EXAMINATION FOR QUALIFIED MEDICAL LABORATORY TECHNICIAN

Candidate Name:

Candidate Number:

Subject: **BIOCHEMISTRY**

Examination Date: **8 October 2022**

Time Allowed: **3 hours – 9.30am – 12.40pm**
10 minutes extra time for reading the paper

General Instructions

1. Total marks for paper = 100.

2. Marks for each question are as indicated,

3. The paper consists of:

	Common	*Discipline Specific*
Section A, questions 1-30 = Total Marks 15	*6 Marks*	*9 Marks*
Section B, questions 31-38 = Total Marks 10	*5 Marks*	*5 Marks*
Section C, questions 39-41 = Total Marks 10	*4 Marks*	*6 Marks*
Section D, questions 42-45 = Total Marks 05	*5 Marks*	*0*
Section E, questions 46-61 = Total Marks 40	*10 Marks*	*30 Marks*
Section F, questions 62-63= Total Marks 20	*0*	*20 Marks*

4. All questions are to be attempted.

5. Use of calculator is permitted.

6. Write all answers into this booklet.

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

(0.5mark 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 Approximately what percent alcohol is in a standard use hand sanitiser?

a. 95%
b. 75%
c. 30%
d. 10%

C.2 The patella is part of which human joint?

a. Shoulder
b. Elbow
c. Knee
d. Wrist

C.3 An anticoagulant is used to:

a. stop blood clotting
b. stop blood haemolysing
c. help blood separating
d. separate red cells and plasma

C.4 Which of the following is **NOT** listed in the Health and Safety at Work Act 2015 as "Duties of Workers"?

a. take reasonable care for his or her own health and safety

b. take reasonable care that his or her acts or omissions do not adversely affect the health and safety of other persons

c. co-operate with any reasonable policy or procedure of the PCBU (person conducting a business or undertaking) relating to Health and Safety at the workplace that has been notified to workers

d. issue provisional improvement notices

C.5 Which of the following statements is true of an acidic solution?

a. has a pH less than 7

b. is caustic

c. has a pH greater than 7

d. is Isotonic

C.6 The reference interval for a given test is based on the results that are seen in what percent of the healthy population?

a. 5%

b. 10%

c. 90%

d. 95%

C.7 Treating all blood and body fluids as potentially infectious is an example of:

a. Laboratory standard operating procedures

b. CDC guidelines

c. Standard precautions

d. Health and safety requirements

C.8 Which laboratory department is primarily responsible for the diagnosis of leukaemia?

a. Haematology

b. Histology

c. Blood Transfusion

d. Biochemistry

C.9 Hormones are produced by which bodily system?

a. Lymphatic

b. Cardiovascular

c. Endocrine

d. Digestive

C.10 Formalin is a laboratory fluid used to

a. Preserve tissue samples

b. Wash histology cutting knives

c. Clean benches

d. Decontaminate centrifuges

C.11 A chemical that is described as a carcinogen poses what specific risk?

a. It may burn the skin

b. It may cause cancer

c. It may poison the liver

d. It may cause loss of vision.

C.12 The practice of enforcing document management standards within the workplace is referred to as:

a. Quality management

b. Quality control

c. IANZ requirements

d. Document control

D.13 Which of the following analytes can show falsely increased results if the sample has been contaminated with heparin anticoagulant?

a. Potassium

b. Lithium

c. Calcium

d. Glucose

D.14 When a SST sample is contaminated with EDTA anticoagulant, which of the following analytes can falsely be increased?

a. Sodium
b. Calcium
c. Glucose
d. Potassium

D.15 Hypokalemia is a decrease in which blood parameter?

a. Potassium
b. Sodium
c. Calcium
d. Magnesium

D.16 What major blood vessel carries blood back to the heart from the body?

a. The vena cava
b. The pulmonary artery
c. The aorta
d. The iliac artery

D.17 Systole refers to which of the following terms?

a. Refilling of the ventricle immediately after ventricular contraction
b. Contraction of the ventricle of the heart
c. Contraction of the atrium of the heart
d. Contraction of aorta

D.18 Elevated serum potassium levels can be associated with which of the following conditions?

a. Hepatitis
b. Dehydration
c. Myeloma
d. Congestive heart failure

D.19 Overdose of paracetamol can result in which condition?

a. Ketoacidosis
b. Osteoporosis
c. Liver failure
d. Gout

D.20 In a myocardial infarction, which blood parameter is likely to be increased?

