ROYAL CIVIL SERVICE COMMISSION
BHUTAN CIVIL SERVICE EXAMINATION (BCSE) 2016
EXAMINATION CATEGORY: TECHNICAL

PAPER III: SUBJECT SPECIALIZATION PAPER FOR MEDICAL LAB TECHNOLOGY

Date:	2 October 2016
Total Marks:	100
Examination Time:	150 minutes (2.5 hours)
Reading Time:	15 minutes *(prior to examination time)*

GENERAL INSTRUCTIONS

1. Write your Registration Number clearly and correctly on the Answer Booklet.
2. The first 15 minutes is being provided to check the number of pages, printing error, clarify doubts and to read instructions in Question Paper. 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 2 case studies. Choose only **ONE** case study and answer the questions under 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 correct Section, Part and Question Number will NOT be evaluated and no marks would 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 are required to hand over the Answer Booklet to the Invigilator before leaving the examination hall.
10. The Question paper has 13 printed pages 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 your chosen answer 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. For the follow up of diabetic treatment, HbA1c is commonly prescribed by the physician because

    a. fasting and postprandial sugar has no diagnostic roles after the diabetic treatment is started.
    b. HbA1c test becomes more sensitive than fasting and post prandial sugar test after the treatment is started.
    c. High HbA1c level reflects an average concentration of glucose present in the blood circulation over the last three months.
    d. HbA1c is only the test recommended by WHO for follow up of treatment for diabetic patients.

2. Kinetic method of measurement in chemistry involves

    a. recording of absorbance at the certain interval of time during the reactions.
    b. recording of absorbance at the fixed time when the reaction is about to be completed.
    c. recording of absorbance at the fixed time when the reaction is completed.
    d. recording of absorbance at the beginning of the reaction.

3. All the major hospitals and Referral Hospitals in Bhutan have been provided with automated analyzers in clinical chemistry and hematology following a rigorous study on the cost effectiveness, performance characteristics and other advantages. All the following are the advantages of automation EXCEPT:

    a. High throughput to generate results in short time.
    b. Saves time and labor that improves results TAT and delivery of the reports.
    c. Generate results of high accuracy and precision.
    d. Cost effective to be used by entire laboratories in the country.

4. Molarity of the solution is defined as

    a. the number of moles of a substance per liter of solution.
    b. the number of moles of solute per kilogram of solvent.
    c. number of grams of substance per liter of solution.
    d. number of grams of solute per kilogram of solvent.

5. Internal Quality Control (IQC) is an integral part of laboratory procedure to ensure reliable results. To establish this IQC system, Coefficient of Variation (CV) is an important parameter that reflects the precision of the measurement system. Choose any pair of the following parameters which can be used to calculate CV:

   a. Variance and mean
   b. Median and variance
   c. Standard deviation and the mean
   d. Variance and reportable range

6. One of the lipoproteins is called a "Good Cholesterol" because it transports fatty acids from peripheral tissues to the liver for metabolism. Choose the "Good Cholesterol" from the following:

   a. Chylomicron
   b. Very Low Density Lipoprotein Cholesterol (VLDL)
   c. Low density Lipoprotein Cholesterol (LDL)
   d. High Density Lipoprotein (HDL)

7. In the quality control system, closeness of agreement between independent results of measurement obtained under stipulated conditions is termed as

   a. Target value
   b. Precision
   c. Bias
   d. Accuracy

8. Calibration is defined as the process of

   a. analyzing quality control material to validate daily results by checking precision and accuracy.
   b. measurement of carry-over of the equipments to determine the amount of cross contamination.
   c. setting or correcting of a measuring device by adjusting it to conform to a known and unvarying measure value.
   d. setting the wavelength and measurement units of the analyzers.

9. Widely accepted normal value of hemoglobin for female age greater than 18 years is

   a. 14-16g/dl
   b. 12 to 15g/dl
   c. 14-15 g/dl
   d. 13-16 g/dl

10. Variation in the SIZE and SHAPE of RBCs are termed as

    a. Anisocytosis and Poikiolocytosis respectively
    b. Poikiolocytosis and Acanthocytosis respectively
    c. Poikiolocytosis and Anisocytosis respectively
    d. Anisocytosis and Acanthocytosis respectively

11. 3.8% Sodium citrate solution is utilized as anticoagulant in blood sample for ESR tests but not for Complete Blood Count (CBC) analysis because

    a. 3.8% Sodium citrate is ineffective anticoagulant for blood samples meant for CBC analysis.
    b. 3.8% Sodium citrate solution affects the volume of the blood decreasing the WBCs and RBC counts which needs to be multiplied by the factor of 1.1.
    c. 3.8% Sodium citrate cause shrinking of all the cells in the blood, thus giving errors in the counts by the analyzers.
    d. use of 3.8% Sodium citrate has been recommended internationally only for ESR but not for CBC.

