

# EXAMINATION FOR QUALIFIED MEDICAL LABORATORY TECHNICIAN



<b>Subject:</b>	<b>BIOCHEMISTRY</b>
<b>Examination Date:</b>	<b>7 October 2023</b>
<b>Time Allowed:</b>	<b>3 hours – 9.30am – 12.40pm 10 minutes extra time for reading the Paper</b>
<b>Candidate Name:</b>	_____
<b>Candidate No.:</b>	_____

## ***General Instructions***

1. Total marks for paper = 100.
2. Marks for each question are as indicated,
3. The paper consists of:

	<i>Common</i>	<i>Discipline Specific</i>
Section A, questions 1-30 = Total Marks 15	<i>6 Marks</i>	<i>9 Marks</i>
Section B, questions 31-36 = Total Marks 10	<i>5 Marks</i>	<i>5 Marks</i>
Section C, questions 37-40 = Total Marks 10	<i>4 Marks</i>	<i>6 Marks</i>
Section D, questions 41-44 = Total Marks 05	<i>5 Marks</i>	<i>0</i>
Section E, questions 45-66 = Total Marks 40	<i>10 Marks</i>	<i>30 Marks</i>
Section F, questions 67-68 = Total Marks 20	<i>0</i>	<i>20 Marks</i>
4. All questions are to be attempted.
5. Use of calculator is permitted.
6. Put all answers into the examination booklet provided.

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WORD DEFINITIONS	
Calculate	Perform a mathematical process to get the answer
Classify	Be able to designate to a group
Compare	Detail both the differences and the similarities
Complete	Finish, have all the necessary parts
Convert	Express in alternative units
Define	State meaning clearly and concisely
Describe	Give a complete account demonstrating a thorough practical knowledge
Discuss	Give details, explaining both the positives and negatives
Distinguish	To briefly point out the main differences
Expand	To express at length or in a greater detail
Identify	Recognise according to established criteria
Indicate	Briefly point out
Interpret	Express the results of a test or series of tests in a meaningful format
Label	Give a name to
List	Headings only
Match	Find one that closely resembles another
Name	A word or group of words used to describe or evaluate
Outline	Write brief notes incorporating the essential facts
State	Give the relevant points briefly

## SECTION A

Section A – Question 1 to Question 30 = Total Marks: 15

*Multi choice questions*

**Multi choice questions – choose one answer for each question**

**(0.5 mark per correct answer)**

**Circle the letter for the correct answer**

**Example.** Which of the below is a primary colour?

- a. Green
- b. Purple
- ☒ c. Red
- d. Orange

C.1 A synovial fluid is taken from:

- a. The eye
- b. A vein
- c. A joint
- d. An artery

C.2 The cardiovascular system is also referred to as the:

- a. Circulatory system
- b. Endocrine system
- c. Respiratory system
- d. Lymphatic system

C.3 The Medical Sciences Council is responsible for:

- a. Offering a CPD programme
- b. Issuing an Annual Practicing Certificate
- c. Providing QMLT examinations
- d. Laboratory auditing

- C.4 Leukemia is primarily diagnosed in which department in the laboratory?
- a. Haematology
  - b. Histology
  - c. Microbiology
  - d. Biochemistry
- C.5 The prefix “hypo” refers to:
- a. Inflammation
  - b. Excessive
  - c. Increased
  - d. Decreased
- C.6 Standard precautions refers to:
- a. Cleaning the laboratory regularly with an appropriate disinfectant
  - b. Treating all blood and body fluids as potentially infectious
  - c. Following the rules set by the Health and Safety Officer
  - d. Compulsory use of Personal Protective Equipment
- C.7 Which best describes confidential information?
- a. Information given on the understanding that it will not be passed on to others.
  - b. Information that is stamped or marked as “Confidential”
  - c. Information that can only be passed on to a doctor or family member.
  - d. Clinical details written on a form
- C.8 A pathologist is a:
- a. Registered Medical Practitioner
  - b. An advanced Medical Laboratory Scientist
  - c. A specialised Scientific Officer
  - d. Registered Clinical Scientist
- C.9 Within the complaints process of The Code of Health & Disability Services and Consumer Rights, the complaint must be acknowledged in writing within how many working days?
- a. 7 days
  - b. 10 days
  - c. 5 days
  - d. 20 days

