ROYAL CIVIL SERVICE COMMISSION
BHUTAN CIVIL SERVICE EXAMINATION (BCSE) 2023
EXAMINATION CATEGORY: <u>TECHNICAL</u>

PAPER III: SUBJECT SPECIALISATION PAPER FOR <u>MEDICAL LABORATORY TECHNOLOGY</u>

Date	: October 7, 2023
Total Marks	: 100
Writing Time	: 150 minutes (2.5 hours)
Reading Time	: 15 Minutes (prior to writing time)

GENERAL INSTRUCTIONS:

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 **9 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 (d). Each question carries ONE mark. Any double writing, smudgy answers or writing more than one choice shall not be evaluated.

1. In the clinical laboratory internal quality control system, the deviation of the laboratory results from IQC reference value is termed as
   a) Accuracy
   b) Precision
   c) Bias
   d) Target range

2. The most correct cause of systemic errors from the following is
   a) change in reagent and control lot.
   b) inappropriate pipetting.
   c) change in laboratory personnel.
   d) expiring of reagents.

3. Which of the following is the most appropriate characteristic of lyophilized serum used as quality control material?
   a) It is in liquid form which is ready made to be used.
   b) It can be stored at room temperature.
   c) It is stable for longer period at 2-8°C
   d) Doesn't affect by the light

4. Setting the equipment to generate laboratory results in reportable range is termed as
   a) Validation
   b) Analysis
   c) Measurement
   d) Calibration

5. Kinetic method of measurement involves
   a) recording of absorbance at the certain interval of time during the chemical 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.

6. The **CORRECT** statement of the Lambert-Beer's Law is
   a) Absorbance is indirectly proportional to the concentration of the solution in the cuvette.
   b) Absorbance is indirectly proportional to the intensity of the monochromatic light striking the cuvette with solution.
   c) Absorbance is directly proportional to the thickness of the cuvette.
   d) Absorbance is indirectly proportional to the temperature of the solution.

7. The maximum magnification of electron microscope is
   a) 100x
   b) 1500x
   c) 400x
   d) 10^7x

8. Breath analyzer is used to detect
   a) H. pylori
   b) E. coli
   c) Entamoeba species
   d) Shigella

9. All the following tests indicate liver condition **EXCEPT**
   a) ALT
   b) Bilirubin
   c) ALP
   d) HbA1c

10. Choose any of the following parameters which can be used to calculate SD in the Laboratory IQC.
    a) Variance and mean
    b) Median and variance
    c) Standard deviation and the mean
    d) Square root of Variance

11. The sexual life cycle of the malaria parasites occurs in
    a) female anopheles mosquito.
    b) human host.
    c) in the environment.
    d) In all of the above

12. Scientific name for whip worm is
    a) Wuchereria bancrofti
    b) Ascaris lubricoides
    c) Ancylostoma duodenalae
    d) Trichuris trichuria

13. Beef tapeworm infection is caused by
    a) Ascaris lubricoides
    b) Ancylostoma duodenalae
    c) Taenia sagginita
    d) Tania solium

14. The name of the parasite that causes kal-zar is known as
    a) Plasmodium vivax
    b) Trichomonas vaginalis
    c) Leptospira
    d) Leismania donavani

15. Which of the following vector transmits Dengue?
    a) Anopheles gambiae
    b) Ochlerotatus triseriatus
    c) Aedes aegypti
    d) Cules spp

16. Which of the following statements 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

17. All the following are correct for bilirubin **EXCEPT**
    a)   It is a yellow pigment produced by liver
    b)   It is increased in patients with liver diseases
    c)   It is measured using Jendrassic Groff Method
    d)   It is released by the breakdown of WBCs.

18. 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.

19. The purpose of EDTA in the blood collection is
    a)   to prevent clotting of blood in the vial.
    b)   to prevent bacterial action.
    c)   to prevent chemical reaction.
    d)   Plasmodium vivax.