a. Bicarbonate

b. Iron

c. Free triiodothyronine

d. Troponin

D.21 When using a mechanical pipette, which of the following refers to a forward pipetting technique?

a. first stop, aspirate, dispense all contents

b. second stop, aspirate, dispense all contents

c. first stop, aspirate, dispense to first stop

d. second stop, aspirate, dispense to first stop

D.22 Where are the adrenal glands located?

a. In the middle of the neck

b. On top of the kidneys

c. Below the brain

d. Adjacent to the pancreas

D.23 What is the function of the villi?

a. Filter toxins from the blood

b. Hormone regulation

c. Facilitate gas exchange

d. Absorption of nutrients

D.24 If a paediatric patient has severe lipaemia, what colour can the serum appear?

a. Red

b. Yellow

c. Green

d White

D.25 If a SST sample has been exposed to direct sunlight for a long period, which of the following parameter is falsely decreased?

a. Potassium

b. Magnesium

c. Bilirubin

d. Chloride

D.26 In hereditary haemochromatosis, which of the following analyte is likely to be raised?

a. Insulin

b. Copper

c. ACTH

d. Iron

D.27 Elevated creatinine in blood can be attributed to which of the following condition?

a. Heart conditions

b. Liver cirrhosis

c. Renal failure

d. Liver cholestasis

D.28 Cocaine is routinely analysed by which principle?

a. Colourimetry

b. HPLC

c. Immunochemistry

d. Electrophoresis

D.29 An elevated gamma fraction in a monoclonal band for protein electrophoresis suggests which of the following?

a. Renal failure

b. Haemolysis

c. Autoimmune disease

d. Brain tumour

D.30 An overdose of Digoxin can result in which condition?

a. Irregular heartbeats

b. Renal failure

c. Cerebral haemorrhage

d. Pulmonary embolism

END OF SECTION

SECTION B

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

Section B – Question 31 to Question 38 = Total Marks: 10

(Answer all questions)

C.31 Name the following hazard symbols *(0.5 marks per correct answer)*

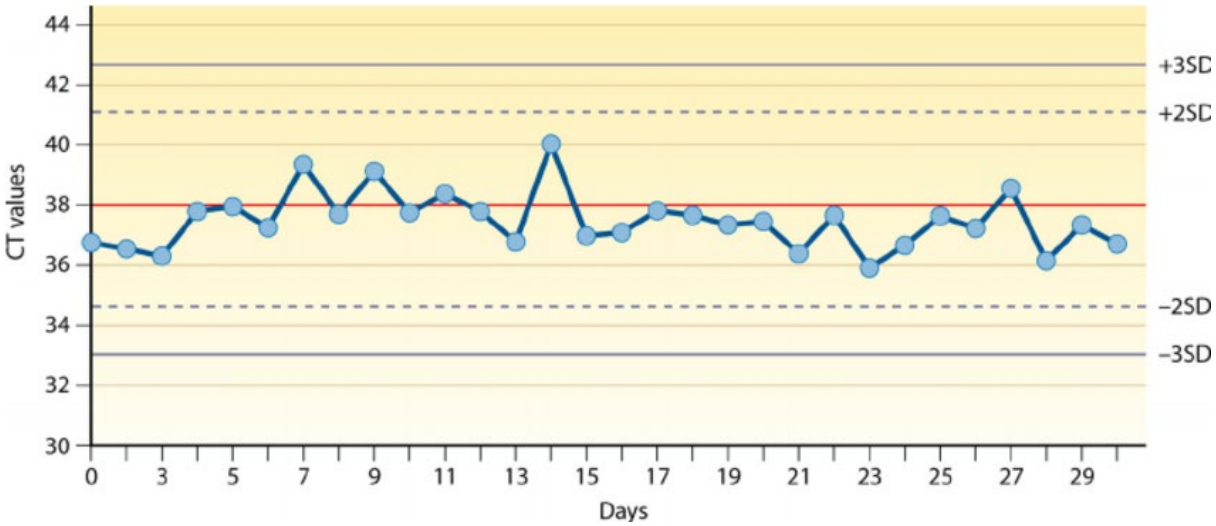
(C.31: 1 mark)

a.		b.	

a. _____ b. _____

C.32 Name the type of graph: *(0.5 marks per correct answer)*

(C.32: 1.5 marks)