- C.10 A method of representing data in a visual, machine-readable form describes:
- a. A histogram
  - b. A cell scanner
  - c. A flow chart
  - d. A barcode
- C.11 "It is the duty of Members to uphold the dignity and honour of the profession, to accept its ethical principles and not engage in any activity that would discredit the profession" is part of:
- a. HPCA Act 2003
  - b. Health and Disabilities requirement of all staff
  - c. NZIMLS code of ethics
  - d. Medical Sciences Council of New Zealand practitioner requirement
- C.12 Venesection, venipuncture, phlebotomy and blood collection all come under what scope of practice?
- a. Medical Laboratory Scientist
  - b. Medical Laboratory Technician
  - c. Pre analytical Technician
  - d. Health Care Assistant
- D.13 Which of the following tests is used to investigate disorders of the endocrine system?
- a. Complete Blood Count
  - b. Glucose Tolerance Test
  - c. Thyroid Function Test
  - d. Renal Function Test
- D.14 Which of the following tests is used to investigate kidney function?
- a. Alanine Amino Transferase
  - b. Estimated Glomerular Filtration Rate
  - c. Alveolar-arterial gradient
  - d. Haemoglobin A1c
- D.15 Which of the following tests is used to evaluate liver function?
- a. High sensitivity Troponin T
  - b. Haemoglobin O2 affinity
  - c. Asparate Aminotransferase
  - d. Thyroid Stimulating Hormone

- D.16 Which of the following tests is performed to evaluate lung function and diagnose respiratory conditions?
- a. Natriuretic-proBNP
  - b. Tri-iodothyronine
  - c. Gamma glutamyl-transferase
  - d. Arterial Blood Gas test
- D.17 Which of the following laboratory tests is used to assess bone turnover and diagnose osteoporosis?
- a. Serum Calcium
  - b. Dual-energy X-ray absorptiometry (DXA)
  - c. Complete Blood Count
  - d. Bone Resorption Markers Test
- D.18 Which of the following laboratory tests is used to assess Grave's disease?
- a. Thyroid Stimulating Hormone
  - b. Liver Function Test
  - c. Serum Sodium
  - d. Parathyroid Hormone
- D.19 In spectrophotometry, which of the following statements describes the relationship between the absorbance and concentration of a substance in solution?
- a. Absorbance is inversely proportional to concentration.
  - b. Absorbance is directly proportional to concentration.
  - c. Absorbance is unrelated to concentration.
  - d. Absorbance is determined by the molecular weight of the substance.
- D.20 When using pipetting devices in the laboratory, what is the purpose of calibration?
- a. To adjust the pipetting speed for different substances.
  - b. To ensure accurate and precise volume measurements.
  - c. To determine the total capacity of the pipetting device.
  - d. To verify the compatibility of the device with specific reagents.

- D.21 Electrophoresis is a laboratory technique used for separating molecules based on which of the following?
- a. Molecular weight and charge.
  - b. Refractive index and solubility.
  - c. Melting point and boiling point.
  - d. pH and viscosity.
- D.22 Which anticoagulant is contained in green tubes?
- a. Lithium Heparin
  - b. EDTA
  - c. Citrate
  - d. No anticoagulant
- D.23 Immunofixation is a technique used for the identification and characterisation of which of the following?
- a. Enzyme activity.
  - b. DNA sequence.
  - c. Protein bands.
  - d. Cellular morphology.
- D.24 Which method of water purification involves the removal of impurities through a semipermeable membrane?
- a. Distillation
  - b. Ion exchange resins
  - c. Reverse osmosis
  - d. Filtration
- D.25 Which anticoagulant prevents blood coagulation by inhibiting thrombin formation?
- a. Citrate
  - b. EDTA
  - c. Potassium oxalate-sodium fluoride (fluoride oxalate)
  - d. Heparin