20. What percent of formalin is used for preservation of tissue samples?
    a)   5%
    b)   10%
    c)   15%
    d)   20%

21. Mounting fluid for skin scraping for fungal identification is
    a)   Lactophenol cotton blue
    b)   10% KOH solution
    c)   0.85% saline
    d)   None of the above

22. Which of the following is an acid-fast bacterium?
    a)   Pseudomonas seruginosa
    b)   Escherichia coli
    c)   Mycobacterium tuberculosis
    d)   Cornybacterium diphtheria

23. How long can you keep the serum sample at room temperature prior to testing for Biochemical markers?
    a)   Less than 1 hour
    b)   More than 1 hour
    c)   12 hours
    d)   Overnight

24. Which of the following virus causes flu in Human being?
    a) H5N1
    b) H1N1
    c) Influenza virus type B
    d) All of the above

25. The normal reference range of Hemoglobin in adult women is
    a) 10-11 g%
    b) 15-17 g%
    c) 9-11 g%
    d) 12-16 g%

26. In TB microscopy 100 bacilli in 100 fields is graded as
    a) 3+
    b) 2+
    c) 1+
    d) Scanty

27. You are given 10ml stock solution of 20mg/mL. What would be the concentration of the solution if it is diluted to a final volume of 500 mL?
    a) 25mg/mL
    b) 2.0 mg/mL
    c) 2.5 mg/mL
    d) 0.4 mg/mL

28. Internal quality control should be done
    a) At regular intervals.
    b) Whenever problems occur.
    c) Anytime there is a chance, e.g. new equipment, reagent.
    d) Before running the test.

29. How would you safely prepare 500 ML of 1.00 M H_2SO_4 solution from a 12.4 M H_2SO_4 stock solution?
    a) Add 40.3 mL of 12.4 M H_2SO_4 to 500. mL of water.
    b) Add 12.4 mL of 12.4 M H_2SO_4 to 500. mL of water.
    c) Add 40.3 mL of 12.4 M H_2SO_4 to 459.7 mL of water.
    d) Add 459.7 mL of water to 40.3 mL of 12.4 M H_2SO_4.

30. 1000 micro-liter (uL) is equal to:
    a) 1000 ml
    b) 10 ml
    c) 1 ml
    d) 0.1 ml

PART II – Short Answer Questions [20 marks]

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

1. Name and describe the principle, procedures and interpretation of the staining technique for AFB bacilli.

2. List down the material requirements and procedures for blood specimen collection for biochemistry and hematology tests. Explain the precautions to be taken during blood collection and specimen processing to produce reliable results.