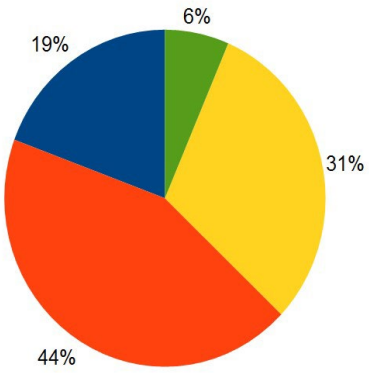


Type of graph: _____

Name the axis: CT values = _____ axis

Days = _____ axis

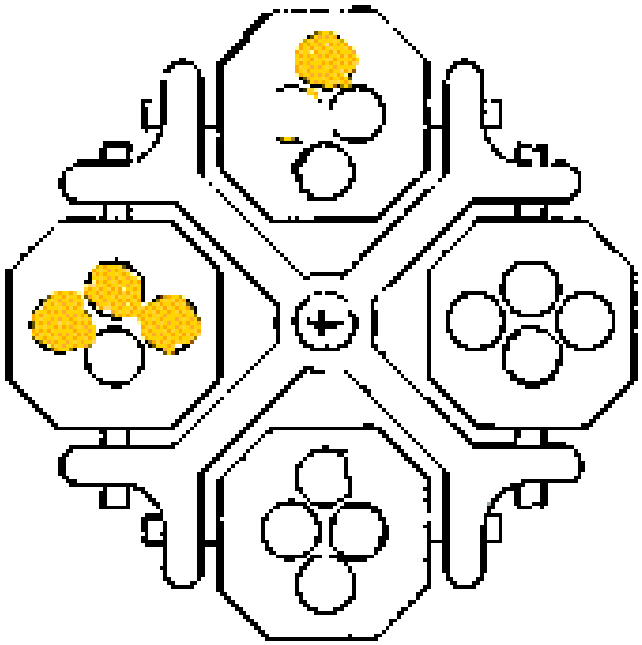
C.33 Name the type of graph **(C.33: 0.5 mark)**



C.34 The yellow dots represent blood tubes in a swing out centrifuge rotor, assume all tubes are filled to the same level.

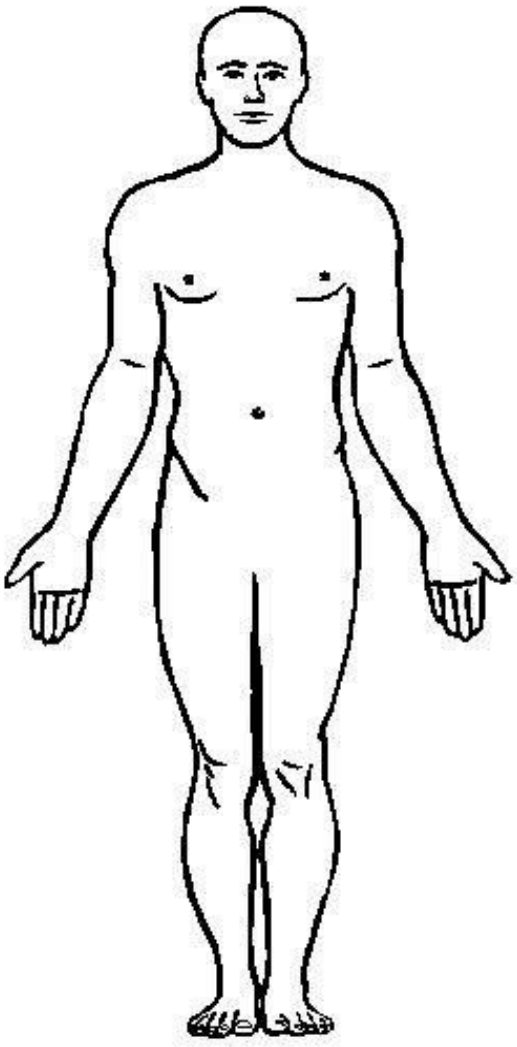
You have 4 more tubes to centrifuge, indicate on the rotor where they need to be positioned.