- D.26 Which metabolite plays a key role in the evaluation of diabetic ketoacidosis?
- Beta-hydroxybutyrate
  - Bicarbonate
  - Iron
  - Uric acid
- D.27 Which enzyme is measured to diagnose acute pancreatitis?
- Acetylcholinesterase
  - Aspartate aminotransferase (AST)
  - Gamma glutamyl-transferase (GGT)
  - Lipase
- D.28 Which therapeutic drug is monitored for use as an anticonvulsant to control seizures?
- Digoxin
  - Carbamazepine
  - Salicylate
  - Gentamicin
- D.29 What is the effect of delayed blood separation on blood constituents, and how can this effect be minimised?
- Increased bilirubin, best prevented by protecting samples from light.
  - Increased glycolysis, best prevented by immediate centrifugation.
  - Non-homogeneity of frozen specimens, best prevented by using anticoagulants.
  - Haemolysis of red blood cells, best prevented by using EDTA as an anticoagulant.
- D.30 In the context of biochemistry, what does harmonisation refer to?
- Achieving identical results using different laboratory methods
  - Complying on ISO-15189 accreditation requirements
  - Ensuring patient data is safe and confidential
  - Standardisation of pathology units and terminology

***(Total: 15 marks)***

**END OF SECTION**

## SECTION B

*Labelling of diagrams e.g. anatomy, hazard identification, instrument*



**Section B – Question 31 to Question 36 = Total Marks: 10**

**(Answer all questions)**

C.31 Name the following hazard symbols

**(1 mark)**

*(0.5 marks per correct answer)*

a.		b.	
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a. \_\_\_\_\_

b. \_\_\_\_\_

C.32 Name the instruments and describe their use

**(2 marks)**

*(1 mark per correct answer)*

a.		b.	
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a. \_\_\_\_\_

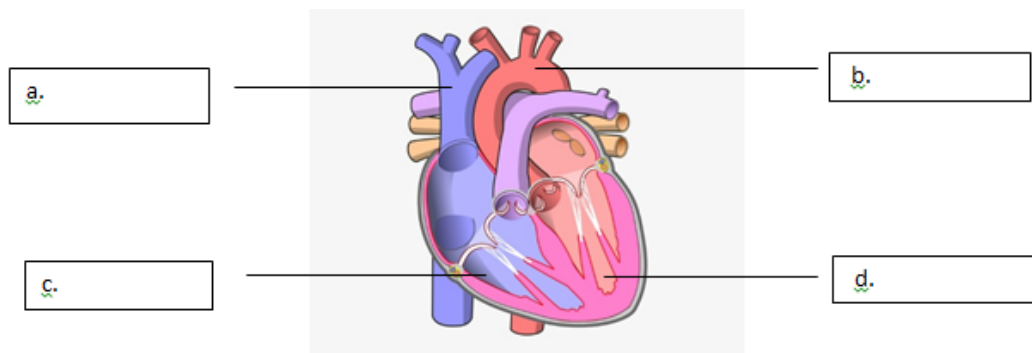
\_\_\_\_\_

b. \_\_\_\_\_

\_\_\_\_\_

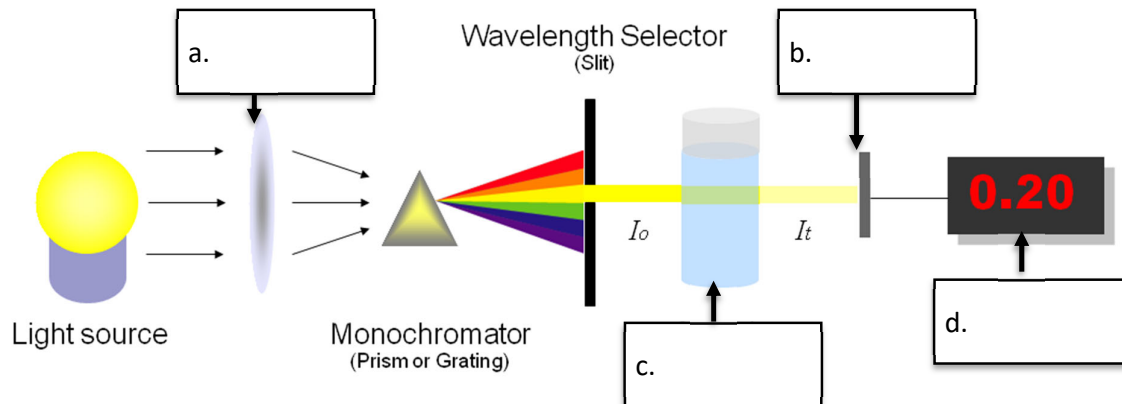
C.33 Label the following diagram:

(2 marks)



- a. \_\_\_\_\_
- b. \_\_\_\_\_
- c. \_\_\_\_\_
- d. \_\_\_\_\_

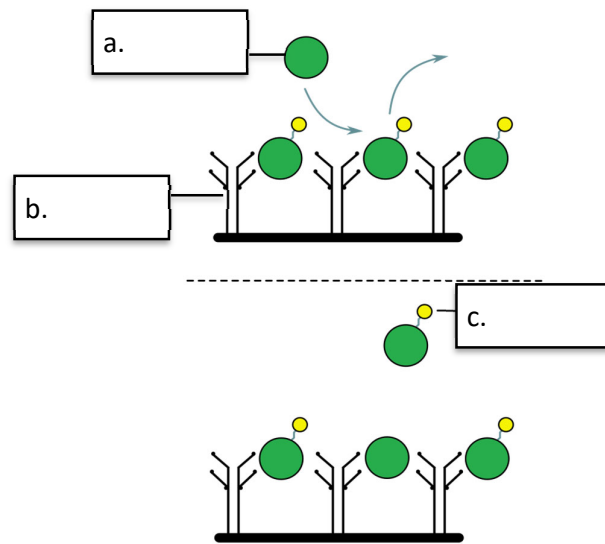
D.34 Label the following diagram demonstrating the principle of a spectrophotometer: (2 marks)



- a. \_\_\_\_\_
- b. \_\_\_\_\_
- c. \_\_\_\_\_
- d. \_\_\_\_\_

D.35 Label the following diagram of a competitive immunoassay

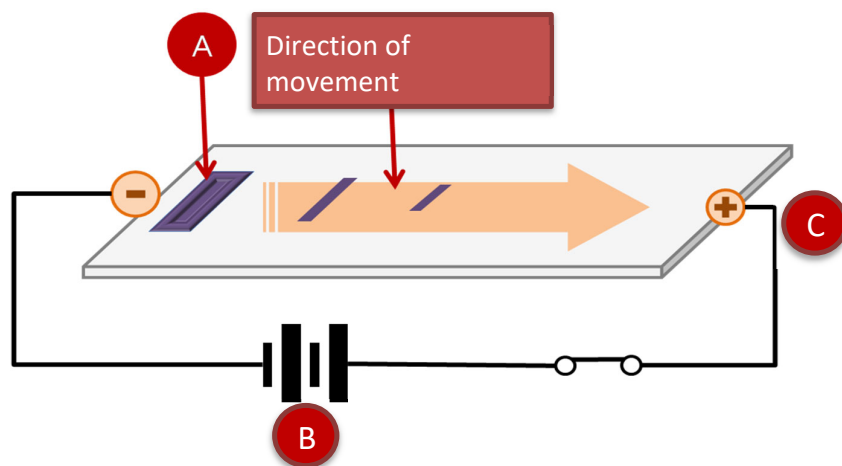
(1.5 marks)