12. For capillary blood collection using a finger prick method, selection of finger is important to ensure adequate sample and avoid discomfort to the patients. For this reason, middle and ring fingers are commonly chosen for the purpose. Choose the INCORRECT statement of reasons for choosing the suitable finger for capillary blood collection.

    a. middle or ring fingers are most desirable site because these two figures are completely free of nerve endings but has more capillary network.
    b. index finger is not recommended because it is more sensitive due to presence of increased number of nerve endings.
    c. the fifth finger or little finger is not used as the tissue on this finger is considerably thinner than that on other fingers.
    d. thumb or the first finger is not used because of presence of calluses which is hard to reach the capillary by the lancet.

13. Leukocytes in fresh blood smear take different stains. Some are basophilic; others are acidophilic while some cells accept neutral stain. Therefore, the stain used is combination of these three characteristics. The common name for such stains used in hematology is called as

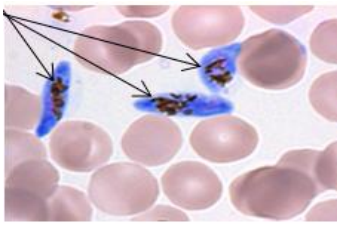
    a. Leishman stain
    b. Giemsa’s stain
    c. Romanowsky stain
    d. Wright’s stain

14. Choose the INCORRECT description of the following cells seen under the high power field in blood smear stained with Leishman stain.

    a. Neutrophils: Purple coloured nuclei with pink cytoplasm
    b. Eosinophil: Faint pink cytoplasm with purple nucleus and orange granules.
    c. Lymphocyte: Dark blue cytoplasm with light blue nucleus.
    d. Monocytes: Pinkish cytoplasm with purple colour nucleus.

15. In the following blood smear under the oil emersion field , the object indicated by the three arrows are

    a. Poikilocytes
    b. Leismania Donavani (LD) bodies
    c. Gametocytes of malaria parasites
    d. Elongated WBCs



16. Which type of biological safety cabinet must be used while handling risk Group-3 organisms?

    a. Class I biological safety cabinet
    b. Class III biological safety cabinet
    c. Class II biological safety cabinet
    d. Clean bench (Laminar flow)

17. All the following organisms are gram negative EXCEPT:

    a. E.coli
    b. Shigella
    c. Pneumococci
    d. Klebsiella

18. Mycobacterium tuberculosis differs from mycobacterium leprae in terms of morphological features, pathogenesis and mode of transmission. However, the steps of the diagnostic tests are similar with slight difference in use of decolorizing agent. Choose the most appropriate differences between this two organisms in terms of diagnosis and identification:

    a. M. tuberculosis appears red in colour whereas M. leprae appear slightly pinkish due to retention of carbol fuchsin.
    b. M. tuberculosis is transmitted through aerosols whereas M. leprae is through skin contact.
    c. M. tuberculosis is more acid fast which resists 20% H_2SO_4 whereas M. leprae is weakly acid fast that resists only 5% H_2SO_4.
    d. The optimum growth temperature for mycobacterium tuberculosis is 30^oC - 32^oC whereas for M. leprae is 27^oC - 30^oC.

19. Which of the following parasites can be transmitted when humans contact with infected dogs feces?

    a. Taenia saginata
    b. Taenia solium
    c. Ascaris lumbricoides
    d. Echinococcus granulosus

20. KOH wet mount is only the technique available at our District Hospitals and BHU-Is for examination of fugal hyphae and spores. The purpose for using a KOH is to

    a. dissolve the keratin to unmask the fungus elements.
    b. stain the hyphae and conidia of the fungi.
    c. reveal capsules that may be found around yeast cells.
    d. kill any bacteria that may be present in the specimen.