3. Name the important parts of Automated Chemistry analyzer shown in the diagram and explain the functions of each part. Write down at least 5 advantages of automation in the clinical laboratory.
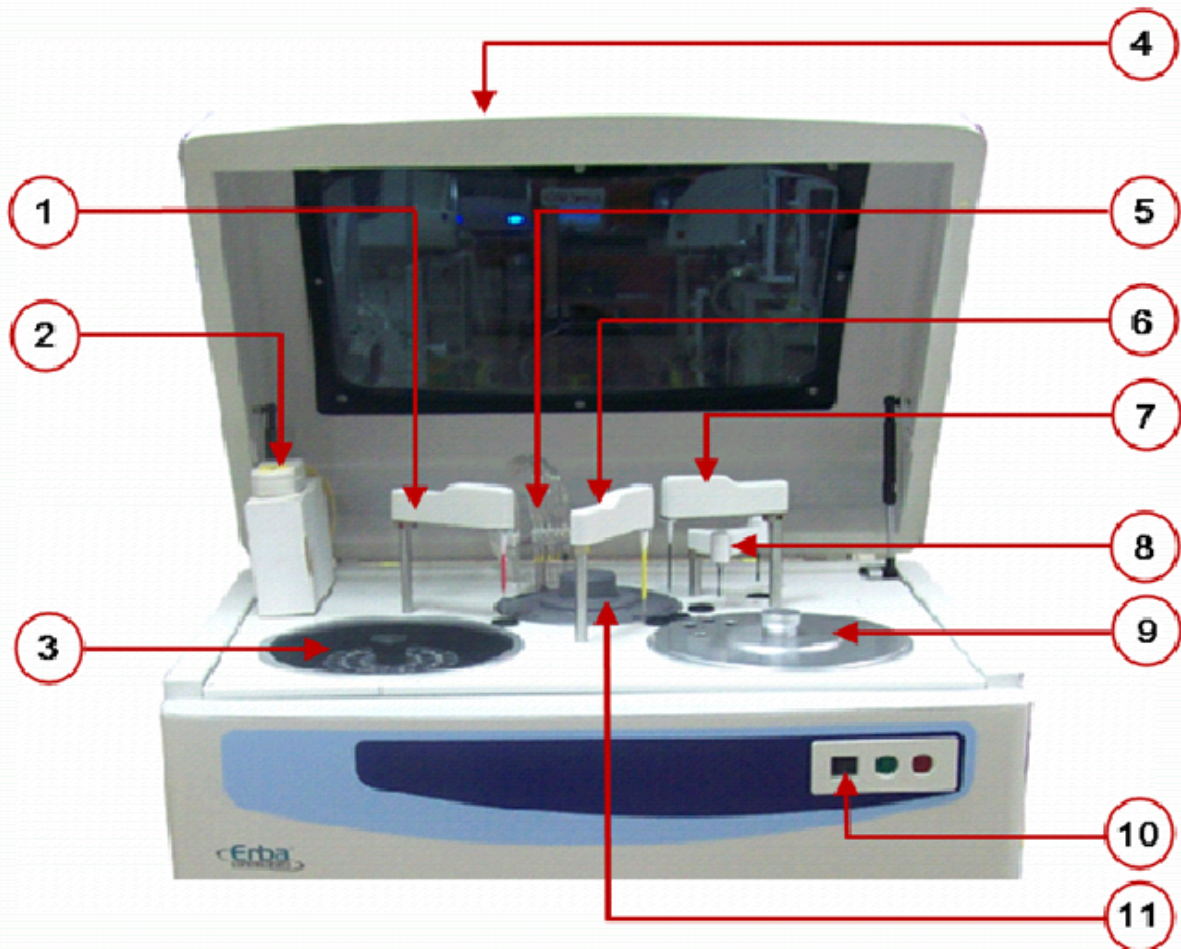
4. Match the test parameters in Column A to their correct options in Column B and rewrite the correct pairs by writing the number and corresponding alphabet in the Column C (No need to copy the table).

Column A	Column B	Column C
A. Male sex hormones	i. Water soluble proteins	A =
B. Uracil	ii. Triglyceride	B =
C. T4	iii. Ribonucleic acid	C =
D. Albumin	iv. Testosterone	D =
E. Lipid panel	v. Tetra iodothyronine	E =
F. Alpha feto protein (AFP)	vi. Deoxyribonucleic acid	F =
G. CRPA	vii. Estrogen	G =
H. PO2	viii. Tumor marker	H =
I. ALT	ix. Marker of infections	I =
J. GFR	x. Blood gas	J =
	xi. Liver enzyme	
	xii. Kidney function test	
	xiii. Diabetic profile test	
	xiv. Cardiac Marker	
	xv. Hormone	

SECTION B: Case Study [50 marks]

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

CASE I

55-year-old woman with type 1 diabetes first diagnosed at Jigme Dorji Wangchuk National Referral Hospital (JDWNRH) visits one of the district hospitals. 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

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 is no clinical evidence of congestive heart failure or peripheral vascular diseases. Following laboratory investigations were ordered and results were obtained as follows:

Biochemistry investigation	Urine analysis	Blood Routine examination
a) RBS – 250 mg/dl	a) Urine sugar – 2+	WBC - 10×10^3 /L
b) Urea – 14mg/dl	b) Albumin - 3+	RBC - 6×10^6/L
c) Creatinine – 1.2 mg/dl	c) WBCs - Numerous	Hb - 7.5 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) Crystals – 5/hpf	

From the above case study, answer the following questions: (10 marks each)