(C.34: 0.5 mark)



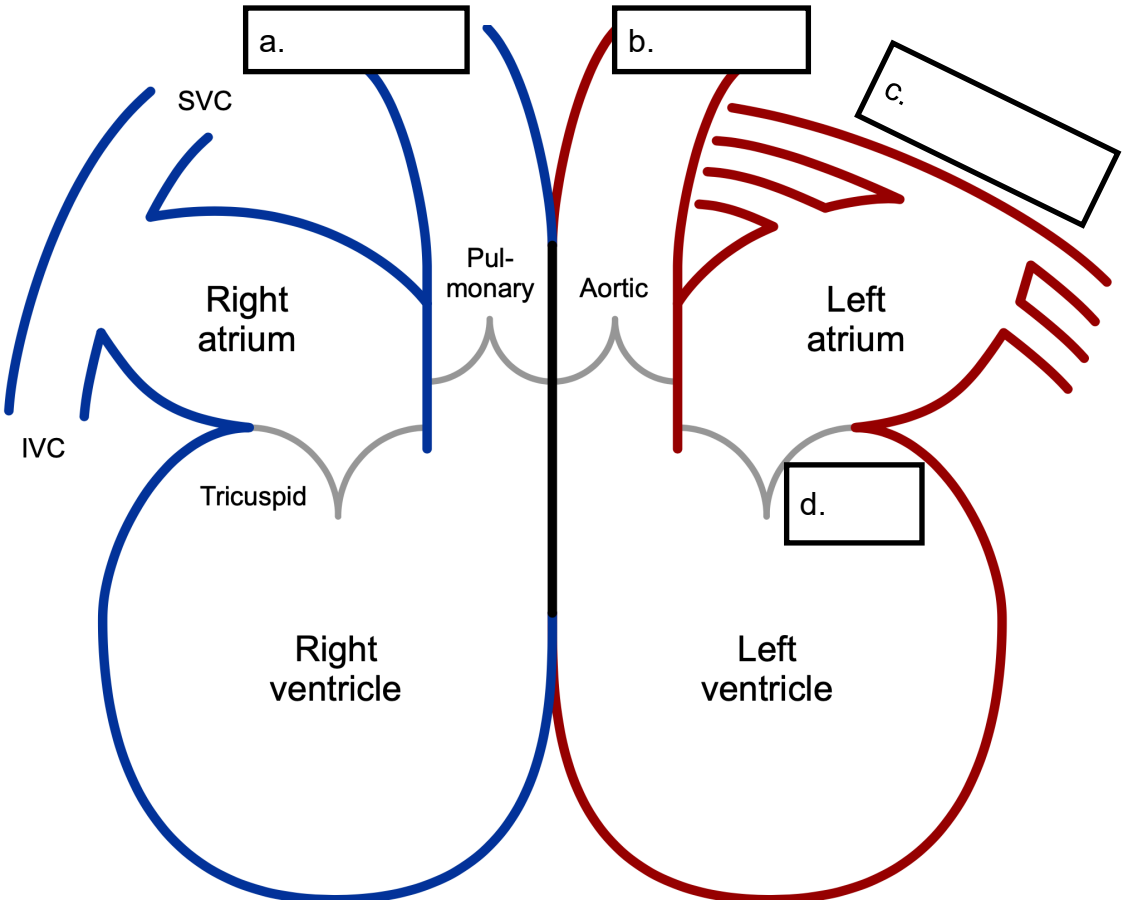
C.35 On the diagram, show the location of the following: **(C.35: 1.5 marks)**

a. Femoral artery
b. Jugular vein
c. Median cubital vein



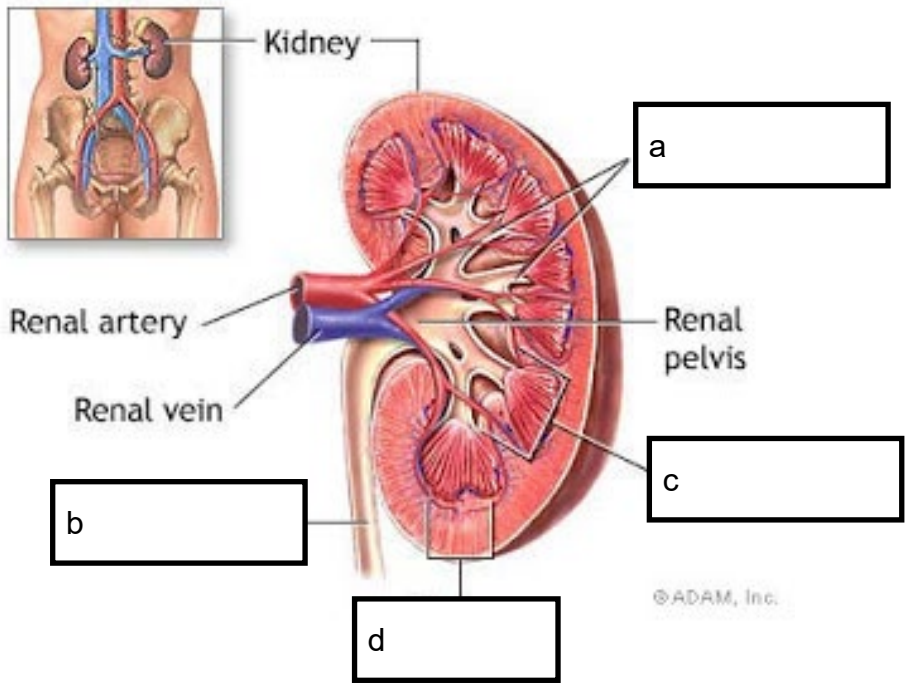
D.36 On the diagram, add the correct labels to the boxes a.-d. *(0.5 marks per correct answer)*

