NAMIBIA UNIVERSITY
OF SCIENCE AND TECHNOLOGY

FACULTY OF HEALTH, APPLIED SCIENCES AND NATURAL RECOURCES

DEPARTMENT OF HEALTH SCIENCES

QUALIFICATION: BACHELOR OF MEDICAL LABORATORY SCIENCES	
QUALIFICATION CODE: 08BMLS	**LEVEL: 6**
COURSE CODE: HAM621S	**COURSE NAME:** HAEMATOLOGY 2B
SESSION: JANUARY 2023	**PAPER:** THEORY
DURATION: 3 HOURS	**MARKS:** 100

SUPPLEMENTARY / SECOND OPPORTUNITY EXAMINATION PAPER	
EXAMINER(S)	**DR MAURICE NYAMBUYA**
MODERATOR:	**DR ELZABE VAN DER COLF**

INSTRUCTIONS
1. Answer ALL the questions. 2. Write clearly and neatly. 3. Number the answers clearly.

PERMISSIBLE MATERIALS

1. Pen
2. Calculator

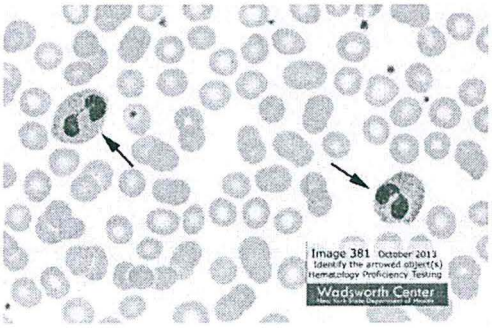
THIS QUESTION PAPER CONSISTS OF 8 PAGES (including this front page)

SECTION A [50]

QUESTION 1 [20]

Select one correct answer to each questions below.

1.1 The following white cells would be described as:



(a) Multi nucleated normoblast which could indicate megaloblastic anaemia
(b) Neutrophils which are undergoing apoptosis
(c) Pelger-huet neutrophils which could be found in myelodysplasia
(d) Left shifted neutrophils found in bacterial infections (1)

1.2 In a case of acute leukaemia the blasts had strong non-specific esterase positivity. Which of the following is the most likely phenotype?

(a) CD2+, CD7+, CD34+
(b) CD13+, CD14+, CD34+
(c) CD13+, CD19+, CD10+
(d) CD2+, CD103+, TdT+ (1)

1.3 Neutrophils which are seen in acute infections would have the following characteristics:

(a) Hypersegmentation, large granules and dohle bodies
(b) Toxic granulation, hypersegmented nuclei and blue cytoplasm
(c) Toxic granulation, bi-lobed nuclei and chediak-higashi granules
(d) Dohle bodies, vacuolation of the cytoplasm and toxic granulation (1)

1.4 Which of the following groups of disorders could cause a neutrophillia

(a) Felty's syndrome, May-heggelin anomaly, malignancy and infection
(b) Megaloblastic anaemia, inflammation, drugs, burns and infection
(c) Drugs, inflammation, localized bacterial infections and metabolic disorders
(d) Bacterial infections, burns, aplastic anaemia and inflammation (1)

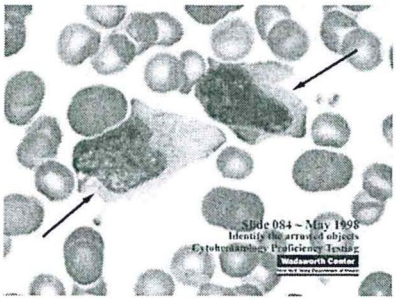
1.5 The following results were obtained on a sample of blood analysed in the haematology laboratory. White cell count: 6.3 x 10^9/l, Neutrophils: 28%, Band cells: 33%, metamyelocytes 8%, lymphocytes: 25%, Monocytes: 6 %. How would you describe this blood picture?