- a. \_\_\_\_\_
- b. \_\_\_\_\_
- c. \_\_\_\_\_

D.36 Label the following diagram of a gel electrophoresis

(1.5 marks)



- a. \_\_\_\_\_
- b. \_\_\_\_\_
- c. \_\_\_\_\_

(Total: 10 marks)

END OF SECTION

### SECTION C

*Tables, match column definition*

**Section C – Question 37 to Question 40 = Total Marks: 10**

**(Answer all questions)**

C.37 Match the columns by **writing the Roman numeral from list B** against the correct match in Column A **(2.0 marks)**

Column A	Column B
A. Hepatic	i. Knee
B. Nephritis	ii. Liver
C. Patella	iii. Molecular
D. PCR	iv. Kidney

Column A	Column B
A. Hepatic	
B. Nephritis	
C. Patella	
D. PCR	

C.38 Expand the common abbreviations: **(2.0 marks)**

a. ACF	
b. CML	
c. COPD	
d. NAAT	

D.39 Expand the biochemistry abbreviations:

**(3 marks)**

a. ABG	
b. hCG	
c. HPLC	
d. LDH	
e. HIV	
f. GC-MS	

D. 40 Match the columns by **writing the Roman numeral from list B** against the correct match in Column A **(3 marks)**

Column A	Column B
A. Lithium	i. Antitumour drug
B. Actinomycin D	ii. Alkaline buffer
C. Gentamicin	iii. Pain relief
D. Carbamazepine	iv. Antidepressant
E. Salicylate	v. Antibiotic
F. Bicarbonate	vi. Anticonvulsant

Column A	Column B
A. Lithium	
B. Actinomycin D	
C. Gentamicin	
D. Carbamazepine	
E. Salicylate	
F. Bicarbonate	

**(Total: 10 marks)**

**END OF SECTION**

## SECTION D

### Calculations

Section D – Question 41 to Question 44 = Total Marks: 5

### Calculations

C.41 A patient has had daily Sodium and Potassium tests done for one week, the results are as follows:

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Sodium	135.7	135.9	136.3	136.9	137.2	136.5	135.4
Potassium	3.9	4.2	4.8	4.1	3.8	4.0	3.6

Calculate the mean Sodium and Potassium for the week. (Show all workings)

**(2 marks)**

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C.42 Convert:

**(1.5 marks)**

32.7 mg to \_\_\_\_\_ kg

$\frac{5}{8}$  to \_\_\_\_\_ %

200 uL to \_\_\_\_\_ mL

C.43 A test has been set up at 1730hrs and has an incubation time of 18 hours, the requester is asking what time they could expect the result (assume the result can be given as soon as the incubation period is complete).

**(0.5 marks)**

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C.44 A colleague accidentally made one litre of 20% solution of Trigene, you have been asked to use that solution and make one litre of 2% Trigene.

Explain your process and show any calculations or workings.

**(1.0 marks)**

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**(Total: 5 marks)**

**END OF SECTION**

## SECTION E

*Short answer questions (answers = one or more words, short sentences)*

**Section E – Question 45 to Question 66 = Total Marks: 40**

### Short Answer Questions

C.45 Define document control: **(2 marks)**

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C.46 Outline the First Aid and Treatment for fainting or unconscious episode of a staff member or patient you are working with. **(1.5 marks)**

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C.47 When referring to laboratory results the term “accuracy” is best described as: **(0.5 marks)**

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C.48 Outline the principle purpose of the Health Practitioners Competency Assurance Act 2003. **(1.5 marks)**

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C.49 Describe why user specific passwords are important when using a Laboratory Information System (Computer System) **(1.5 marks)**