(D.36: 2 marks)



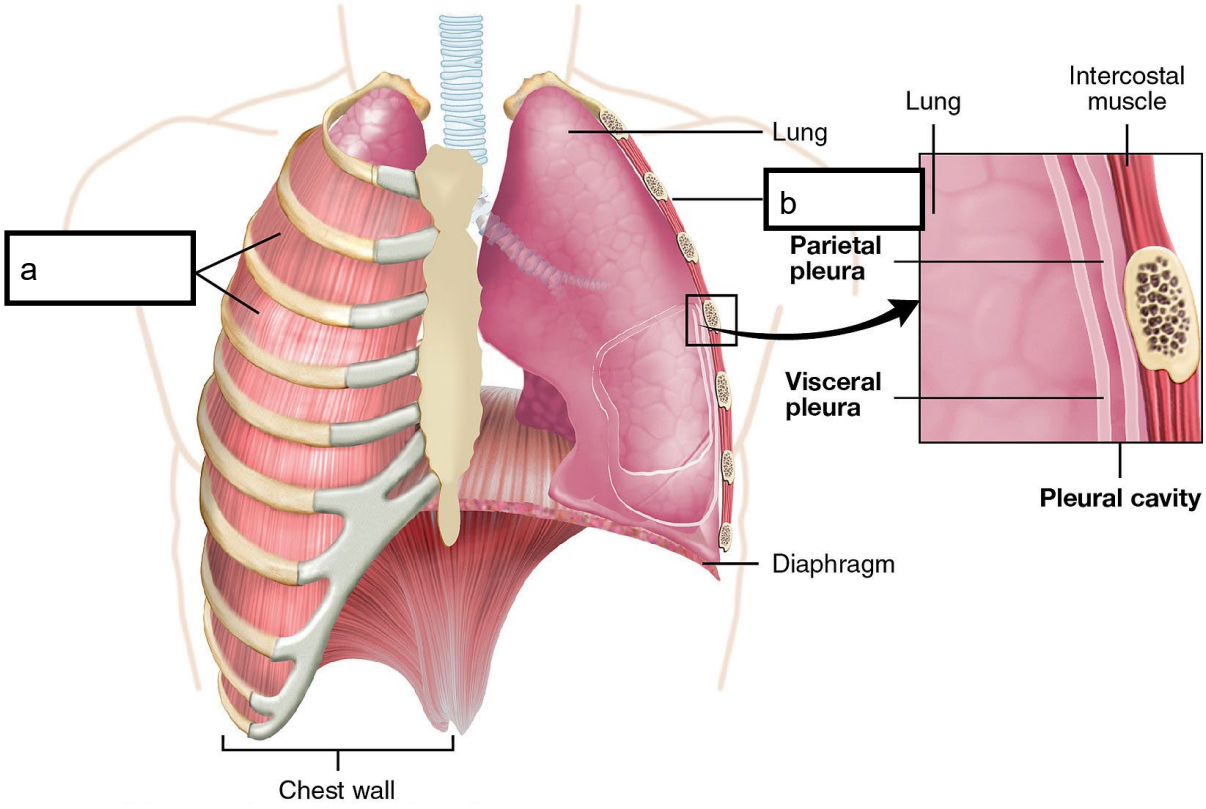
D.37 On the diagram, add the correct labels to the boxes a.-d. *(0.5 marks per correct answer)*

(D.37: 2 marks)



