

EXAMINATION FOR QUALIFIED MEDICAL LABORATORY TECHNICIAN



Subject: IMMUNOLOGY

Examination Date: Saturday 7 November 2020

Time Allowed: 3 hours: 9.30am – 12.40pm
10 minutes extra time allowed 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 syllabus and discipline specific questions. The breakdown is:				
		Common Questions	Common Marks	Discipline Questions	Discipline Marks
	Section A, Multi Choice	C.1 – C.12	6	D.13 - D.30	9
	Section B, Labelling, Diagrams	C.31 – C.33	5	D.34 – D.36	5
	Section C, Tables, Match Columns	C.37	4	D.38 – D.39	6
	Section D, Calculations	C.40 – C.43	5	D.44 – D.45	5
	Section E, Short Answer Questions	C.46 – C.51	10	D.52 – D.61	
	Section F, Essay Questions			D.62 – D.63	20
	To pass the QMLT examination, candidates must gain a minimum of a C grade (50%) in the common syllabus examination component and a minimum of a C grade (50%) in the discipline specific component of the written examination.				
4.	All questions to be attempted.				
5.	Use of a calculator is permitted.				
6.	Write all answers into the examination booklet provided unless answer sheet(s) are provided.				

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WORD DEFINITIONS	
LIST	Headings only
DEFINE	State meaning clearly and concisely
OUTLINE	Write brief notes incorporating the essential facts
IDENTIFY	Recognise according to established criteria
DESCRIBE	Give a complete account demonstrating a thorough practical knowledge in a logical sequence
INDICATE	Briefly point out
CLASSIFY	Be able to designate to a group
DISTINGUISH	To briefly point out the main differences
DISCUSS	Give details, explaining both the positives and negatives
CALCULATE	Perform a mathematical process to get the answer
MATCH	Find one that closely resembles another
EXPAND	To express at length or in greater details
COMPLETE	Finish, have all the necessary parts
NAME	A word or group of words used to describe or evaluate
LABEL	Give a name to
CONVERT	Express in alternative units
INTERPRET	Express the results of a test or series of tests in a meaningful format
STATE	Give the relevant points briefly
COMPARE	Detail both the differences and the similarities

SECTION A

Multi Choice Questions – choose one answer for each question

Common Curriculum Questions C.1 – C.12 = 6 marks

Discipline Specific Questions D.13 – D.30 = 9 marks

(0.5 marks per correct answer)

Total Marks = 15 marks

Common Curriculum Questions:

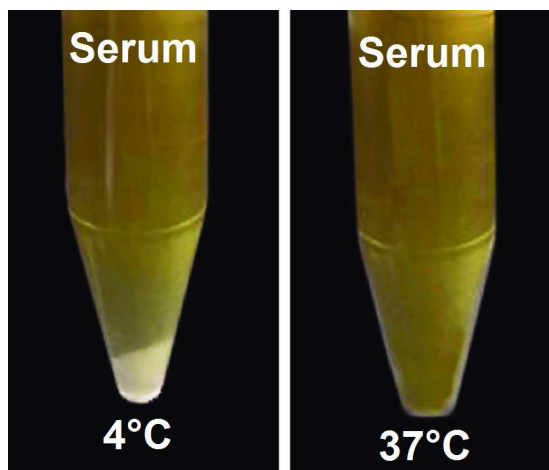
- C.1 Hepatitis is the inflammation of which body organ?
- a. Brain
 - b. Spleen
 - c. Liver
 - d. Thyroid
- C.2 Which organisation is responsible for issuing an Annual Practising Certificate?
- a. Medical Sciences Council of New Zealand.
 - b. New Zealand Institute of Medical Laboratory Science.
 - c. New Zealand Ministry of Health.
 - d. New Zealand Qualification Authority.
- C.3 A solution with a pH of less than 7 is referred to as:
- a. Neutral
 - b. Acidic
 - c. Alkaline
 - d. Isotonic
- C.4 A Class 1 biosafety cabinet offers protection to:
- a. Personnel only
 - b. Personnel and products
 - c. Products only
 - d. Personnel and environment
- C.5 Which laboratory department is mostly responsible for the identification of pathogens?
- a. Transfusion Science
 - b. Histology
 - c. Microbiology
 - d. Biochemistry
- C.6 The process for organising, authorising and distributing documentation is known by which of the following terms?
- a. Record keeping
 - b. Document control
 - c. Organisational charts
 - d. IANZ auditing