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C.50 Describe why it is important for the laboratory to have a robust specimen labelling policy. **(1.5 marks)**

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C.51 Define Patient/Donor confidentiality **(1.5 Marks)**

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D.52 Describe the principle of operation for a spectrophotometer and explain the relationship between absorbance and concentration of a substance in solution. **(2 marks)**

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D.53 Outline the calibration process of manual pipetting devices. **(3 marks)**

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D.54 Describe how to prepare a serial dilution in order to create a standard curve. **(2 marks)**

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D.55 Give **TWO** (2) reasons why purified water is required for reagent preparation and rinsing glassware. **(1 mark)**

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D.56 For heparin anticoagulant, name the colour of the tube, **ONE** (1) mode of action, and **ONE** (1) use. Indicate ONE (1) potential cause of erroneous results through the incorrect use of this tube. **(2 marks)**

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D.57 For EDTA anticoagulant, name the colour of the tube, **ONE** (1) mode of action, and **ONE** (1) use. Indicate ONE (1) potential cause of erroneous results through the incorrect use of this tube: **(2 marks)**

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D.58 Distinguish between the following: **(6 marks)**

a. An end point assay and a rate of reaction assay **(2 marks)**

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b. Venous and Capillary blood gas samples **(2 marks)**

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c. Acid and base **(2 marks)**

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D.59 Describe the process of glycolysis in blood samples after collection and outline **TWO** (2) measures that can be taken to prevent it. **(2 marks)**

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D.60 Outline the principle of the ion specific electrode and give **TWO** (2) examples of its analytes. **(2 marks)**

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D.61 Explain the effects of haemolysis on blood samples and its implications for laboratory analysis. **(2 marks)**  
*(0.5 marks per correct answer)*

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D.62 Outline the principle of immunochemical assays. Include **TWO** (2) techniques of immunochemical tests in your answer. **(2 marks)**  
*0.5 marks per correct answer)*

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- D.63 Interpret the following blood test. State which organ is in disorder and suggest **ONE** (1) further follow up test that may be requested. **(1 mark)**

Chemistry	Result	Reference interval
AST	1396 U/L	<45 U/L
Bilirubin - Total	204 umol/L	<25 umol/L
GGT	474 U/L	<60 U/L
ALT	331 U/L	<45 U/L
ALP	521 U/L	40-110 U/L
Amylase	29 U/L	28-100 U/L

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- D.64 Interpret the following blood test. State which organ is in disorder and suggest **ONE** (1) further follow up test that may be requested. **(1 mark)**

Chemistry	Result	Reference interval
AST	27 U/L	<45 U/L
Bilirubin - Total	17 umol/L	<25 umol/L
GGT	53 U/L	<60 U/L
ALT	16 U/L	<45 U/L
ALP	87 U/L	40-110 U/L
Amylase	3876 U/L	28-100 U/L

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- D.65 State **TWO** (2) examples of the clinical significances of detecting and quantifying hCG in a sample **(1 mark)**

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D.66 Outline the clinical significance of Acetaminophen (Paracetamol) overdose and the treatment.  
(1 mark)

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***(Total: 40 marks)***

**END OF SECTION**

**ESSAY**

**Section F – Question 67 to Question 68 = Total Marks: 20**

**Essay Questions**

**ESSAY**

**Section F – Question 67 to Question 68 = Total Marks: 20**

**Essay Questions**

**ESSAY**

**Section F – Question 67 to Question 68 = Total Marks: 20**

**Essay Questions**

D.67 In essay format, describe how the endocrine system relates to diabetes and discuss **THREE** (3) laboratory tests that could be ordered to confirm the diagnosis. **(10 marks)**

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[illegible]

D.68 In essay format, outline the principle of a creatinine measurement method in the evaluation of kidney function. Discuss the clinical significance of creatinine and include in your answer the factors that can cause variations in creatinine levels between individuals. **(10 marks)**

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**END OF SECTION**