D.38 On the diagram, add the correct labels to the boxes a. and b. *(0.5 marks per correct answer)*

(D.38: 1 mark)



END OF SECTION

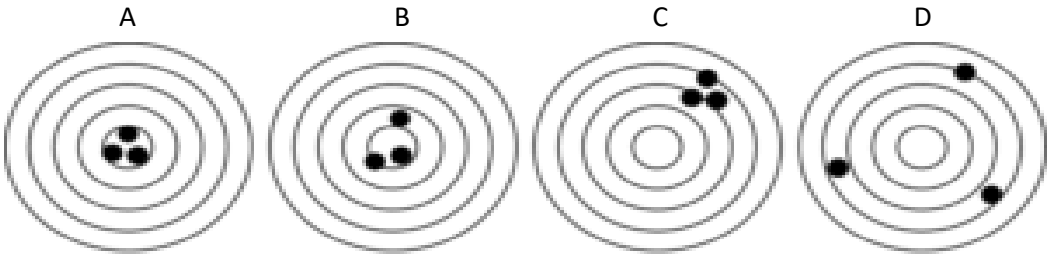
SECTION C

Tables, match column definition

Section C – Question 39 to Question 41 = Total Marks: 10

(Answer all questions)

C.39 Select the correct letter for each description: **(C.39: 2 marks)**



Description Letter

Low Accuracy / High Precision = _____

High Accuracy / Low Precision = _____

Low Accuracy / Low Precision = _____

High Accuracy / High Precision = _____

C.40 Match Column A to Column B, and write your answers in the table below:
(Roman Numerals only required): **(C.40: 2 marks)**

Column A	Column B
Medical Sciences Council	i. Certifies laboratory quality systems
International Accreditation New Zealand	ii. Issues Annual Practising Certificate
New Zealand Institute of Medical Laboratory Science	iii. Patients' rights for service
Health and disability commission	iv. Professional affairs and education

Column A	Column B (Roman numerals only required)
Medical Sciences Council	
International Accreditation New Zealand	
New Zealand Institute of Medical Laboratory Science	
Health and disability commission	

D.41 Match the laboratory test (Alpha) to the correct description (Numeric), and write your answers in the table below (Roman Numeral only required): *(0.5 marks per correct answer)*

(D.41: 6 marks)

	Laboratory Test		Description
a	Calcium	i	Increased in metabolic alkalosis
b	Urea	ii	Used for cardiovascular risk assessment
c	Gamma glutamyl-transferase	iii	Increased in gout
d	Lipase	iv	Falsely increased in haemolysis
e	Lactate Dehydrogenase	v	Increased in dehydration
f	Beta-Hydroxybutyrate	vi	Increased in tumours
g	Bicarbonate	vii	Increased in acute pancreatitis
h	Triglycerides	viii	Decreased in anaemia
i	Iron	ix	Increased in post hepatic obstruction
j	Uric Acid	x	Decreased in hypoparathyroidism
k	Beta hCG	xi	Increased in diabetic ketoacidosis
l	Salicylate	xii	Can cause anaphylaxis reactions

	Laboratory Test		Description
a	Calcium		
b	Urea		
c	Gamma glutamyl-transferase		
d	Lipase		
e	Lactate Dehydrogenase		
f	Beta-Hydroxybutyrate		
g	Bicarbonate		
h	Triglycerides		
i	Iron		
j	Uric Acid		
k	Beta hCG		
l	Salicylate		

END OF SECTION

SECTION D

Calculations

Section D – Question 42 to Question 45 = Total Marks: 5

Calculations

C.42 A Glucose Tolerance Test dose is 75g glucose in 350mL water. This test requires the patient to fast for 12 hours before drinking the solution. A blood test is then collected 120 minutes after the drinking the solution. **(C.42: 1.5 marks)**

a. Calculate the percentage glucose in solution. *(Show working)* *(0.5 mark)*

a. _____

_____

b. If the patient finished their evening meal at 2115 hrs, state the earliest time they can present for the test the following day. *(0.5 mark)*

b. _____

_____

c. If the patient drinks the solution at 1010 hrs, state the time the blood test is required. *(0.5 mark)*

c. _____

_____

C.43 Refer to daily fridge temperature monitoring record below. **(C.43: 1 mark)**