21. Which of the following statement is considered a major incompatibility?

    a. Transfuse PRBCs group B to group AB patients
    b. Transfuse PRBCs group A to group B patients
    c. Transfuse PRBCs group A to group AB patients
    d. Transfuse PRBCs group O to group B patients.

22. Blood group 'O' contains

    a. A antibodies
    b. B antibodies
    c. Both A and B antibodies
    d. A and B antigens

23. To prepare 500ml of 10% H_2SO_4 from 40% H_2SO_4, you need to add

    a. 25ml of 40% H_2SO_4 and 475ml distilled water
    b. 125 ml of 40% H_2SO_4 and 375ml distilled water
    c. 4ml of 40% H_2SO_4 and 496 ml distilled water
    d. none of the above

24. If you add 0.1ml of serum and 1.9ml of diluents, the factor will be

    a. 1:10
    b. 1:20
    c. 1:30
    d. 1:40

25. All the following descriptions are correct for Exofolitive Cytology EXCEPT

    a. It is the branch of Cytopathology which involves the study of surface cells from the epithelium and the mesothelial linings.
    b. Desquamated cells are scrapped from the surface of an abnormal area for cytological examination.
    c. Developed by Georgian Papaniculous who introduced Pap method of cytological screening for malignancies and follow up of cancer treatment.
    d. Pap Method is used for staining Histopathological smear to study the pathological features of biopsies.

26. Hormonal cytology involves evaluation of hormonal effects on proliferation, maturation and desquamation of vaginal cells expressed in indices. Choose the correct description of the karyopyknotic Index (KPI):

    a. It is the ratio of superficial cells to intermediate cells to the parabasal cells.
    b. It is the ratio of mature eosinophil superficial cells to mature cynophilic squamous cells regardless of nuclear appearance.
    c. It is the ratio of mature superficial cells to the mature intermediate cells.
    d. It is the ratio of mature squamous cells in clusters of 4 or more cells to the cells lying singly or clusters of less than 4 cells.

27. An abnormal female with only one X chromosome is termed as

    a. Klinefelter's syndrome
    b. Turner's Syndrome
    c. Down Syndrome
    d. Edward Syndrome

28. Tissue processing in histopathology involves at least six important steps prior to the staining process. Choose the correct tissue processing steps in order from the following:

    a. Dehydration- Infiltration-Clearing-Embedding-Sectioning-Mounting.
    b. Clearing- Dehydration-Infiltration-Embedding-Sectioning-Mounting.
    c. Dehydration-Clearing-Infiltration-Embedding-Sectioning-Mounting.
    d. Dehydration- Embedding-Clearing-Infiltration-Sectioning-Mounting.

29. All the following are the purposes of fixation of the biopsies EXCEPT

    a. To preserve the cells and maintain close to life-like state.
    b. To prevent autolysis and stabilize the cellular and tissue constituents.
    c. To improve the clarity of nucleus and cytoplasm for microscopic examination.
    d. To ovoid bacterial decomposition.

30. Various factors influence the rate of tissue processing. Choose the factors which doesn't have effect on the tissue processing steps in histopathology.

    a. Amount of fixatives.
    b. Environmental temperature.

c. Viscosity and thickness of tissues.
d. Types of diseases.

PART II – Short Answer Questions (20 marks).

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

1. Draw a clear and labeled flow diagram of the blood coagulation pathway and explain its role in hemostasis and name all the factors involved in blood coagulation process.

2. Routine Biochemistry tests performed at Jigme Dorji Wangchuk National Referral Hospital (JDWNRH) are given below. Choose the tests and group them under the panel listed a) – k). There should be at least 3 tests in each panel and no marks will be awarded for writing extra tests. Any panels without 3 tests or wrongly categorized will cancel that test panel.

   Routine biochemistry tests performed at JDWNRH: Random Glucose, Post Prandial Glucose, fasting glucose, creatinine, AST, ALP, Total bilirubin, direct bilirubin, total proteins, globulin, Triglyceride, cholesterol, creatinine kinase, ALT, CK-MB, Urea, LDH, Amylase, Lipase, LDH, LDL, HDL, Gamma GT, HbA1c, sodium, potassium, chloride, calcium, iron, magnesium, T3, T4, TSH, Chorioembryonic antigen, Acid Phosphatase, albumin, Alpha-fetoprotein, Troponin, CA-125, Estradiol, progesterone, testosterone, luteinizing hormones, follicle stimulating hormones. Triodothyronin, Tetraiodothyronin, and thyroid stimulating hormone.