(a) Leukaemoid reaction
(b) Left shift
(c) Leucoerythroblastic blood picture
(d) Granulocytosis (1)

1.6 A hypercellular bone marrow with an M:E ratio of 1:10 indicates:

(a) Decreased erythropoiesis
(b) Increased erythropoiesis
(c) Increased myelopoiesis
(d) Decreased myelopoiesis (1)

1.7 A 14-year-old patient with flu-like symptoms and lymphadenopathy presents with an absolute lymphocytosis, slightly increased white cells, normal haemoglobin and cells which have the following morphology:



Which of the following conditions are these cells suggestive of:

(a) A viral infection
(b) Di-George syndrome
(c) A bacterial infection
(d) A parasitic infection (1)

1.8 Which one of the following is a correct explanation of epigenetics?

(a) Genes which regulate the rate at which cells divide and die
(b) Genes which regulate the process of transcription
(c) The heritable changes in gene expression due to the chemical composition of the DNA

(d) The inactivation of certain genes due to mutations which lead to increased proliferation and decreased apoptosis (1)

1.9 Which of the following described a chromosomal deletion?

(a) Point mutation resulting in a single aminoacid substitution
(b) Transfer of genetic material from one chromosome to another
(c) Loss of genetic material from a chromosome that does not appear on another chromosome
(d) Duplication of a chromosome resulting in an increase of genetic material (1)

1.10 A patient has a platelet count of 1000 x 10^9/l. The platelets are abnormal in size, shape and granularity. The white cell count is 12 x 10^9/l and the haemoglobin in 11g/dl. There is no Philadelphia chromosome. Which of the following is the most likely diagnosis?

(a) Chronic Myeloid leukaemia
(b) Polycythaemia Vera
(c) Essential Thrombocythaemia
(d) Myelofibrosis (1)

1.11 Acute leukaemias are often associated with which of the following?

(a) Bleeding
(b) Tiredness
(c) Bruising
(d) All of the above (1)

1.12 The following surface marker results were obtained with lymphocytes from a 21-year-old-man with a lymphocytosis of 16 × 10^9/L. Percentage of peripheral lymphocytes reactive with antisera to: Kappa = 6%; Lambda = 4%; CD19 = 10%; CD11c = 0%; T cells = 81%; CD56 (NK cells) = 6%. Which ONE is the most likely diagnosis?

(a) Infectious mononucleosis
(b) 5q syndrome
(c) Chronic myelomonocytic leukaemia
(d) Sepsis (1)

1.13 A 35-year-old man presented with weakness, lassitude and feeling easily tired. Her bone marrow aspirate showed 15% myeloblasts and reduced erythropoiesis. What is the most likely cause?

(a) Acute myeloid leukaemia
(b) Acute lymphoid leukaemia
(c) Myelodysplastic syndrome
(d) Myelofibrosis (1)

1.14 Döhle bodies are patches of dilated endoplasmic reticulum that appear as cerulean blue cytoplasmic puddles and are mostly seen in___.

(a) Chronic myeloid leukaemia
(b) Leukemoid reaction
(c) Chediak higashi syndrome
(d) Infectious mononucleosis (1)

1.15 A subtype M3 is associated with which of the following gene translocation.

(a) t(15;17)
(b) t(8;21)
(c) t(16;16)
(d) t(9;22) (1)

Determine whether the following statements are True or False. Only select the correct letter (a/b) corresponding to your answer.

1.16 Terminal deoxynucleotidyl transferase (Tdt) is a surface protein marker of mature B cells.

(a) True
(b) False (1)

1.17 Secondary immune deficiencies are rarely due to medicinal treatments.

(a) True
(b) False (1)

1.18 Coulter's principle or cell impedance method uses fluorochromes to count cells.

(a) True
(b) False (1)

1.19 In a leukemoid reaction, the NAP/LAP score is usually high.

(a) True
(b) False (1)

1.20 Lymphocytosis is characterised by lymphocyte count of >3.5 x10^9/L.

(a) True
(b) False (1)

QUESTION 2 [30]

A 28-year-old woman had a sore throat, fever and generalised lymphadenopathy. The Doctor took blood samples and sent them to the laboratory for analysis and the initial results were as follows.

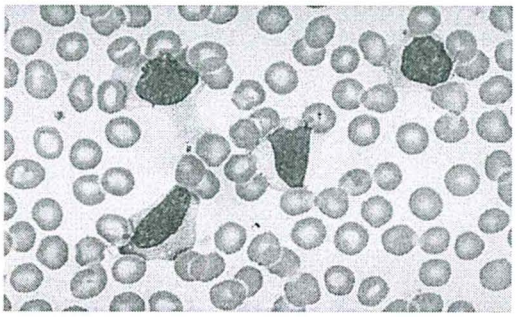
White cell count	14.0 x 10^9/l
Haemoglobin	12.1g/dl
Platelets	201 x 10^9/l
Neutrophils	39%
Lymphocytes	52%
Monocytes	5%
Band cells	2%
Eosinophils	2%

The granulocyte morphology was normal and acute leukaemia was ruled out. The lymphocytes were however atypical and flow cytometry was requested