Day of the week	Monday	Tuesday	Wednesday	Thursday	Friday
Daily Fridge temperature.	4.6	3.8	3.1	9.3	5.1

a. Calculate the mean recorded temperature for the week. (*Show calculations)*

a. _____

_____

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_____

C.44 Convert the following: **(C.44: 1.5 marks)**

a) 4.5 mL to _____ µL

b) 1.125kg to _____ g

c) 1500 µmol to _____ mmol

C.45 Calculate how many grams of sodium chloride (NaCl) are required to make 1.0L of a 2 Molar solution?
(Show calculations) **(C.45: 1 mark)**
Atomic Weight of sodium (Na) = 23
Atomic Weight of chlorine (Cl) = 35.5

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END OF SECTION

SECTION E

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

Section E – Question 46 to Question 61 = Total Marks: 40

Short Answer Questions

C.46 List the activities that registered laboratory staff must do to comply with the HPCA act? **(C.46: 1 mark)**

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C.47 Outline cultural competency as it relates to medical laboratory science? **(C.47: 2 marks)**

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C.48 Outline Total Quality Management in the medical laboratory setting **(C.48: 2 marks)**

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C.49 Describe the procedures taken when dealing with a blood spill in the laboratory or phlebotomy clinic? **(C.49: 2 marks)**

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C.50 Define Occupational Overuse Syndrome in a medical laboratory workplace. Name a common cause and who should you speak to if you suffer from it? **(C.50: 1.5 marks)**

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C.51 On removing a reagent or product from a laboratory fridge, it is found to be a room temperature. What is the correct process to follow? **(C.51: 1.5 marks)**

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D.52 Distinguish between plasma and serum samples: **(D.52: 2 marks)**

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D.53 Describe the basic function of the following systems, and name 2 organs involved in each system: *(1 mark per correct function, and 0.5 marks for naming correct organs)*
(D.53: 6 marks)

a. Gastrointestinal

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b. Cardiovascular

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c. Endocrine

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D.54 Distinguish between the principles of operation in colourimetry, immunochemical, and ion-specific electrode systems: **(D.54: 3 marks)**

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D.55 Distinguish between spectrophotometric end point assays and rate reaction (kinetic) assays

(D.55: 2 marks)

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D.56 Distinguish between venous, arterial, and capillary samples. Your answer should include the oxygen level in each sample type: **(D.56:3 marks)**

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D.57 Distinguish between the following: **(D.57: 6 marks)**

a. Accuracy and Precision

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b. Forward and Reverse Pipetting

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c. Direct and Indirect ISE Measurement

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D.58 Describe two uses and the mode of action for potassium oxalate with sodium fluoride (fluoride oxalate) grey top tubes: *(0.5 marks per correct use; and 0.5 marks for each mode of action)* **(D.58: 2 marks)**

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D.59 Outline the principle of pH measurement, and describe at least one method for the measurement of pH: **(D.59: 2 marks)**

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D.60 Interpret the following blood results from an adult male, state which organ is in disorder and the treatment for it: *(1 mark for the correct organ and 1 mark for the treatment)* **(D.60: 2 marks)**

Chemistry	Result	Reference range
Sodium	136 mmol/L	135-145 mmol/L
Potassium	3.9 mmol/L	3.6-5.2 mmol/L
Calcium	2.3 mmol/L	2.1-2.55 mmol/L
Albumin	30 mmol/L	32-48 mmol/L
Creatinine	100 umol/L	60-105 umol/L
Troponin	26 ng/L	<15 ng/L

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D.61 Interpret the following blood results from an adult female, state which organ is in disorder and the treatment for it: (*1 mark for the correct organ and 1 mark for the treatment)*

(D.61: 2 marks)

Chemistry	Result	Reference range
Sodium	156 mmol/L	135-145 mmol/L
Potassium	6.1 mmol/L	3.6-5.2 mmol/L
Calcium	2.0 mmol/L	2.1-2.55 mmol/L
Albumin	25 mmol/L	32-48 mmol/L
Creatinine	298 umol/L	45-90 umol/L
Troponin	11 ng/L	<15 ng/L

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END OF SECTION

ESSAY

Section F – Question 62 to Question 63 = Total Marks: 20

Essay Questions

D.62 In essay format, outline liver failure and differentiate between cholestatic and hepatocellular causes. Your answer should include liver function test results that will be abnormal in each case. **(D.62: 10 marks)**

D.63 In essay format, describe pre-analytical error in terms of changes in blood constituents after collection, in relation to biochemistry, and how best to prevent them. **(D.63: 10 marks)**

EXTRA PAPER