- C.7 Using the New Zealand fire classification, water can be used on which class of fire?
- A and B
 - B, C and E
 - A only
 - D only
- C.8 Getting permission from a patient to proceed with a test is best described as:
- Cultural competency
 - Patient confidentiality
 - Patient information
 - Informed consent
- C.9 The endocrine system is best described as:
- A system of glands that produces hormones.
 - A system that controls the flow of blood around the body.
 - A system that oxygenates the blood.
 - A system that filters toxins from the blood.
- C.10 The clinical detail abbreviation S.O.B is most likely to be associated with a:
- Renal patient
 - Respiratory patient
 - Neurological patient
 - Orthopaedic patient
- C.11 When reading the volume of a fluid in a measuring cylinder do you?
- Read the volume where the liquid touches the side of the glass.
 - Read the volume at the mid-point of the liquid's meniscus.
 - Need to know the temperature before you can decide.
 - Read the volume at the base of the meniscus.
- C.12 The inferior vena cava is a vein that is found in the:
- Torso
 - Leg
 - Arm
 - Neck

Discipline Specific Questions:

- D.13 IgE antibodies are associated with _____ and _____ activity.
- Allergic, secretory.
 - Complement fixation, primary response.
 - Secondary response, opsonisation.
 - Allergic, antiparasitic.
- D.14 The _____ phenomenon occurs in agglutination tests when excess antibody is present, causing a false negative reaction.
- Equivalence
 - Heterophile
 - Prozone
 - Lipaemia

- D.15 Which of the following is NOT a component of the innate immune system?
- B lymphocytes
 - Membrane attack complex
 - Lectin pathway
 - C1q
- D.16 Which of the following antibodies is NOT currently used as a marker for coeliac disease?
- Tissue transglutaminase IgA antibodies.
 - Deaminated gliadin peptide IgG antibodies.
 - Endomysial IgA antibodies.
 - Cyclic citrullinated peptide IgG antibodies.
- D.17 Which stage of a syphilis infection is associated with a rash?
- Primary
 - Secondary
 - Latent
 - Tertiary
- D.18 The following diagram depicts a positive test for:



- Cryoglobulin
 - Cryofibrinogen
 - Immunoprecipitation
 - Lipaemia
- D.19 What volume of diluent is required to prepare a working solution of wash buffer if a 50mL bottle of 20x concentrate solution is used?
- 450 mL
 - 900 mL
 - 950 mL
 - 1000 mL
- D.20 A nucleolar ANA pattern is most commonly associated with which systemic rheumatic disease?
- Sjogren's syndrome
 - Systemic sclerosis
 - Systemic lupus erythematosus
 - Mixed connective tissue disease

- D.21 Which combination of results shows a toxoplasma infection most likely occurred within the last month?
- Positive toxoplasma IgG, Positive toxoplasma IgM, Low IgG avidity.
 - Positive toxoplasma IgG, Positive toxoplasma IgM, High IgG avidity.
 - Positive toxoplasma IgG, Negative toxoplasma IgM, High IgG avidity.
 - Negative toxoplasma IgG, Negative toxoplasma IgM, Low IgG avidity.

- D. 22 The following combination of hepatitis B serology results suggests a patient is in which disease status:

Hepatitis B Surface antigen: Negative

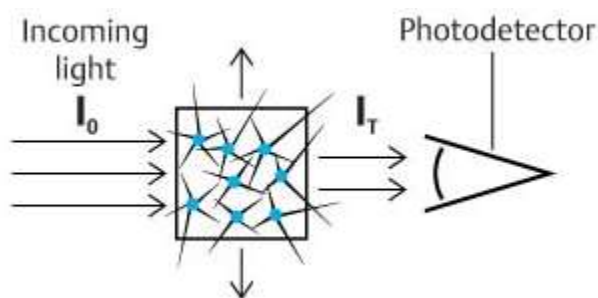
Hepatitis B Surface antibody: Reactive

Hepatitis B Total core antibody: Reactive

Hepatitis B Core IgM: Negative

- Immunity post immunisation
- Cleared past infection
- Acute current infection
- Chronic infection

- D.23 The following diagram demonstrates the principle behind which methodology?