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

2. State the reason and clinical significance of abnormal results given above.

3. What is the diagnosis for her fresh symptoms beside the diabetes what is the cause of her new diseases?

4. Does the patient need blood transfusion? If so, what is the next step for further investigation?

5. What are your advices to recover from her recent infection and Diabetes?
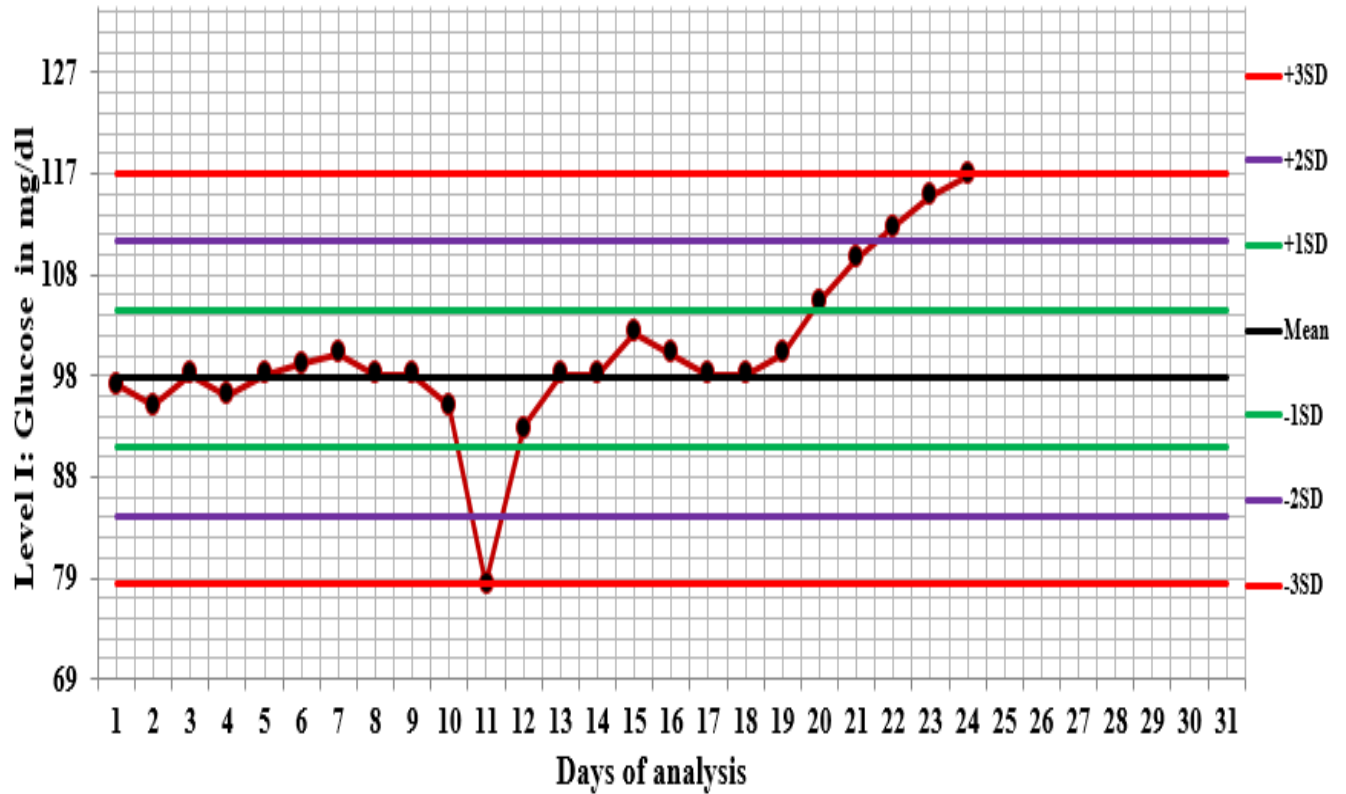
CASE II

One of the district laboratory Incharges established his Internal Quality control for glucose Level 1 using the control results for 15 consecutive days as shown in the table. Daily IQC results are plotted on LJ chart and Westgard's Multi-QC rules are used for detection of the errors.

1. Complete the following table and calculate: (20 marks)
   a) Mean
   b) Standard Deviation (SD)
   c) Coefficient of variation (CV)
   d) Mean±3SD

Days	X_i	$X_i - \overline{X}$	$(X_i - \overline{X})^2$
1	79		
2	87		
3	88		
4	87		
5	87		
6	87		
7	90		
8	87		
9	83		
10	80		
11	83		
12	86		
13	78		
14	81		
15	78		

2. Define the following terms and terminologies of Laboratory QC system. (20 marks)
   a) Standard deviation (SD)
   b) Variance (V)
   c) Coefficient of variation (CV)
   d) Reference Range
   e) Internal Quality Control (IQC)

3. 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)

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