   Panel for classification of biochemistry tests

a) Diabetic profile tests	e) Trace elements	i) Thyroid Function Tests
b) Liver function tests	f) Lipid profile tests	j) Tumor markers
c) Renal function tests	g) Cardiac profile tests	k) Sex hormones
d) Electrolytes	h) Proteins	

3. Describe Ziehl–Neelsen (ZN) staining technique with emphasis on quality of samples, test principle, procedures and interpretation of the results.

4. Describe principle, procedure and interpretation of Coomb's test

SECTION B
Case Study

Choose either Case 1 or 2 from this section. Each case study carries 50 marks.

Case 1

A 52-year-old woman with type 2 diabetes first diagnosed at Jigme Dorji Wangchuk National Referral Hospital (JDWNRH) visits one of the district hospitals. Her medical problems in the past were obesity and hypothyroidism and she had history of heavy alcohol use but promised to quit after diagnosing type 2 diabetes. She presents now with the following fresh symptoms with which she suffered since 10 days ago:

-Frequent urge for urination
-Burning sensation during urination
-Lower abdominal pain
-Frequent headache and fever
-Weakness and loss of appetite

She has visited one of the BHU-Is for two times within a week at his village and she was given 1 course each of amoxicillin & ciprofloxacin in the first and second visit respectively along with her medicines for hypertension. Patient reveals that she is under strict diet control and lost about 10 Kgs in six months. However, she admits that, she drinks alcohol once every week with her friends.

Doctor's physical examination reveals anemia with blood pressure of 136/95 mmHg, and a regular pulse of 80 beats/min. There was no retinopathy, thyromegaly, hepatomegaly or speenomegaly. There was no clinical evidence of congestive heart failure or peripheral vascular disease.

Since district laboratory has limited tests available, following laboratory investigations were ordered and results were obtained as follows:

Biochemistry investigation	**Urine analysis**	Hematology
a) RBS – 190mg/dl	a) Urine sugar – 2+	WBC - $10x10^3$ /L
b) Urea – 14mg/dl	b) Albumin - 2+	RBC - $6x10^6$/L
c) Creatinine – 1.2 mg/dl	c) WBCs - Numerous	Hb - 6.5 mg/dl
d) AST-50 IU/L	d) RBCs – 5/hpf	Neutrophils - 85%
e) ALT-60 IU/L	e) Nitrate Test – Positive	Lymphocyte - 12%
f) Total Bilirubin – 2.1 mg/dl	f) Cast – 3-5/hpf	Eosinophil - 3%
g) Gamma GT – 170 IU/dl	g) Crystals – 5/hpf	

Note: Blood Routine examination in hematology has been done using manual method.

Answer the following questions (5 marks each)

1. List down all the significant abnormal tests results seen in biochemistry, Urine microscopy and hematology.

2. State the reason and clinical significance of abnormal results given above.
3. Write the normal reference range for all the tests parameters reported for this patient.
4. Patient admits an occasional drink with her friends. Is there any indication of an adverse effect on her health by her occasional drinks? What is being indicated by Gamma GT results for this patient?
5. What could be the reasons for slight increase in glucose for this patient despite her strict diet control plan? What is the correlation to make you confident that the above glucose result is correct for this patient?
6. Does the patient need blood transfusion? If so, what is the next step for further investigation which is not done in this hospital?
7. Do you think this patients needs to be referred to higher referral hospitals for further laboratory investigation? If yes, write down all the tests which need to be done at Referral Hospital?
8. Why did patient have to visit two times with same symptoms within a week? Explain Briefly.
9. According to your interpretation on the laboratory results and current clinical symptoms, what is your final diagnosis for this patient? Briefly explain the relation between her type 2 diabetes and current sickness.
10. If you were suffering with the same condition, are you satisfied with investigation and treatment from this hospital? Explain briefly what you would do next.

OR

Case 2

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. In Biochemistry section at JDWNRH, the Section Incharge 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 ±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.