- Chemiluminescent immunoassay
 - Immunoprecipitation
 - Nephelometry
 - Turbidimetry
- D. 24 Where is the thymus located in the human body?
- In the upper left part of the abdomen, to the left of the stomach.
 - At the front of the neck just below the larynx.
 - Behind the sternum and between the lungs.
 - At the back of the throat.
- D.25 Antenatal serology involves testing for which of the following group of infections?
- Hepatitis B, Rubella, Syphilis, HIV
 - Hepatitis B, Hepatitis C, Mumps, Syphilis
 - Hepatitis B, Hepatitis C, HIV
 - Syphilis, Chlamydia, Gonorrhoea, HIV
- D.26 Which concept does this image represent?
- Accurate, and precise
 - Not accurate, but precise
 - Accurate, but not precise
 - Not accurate, and not precise



- D.27 Systemic lupus erythematosus, rheumatoid arthritis and serum sickness are clinical examples of which type of immune response?
- Type 1 anaphylactic response.
 - Type 2 cytotoxic response.
 - Type 3 immune complex-mediated response.
 - Type 4 cell-mediated response.
- D.28 Which of the following is characteristic of a primary immune response?
- Low affinity antibodies.
 - Primarily IgG production.
 - Short lag phase between exposure and response.
 - Long lasting antibody levels.
- D.29 Which virus causes the shingles infection?
- Rubella virus
 - Cytomegalovirus
 - Epstein-Barr virus
 - Varicella zoster virus
- D.30 Liver disease due to viral hepatitis, autoimmune disease and alcoholic liver disease, are associated with which observation by serum protein electrophoresis?
- Decreased Beta 2 fraction.
 - Polyclonal increase in gamma globulins.
 - A monoclonal peak.
 - Decreased gamma globulins.

(Q1-30: 15 marks)

Section A: Total 15 marks

SECTION B

Labelling of Diagrams, eg Anatomy, Hazard Identification, Instrument

Common Curriculum Questions C.31 - C.33 = 5 marks

Discipline Specific Questions D.34 – D.36 = 5 marks



(Answer all questions)

Total Marks = 10 marks

Common Curriculum Questions:

C.31 Name the following hazard symbols:

(0.5 marks per correct answer)

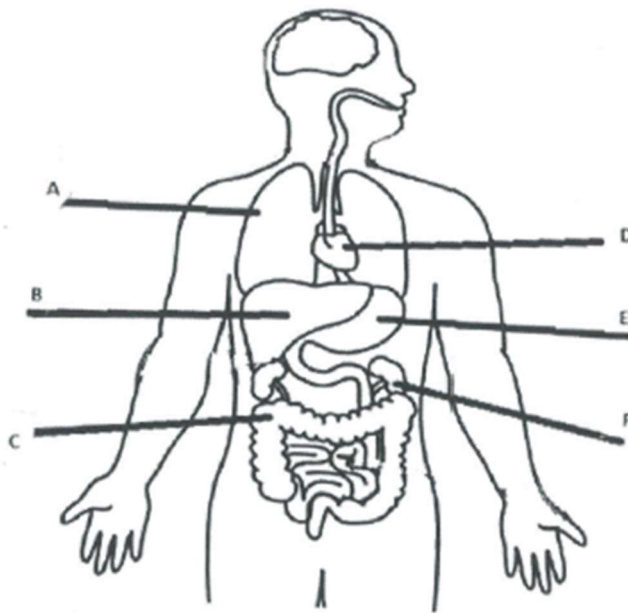
a.		b.	
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(C.31: 1 mark)

C.32 From the diagram below, identify the labelled sites A, B, C, D, E, F.

(0.5 marks per correct answer)