2.1 Calculate the absolute lymphocyte count and comment on the result. (2)

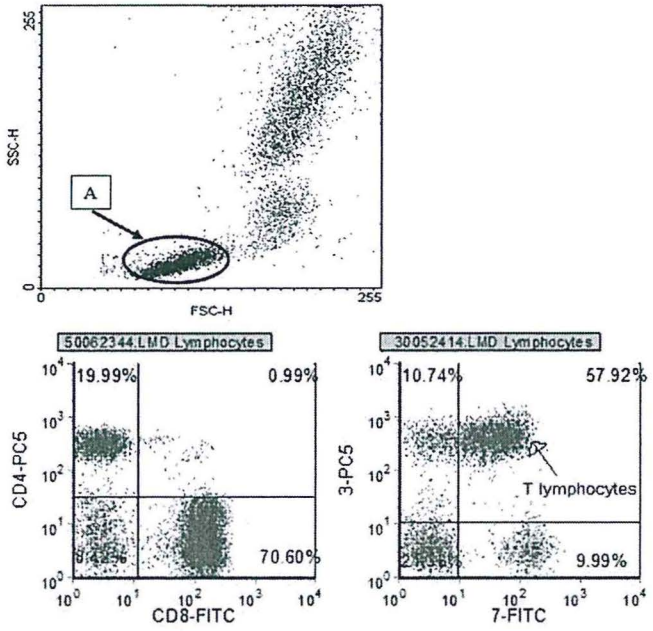
2.2 What is the normal range for lymphocytes in both an adult female and 6 month old baby (2)

2.3 The following is a picture of the abnormal lymphocytes in the peripheral blood.



Describe the appearance of these cells and considering the initial clinical and laboratory results, name the cells and suggest a possible diagnosis. (5)

2.4 The following pictures are representative of the flow cytometry results.



2.4.1 The cells labelled **A** were gated for analysis using forward and side scatter. Explain the purpose and principle of gating. (5)

2.4.2 Using your knowledge of forward and side scatter, and the morphological properties of cells. Explain in your own words why the laboratory scientist has selected the cells in gate A. (5)

2.4.3 Examine the flow cytometric dot plots and write down the immunophenotype of the majority of cells in the gate labelled A. (4)

2.4.4 Name the cells which make up the majority of cells in the gate labelled A. (2)

2.5 Briefly explain the principle of a flow cytometer. (5)

SECTION B [50]

QUESTION 3 [20]

3.1 Briefly describe the effects of the HIV virus on all haematological parameters including the full blood count, peripheral blood and other parameters.

Explain why these occur. (6)

3.2 What peripheral blood morphological features should the Laboratory Scientist look for in order to determine whether granulocytosis is due to a reactive or infective process rather than a haemopoietic malignancy or leukaemia? (5)

3.3 Explain the morphological differences between a blast and a promyelocyte. (4)

3.4 Name two disorders in which Pseudo-Pelger Huet cells could be seen. (2)

3.5 Name the three phases of carcinogenesis. (3)

QUESTION 4 [30]

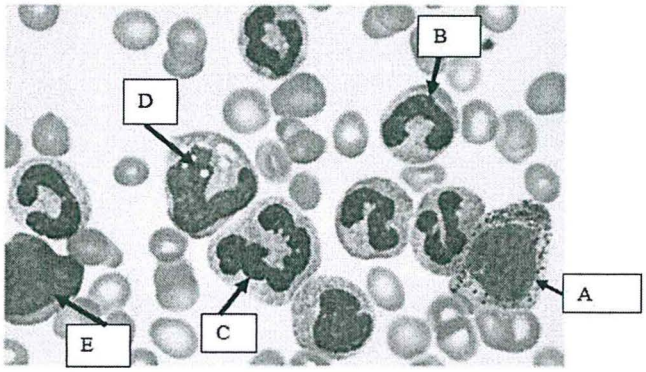
4.1 List 6 categories in which the World Health Organisation (WHO) classified myelodysplastic syndrome into. (6)

4.2 Of the MDS classification you have listed above, which category is most likely to progress into acute myeloid leukaemia. Motivate your answer. (4)

4.3 Discuss the pathogenesis, clinical findings as well as laboratory results of chronic myelomonocytic leukaemia (CMML). (12)

4.4 What disorder is CMML classified as according to the WHO? Explain the rationale behind this classification. (3)

4.5 Identify the cells labeled A-E below. (5)



End of Examination

Total Marks: [100]