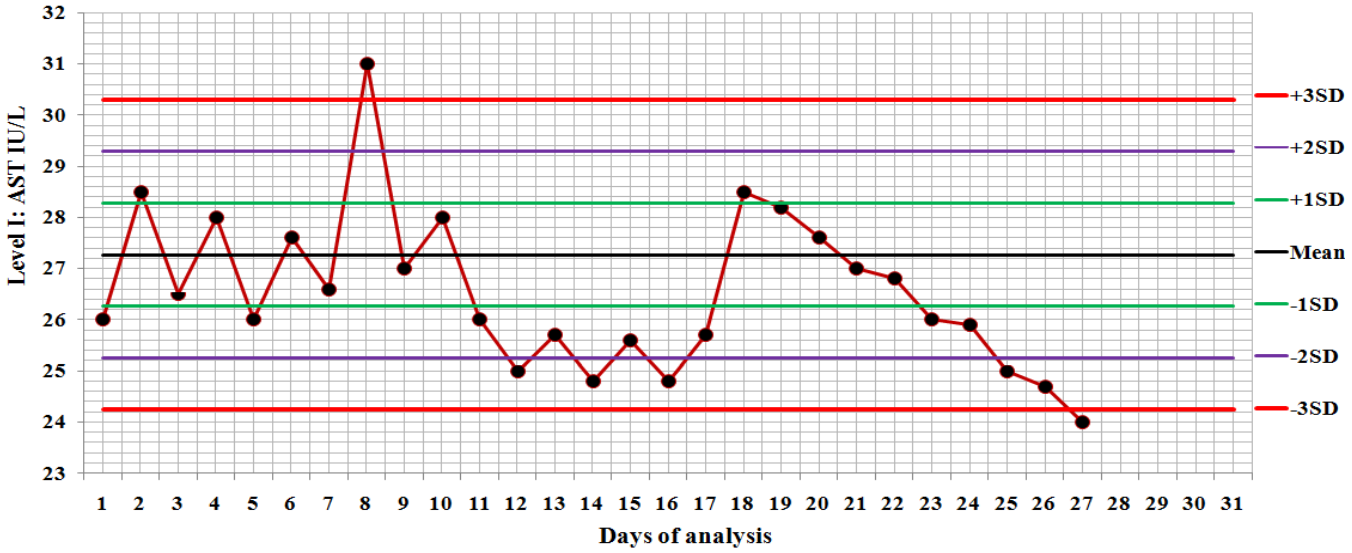
1. Using the data given in the following table, calculate: (20 marks)
   i. Mean
   ii. Standard Deviation (SD)
   iii. Coefficient of variation (CV)
   iv. Mean±2SD
   v. Mean±3SD

Days	X_i	$X_i - \overline{X}$	$(X_i - \overline{X})^2$
1	26 IU/L		
2	27 IU/L		
3	28 IU/L		
4	28 IU/L		
5	29 IU/L		
6	28 IU/L		
7	28 IU/L		
8	26 IU/L		
9	26 IU/L		
10	27 IU/L		
11	28 IU/L		
		$\sum(\overline{X_i} - X)^2$	

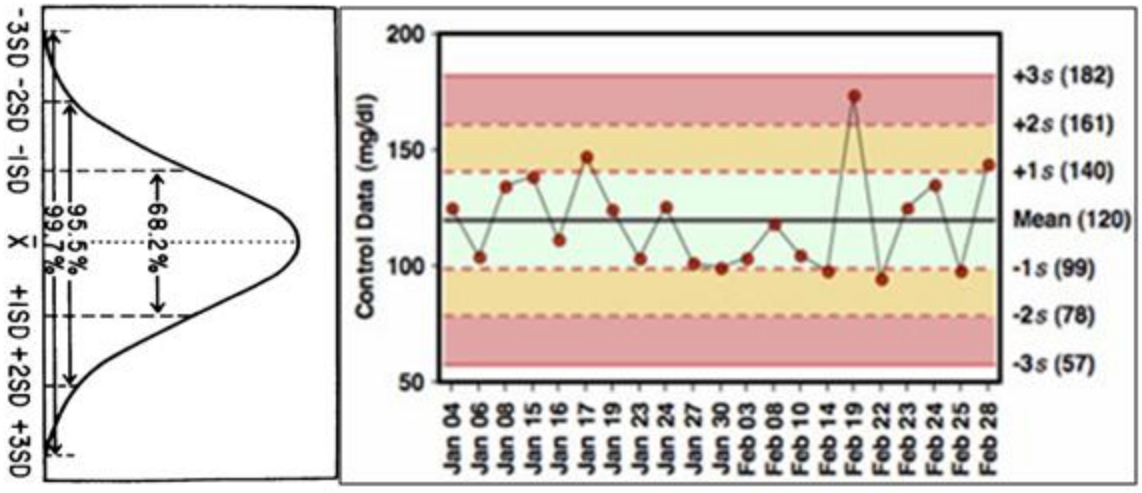
Hint: Use the following formula for calculating standard deviation