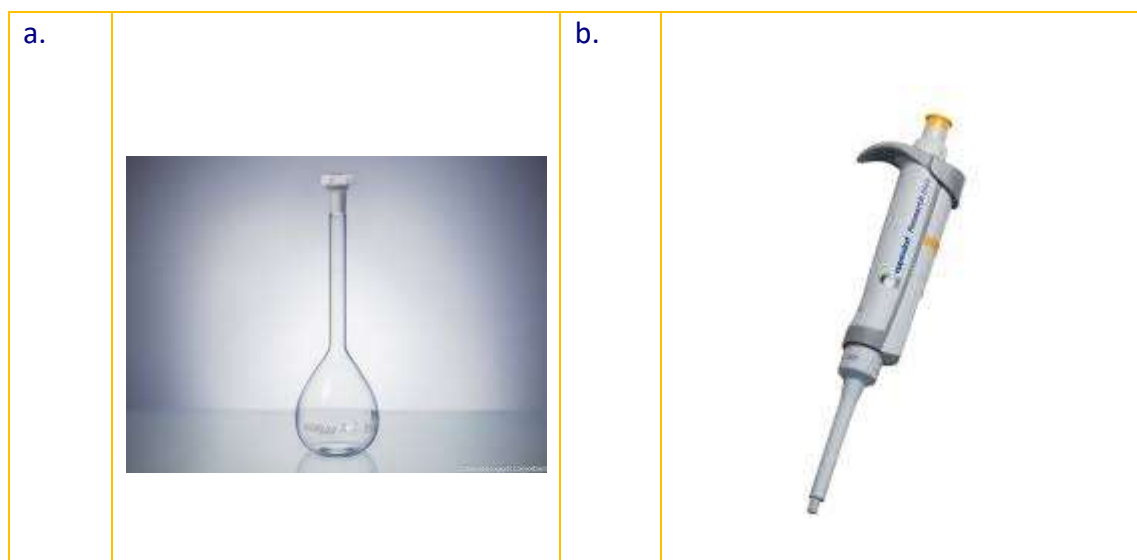
Write your answers on the answer sheet provided.



(C.32: 3 marks)

C.33 Name the equipment pictured below.

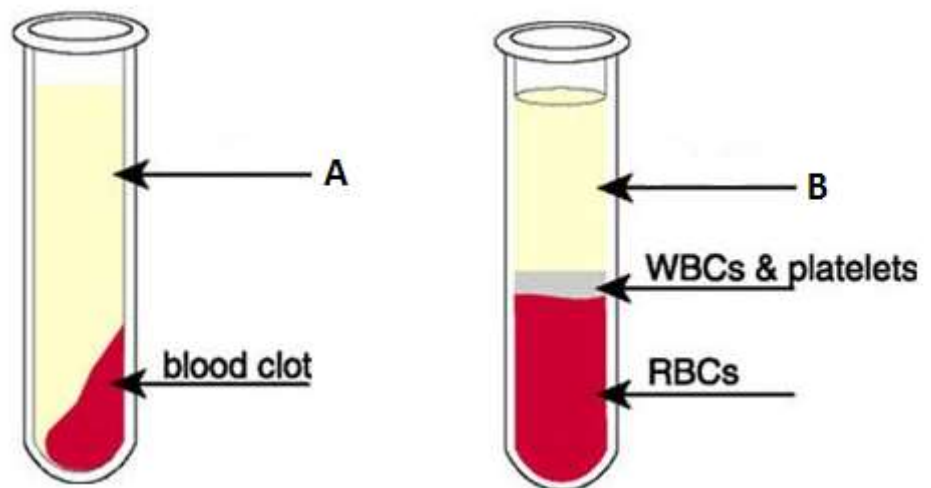
(0.5 marks per correct answer)



(C.33: 1 mark)

Discipline Specific Questions:

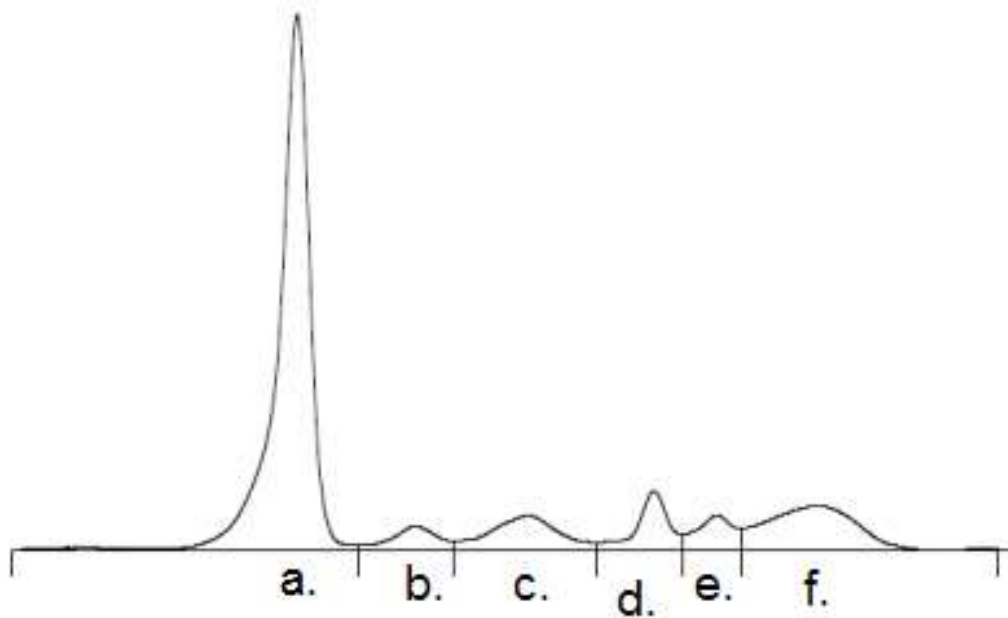
D.34 In your answer book, label A and B.



