks from the list given below: **(20 Marks)**

Risks or consequences of unprofessional practices: Wrong results; wrong diagnosis; infection transmission; wrong treatment; medico-legal cases; administrative actions; patient allegation.

List of Problems	Risks to the Patients and Hospital staff	
	Patients	Hospital Staff (Lab Tech & Nurses)
1.		
2.		
3.		
4.		
5.		

2. Laboratory HOD raised the above issues to the Hospital management. The Hospital director in the meeting instructed HOD to plan a one day training for the nurses on basic good laboratory practices. HOD call a meeting of the laboratory incharges and instructed the incharges to prepare an agenda for the training of nurses on the good laboratory practices on the following topics:

- i. Blood collection procedures
- ii. Identification of vials and tubes, blood collection sites
- iii. Blood storage and transportation technique.
- iv. Communication skills for the nurses.

1. From the above topics provided by HOD to train the nurses, write down the blood collection procedure in in details. **(20 marks)**
2. Name at least five types of colored vials used for blood collection, describe the purposes and name anti-coagulations or chemicals used in each vial with their functions. **(10 marks)**

CASE II

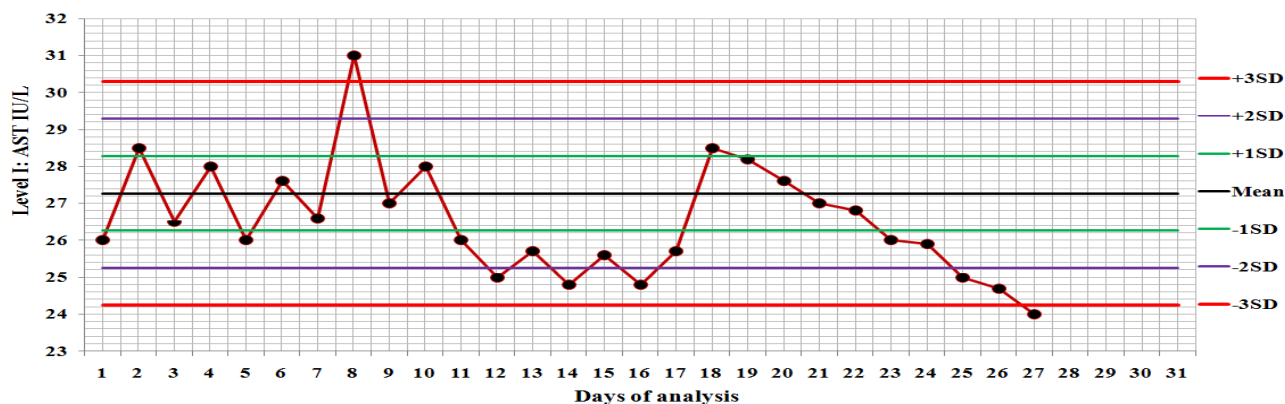
Robust Internal quality control system has been established for all the laboratories in Bhutan in clinical chemistry and hematology to monitor the precision and accuracy of the laboratory results since 2011 in Bhutan. In Biochemistry section at JDWNRH, Mr. Jigme Tenzin establishes his Internal Quality control for ALT using the control results for 11 consecutive days as shown in the table. The control results of 11 days are trimmed at $\pm 2SD$ or by using CLIA CV. Daily IQC results are plotted on LJ chart and Westgard's Multi-QC rules are used for detection of the errors.

1. Using the data given in the following table, calculate: **(20 marks)**

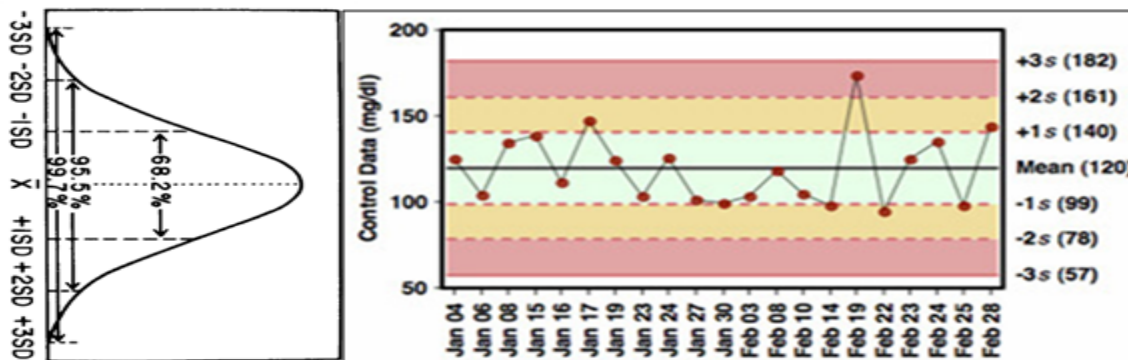
- Mean
- Standard Deviation (SD)
- Coefficient of variation (CV)
- Mean $\pm 2SD$
- Mean $\pm 3SD$