a) Variance (V) = $\sum(X_i - \overline{X})^2$ /n-1
b) Standard Deviation (SD) = Square Root of V
c) CV = Mean/SDx100

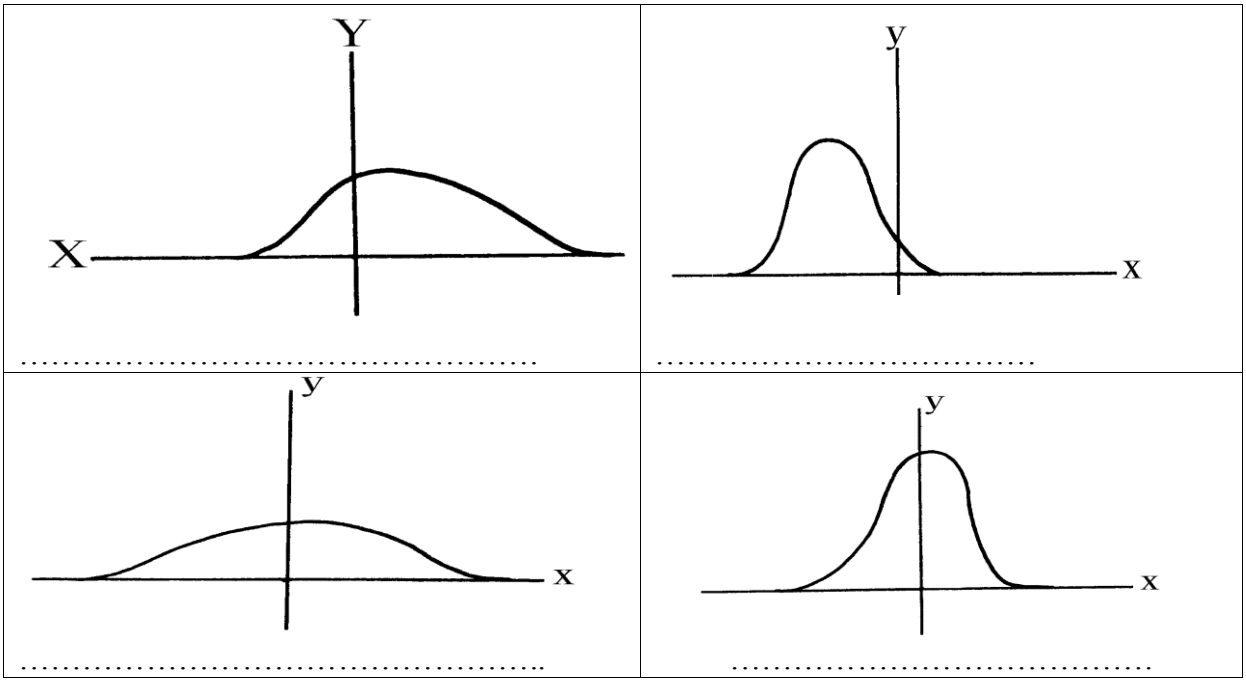
2. In the following control charts, what are the control rule violations seen in the Graph. For each rule violation, state the possible causes and suggest some corrective actions to be taken for each violation. (10 marks)



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



4. 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



5. Royal Centre for Disease Control (RCDC) evaluates the performance of the district laboratories on sputum panel slides every year. RCDC sends total of 50 slides to Bumthang hospital among which 30 were positive and 20 negative. Bumthang laboratory technician reports 35 positive slides and 15 negative slides. Fill up the following table and calculate: (10 marks)
   a) Sensitivity
   b) Specificity
   c) False positive rate
   d) False negative rate

		PHL		Total
		Positive	Negative	
Bumthang	Positive	……	……	…….
	Negative	……	……	…….
Total		……	…….	……

TASHI DELEK