(D.34: 1 mark)

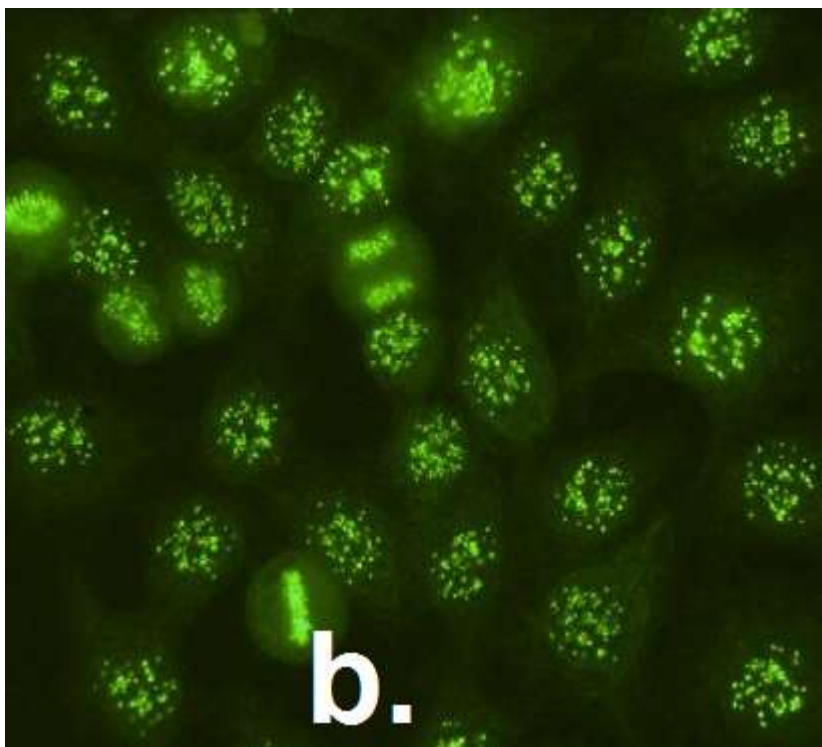
D.35 Label the fractions of serum proteins produced by the technique of protein electrophoresis.