Days	Results (IU/L)	Hint: Use the following formula for calculating standard deviation 1. Variance (V) = $\sum (X_i - \bar{X})^2 / n - 1$ 2. SD = Square Root of V 3. CV = Mean/SDx100
1	26	
2	27	
3	28	
4	28	
5	29	
6	28	
7	28	
8	26	
9	26	
10	27	
11	28	

2. In the following control charts, what are the control rule violations seen in the Graph. For each rule violation, state the possible causes of control rule violations and suggest some corrective actions to be taken for each violation. **(10 marks)**

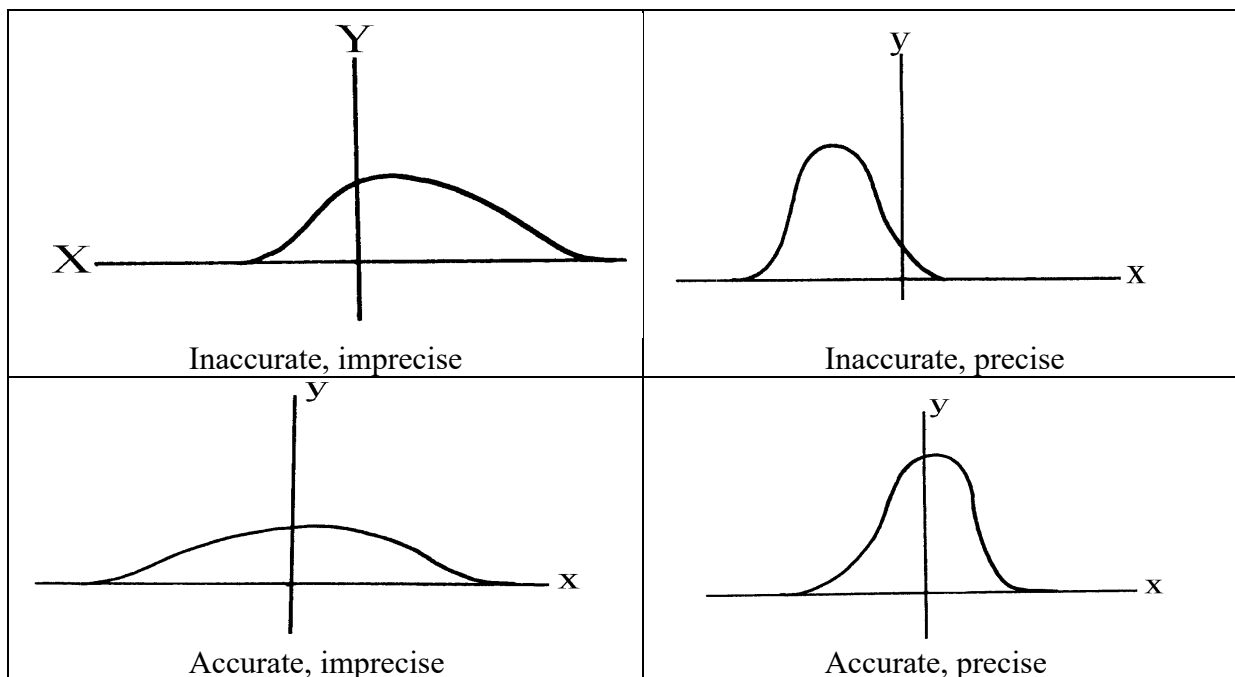


3. Use the following Diagram to state the THREE most important properties of Normal Gaussian Distribution applied in internal quality control system. (5 marks)



1. For each of the following diagrams, choose the pair of terms most appropriate and write them in the blanks provided. (5 marks)

- a) Accurate, precise
- b) Inaccurate, precise
- c) Inaccurate, imprecise
- d) Accurate, imprecise



PAPER III: SUBJECT SPECIALISATION PAPER FOR MEDICAL LABORATORY TECHNOLOGY

4. Royal Centre for Disease Control (RCDC) evaluates the performance of the district laboratories on sputum panel slides every year. RCDC sends total of 50 unstained slides to Trashigang hospital among which 45 were AFB negative and 5 positive. Trashi Gang laboratory technician reported 48 negative and 2 positive slides. Fill up the following table and calculate:

(10 mark)

- a) Sensitivity
- b) Specificity
- c) False positive rate
- d) False negative rate

		RCDC		Total
		Positive	Negative	
Trashi Gang Laboratory	Positive			
	Negative			
Total				

TASHI DELEK