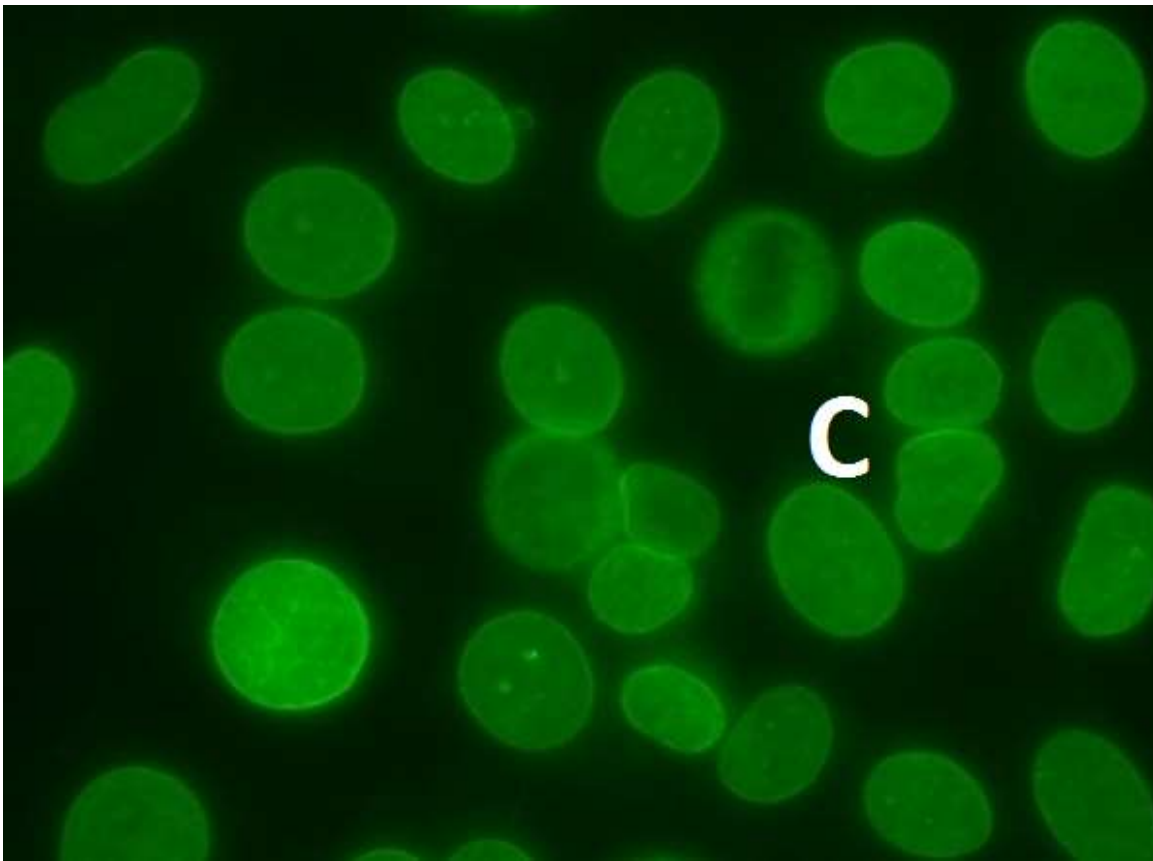
Write your answers into the attached answer sheet provided.



(D.35: 2.5 marks)

- D.36 Label the cellular organelles that are staining in these HEp-2 cells used for ANA testing.
(0.5 marks per correct answer)





(C.36: 1.5 marks)

Section B: Total 10 marks

SECTION C
Tables, Match Column Definition

Common Curriculum Questions C.37 = 4 marks
Discipline Specific Questions D.38 – D.39 = 6 marks

(Answer all questions)
Total Marks = 10 marks

Common Curriculum Questions:

C.37 Match the following list of terms in Column A with the most appropriate in Column B:

(0.5 marks per correct answer)

Write your answers on the answer sheet provided.

A.		B.	
a.	Quality control	i.	The ability of a measurement to match the actual value of the quantity being measured
b.	Decreased	ii.	The ability of a measurement to be consistently reproduced
c.	The Health Practitioners Competency Assurance Act	iii.	Hypo
d.	Increased	iv.	Values deemed normal in healthy people
e.	Precision	v.	Methods
f.	Standard Operating Procedures	vi.	Protect the health and safety of members of the public
g.	Accuracy	vii.	The monitoring to ensure compliance.
h.	Reference range	viii.	Hyper

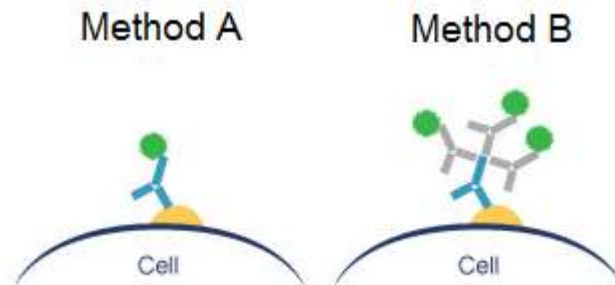
(C.37: 4 marks)





Discipline Specific Questions:

D.38 Match each immunofluorescence assay component with its corresponding description.

(0.5 marks per correct answer)

Write your answers on the answer sheet provided.



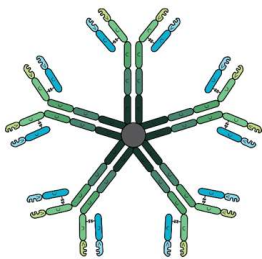
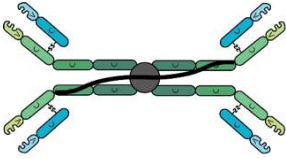
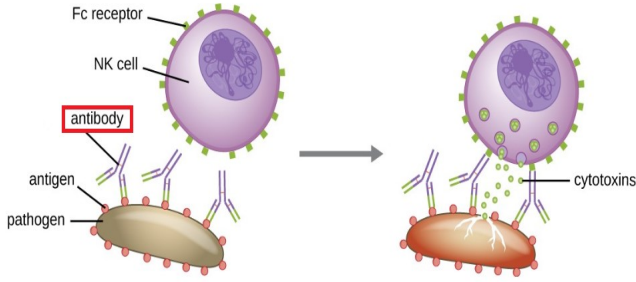
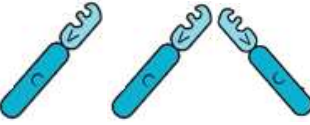
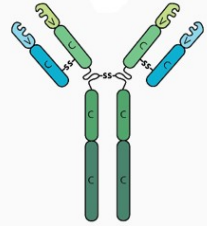
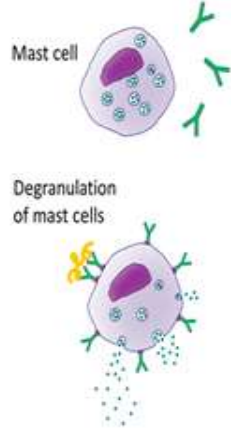
Component	Description	Description Answers
	Direct	
	Secondary Antibody	
	Antigen	
	Indirect	
Method A	Primary antibody	
Method B	Fluorophore	

(C.38: 3 marks)

D.39 Match each image on the left with the most appropriate antibody or antibody component on the right.

(0.5 marks per correct answer)

Write your answers on the answer sheet provided.

Image	Component	Answer
	Free light chain	
	IgD	
	IgM	
	IgE	
	IgG	
	IgA	

(D.39: 3 marks)

Section C: Total 10 marks

SECTION D
Calculations

Common Curriculum Questions C.40 – C.43 = 5 marks

Discipline Specific Questions D.44 – D.45 = 5 marks

(Answer all questions)

Total Marks = 10 marks

Common Curriculum Questions:

- C.40 A patient is asked to have three blood tests each four hours apart. The first blood test appointment is for 0930 hrs.

What times do you ask the patient to return for their remaining tests?

(C.40: 1 mark)

- C.41 Below is a table showing a fridge temperature taken each day of the week.

Day of the week	Monday	Tuesday	Wednesday	Thursday	Friday
Temperature per day	4.8	3.7	6.6	6.2	5.1

What is the mean temperature over the five (5) days?

Show calculations.

(C.41: 1 mark)

- C.42 How many grams of CaCO_3 (Calcium Carbonate) are required to make 0.5L of a 1 Molar solution?

Show calculations.

Atomic Weight of Calcium (Ca) = 40

Atomic Weight of Carbon (C) = 12

Atomic weight of Oxygen = 16

(C.42: 1 mark)

- C.43 Convert:
- 1.2 g to μg
 - 35mL to L
 - 15mm to cm
 - 25kg to g

(C.43: 2 marks)

Discipline Specific Questions:

- D.44 Outline the steps you would take to manually dilute a serum sample for ANA testing, using a microtitre plate, where the dilutions 1:80, 1:160, 1:640 and 1:1280 are required.

Include the sample and reagent volumes and type of diluent used in your answer.

(D.44: 2.5 marks)

- D.45 Toxoplasma avidity testing by VIDAS requires the serum to be diluted in kit diluent R1, to a toxoplasma IgG concentration of 15 IU/mL. 200uL of diluted sample is required to perform the test.

Outline the steps you would take to dilute a serum sample that has tested positive for toxoplasma IgG with a concentration of 320 IU/mL.

(D.45: 2.5 marks)

Section D: Total 10 marks

SECTION E
Short Answer Questions

Common Curriculum Questions C.46 – C.51 = 10 marks
Discipline Specific Questions D.52 – D.61 = 25 marks

(Answer all questions)
Total Marks = 35 marks

Common Syllabus Questions:

- C.46 Outline the meaning of the term “Standard precautions” in the laboratory setting.
(0.5 marks per correct point)
- C.47 a. Describe the safety precautions to be considered to prepare a laboratory for a potential earthquake.
(0.5 marks per correct point)
(1.5 marks)
- b. Describe emergency procedures taken in the laboratory in the event of an earthquake.
(0.5 marks per correct point)
(1 mark)
C.47: 2.5 marks)
- C.48 Name three (3) commonly used laboratory bench wash disinfectants used in the laboratory.
(0.5 marks per correct answer)
(C.48: 1.5 marks)
- C.49 Describe the concept of cultural competency as it relates to medical laboratory science in New Zealand.
(0.5 marks per correct point)
(C.49: 2 marks)
- C.50 Distinguish between the Medical Sciences Council of New Zealand and the New Zealand Institute of Medical Laboratory Science.
(0.5 marks per correct point)
(C.50: 2.5 marks)

C.51 For effective anti-viral precautions, hand sanitiser should contain, which of the following minimum percentage of alcohol?

- a. 20%
- b. 60%
- c. 50%
- d. 35%

(C.49: 0.5 marks)

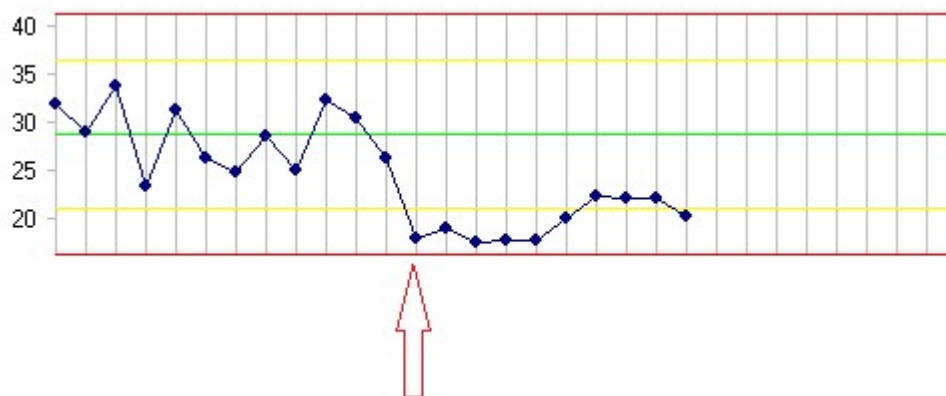
Discipline Specific Questions:

D.52 Outline two (2) functions of a virus capsid.

(C.52: 1 mark)

D.53 The following Levey-Jennings plot represents a single lot of in-house QC material tested each day an assay is run on an automated chemiluminescence platform.

Indicate the most likely reason for the shift seen on the day pointed out by the red arrow.



(C.53: 1 mark)

D.54 An add-on request is received for complement C3 and C4 testing on a serum sample that was collected three days ago. The sample has since been stored in the fridge since receipt in the laboratory.

Can this test be reliably performed on this sample? Discuss your answer.

(C.54: 2 marks)

D.55 The Bordetella pertussis toxin IgG ELISA test kit includes positive and negative controls with manufacturer defined acceptance limits. Once the serum samples to be tested have been diluted in sample buffer, the next step in the method is to add 100uL of the provided neat controls, neat standards and then diluted patient sera to the ELISA test wells.

State why it is important for an in-house control to be included when running an ELISA test such as the example above.

(D.55: 2 marks)

D.56 Outline the principle of an ELISA test and provide one specific example of a commercially available ELISA test.

(D.56: 3 marks)

D.57 Define the difference between direct and indirect agglutination and provide an example of a laboratory test based on each of these principles.

(D.57: 3 marks)

D.58 Name and distinguish between two methodologies currently used to detect anti-neutrophil cytoplasmic antibodies (ANCA).

(D.58: 3 marks)

D.59 Identify two (2) key structural differences between gram positive and gram negative bacteria and provide one example of each type of bacteria.

(D.59: 3 marks)

D.60 Identify three (3) serology tests used to diagnose syphilis and distinguish between them by their methodologies and whether they are Treponemal or non-Treponemal.

(D.60: 3 marks)

D.61 Distinguish between the functions of primary and secondary lymphoid organs.

List two (2) primary and two (2) secondary lymphoid organs of the human body.

(D.61: 4 marks)

Section E: Total 35 marks

SECTION F
Essay Questions

Discipline Specific Questions D.62 – D.63 = 20 marks

Total Marks = 20 marks

Discipline Specific Questions:

D.62 In essay format, describe the disease Multiple Myeloma and discuss the roles of the tests used to detect and quantitate monoclonal proteins.

(D.62: 10 marks)

D.63 In essay format, describe the principle of operation of the absorbance plate spectrophotometer as used in the Immunology laboratory.

Describe how and why quality control of the instrument is performed.

(D.63: 10 marks)

Section F: 20 marks