

Instrumentation

1. List normal reference range for the following CBC and differential parameters.

WBC-	% Neutrophil-
RBC-	% Lymphocyte -
Hemoglobin-	% Monocyte -
Hematocrit -	% Eosinophil-
MCV -	% Basophil -
MCH-	
MCHC -	
RDW-CV-	
PLT -	
Reticulocyte-	

2. Blood Cells

Type of Cell	Function	Site of Production
RBCs(Erythrocytes)		
Granulocytes		
Lymphocytes		
Platelets		

3. Normal leukocytes of peripheral blood

- 1.
- 2.
- 3.
- 4.
- 5.

4. Define the following terms

- a. Leukocytosis-
- b. Leukocytopenia-
- c. Thrombocytosis

d. Thrombocytopenia

e. Anisocytosis

f. Poikilocytosis

g. Polychromasia

5. Define the following quantitative abnormality of leukocytes

h. Neutrophilia-

i. Neutropenia-

j. Cyclic neutropenia-

k. Lymphocytosis

l. Lymphopenia

m. Monocytosis

n. Eosinophilia

o. Basophilia

6. How to calculate an absolute value of differential parameters. (List the formula)

7. Calculate absolute values.

1. WBC count- 14.8 k/uL

% value

Neutrophil 55

Lymphocyte 25

Absolute value

Monocyte	10	_____
Eosinophil	5	_____
Basophil	5	_____

2. WBC count- 10.3 k/uL

% value		Absolute value
Neutrophil	55	_____
Lymphocyte	25	_____
Monocyte	10	_____
Eosinophil	5	_____
Basophil	5	_____

8. Manual hemoglobin determination

- a. Method-
- b. Reagents used-
- c. The process to convert cyanmethemoglobin-
- d. Which hemoglobin is not measured by this method?
- e. Falsely high results-
- f. Erroneous results-

9. Manual hematocrit determination

- a. Centrifugation time and speed-
- b. Definition-
- c. Falsely high results-
- d. Falsely low results-

10. RBC Indices.

- g. MCV:
 - i. Formula-

ii. Reference ranges-

iii. Definition-

h. MCH

i. Formula-

ii. Reference ranges-

iii. Definition-

i. MCHC

i. Formula

ii. Reference ranges-

iii. Definition-

11. Calculate indices for the followings.

a. RBC- 1.96

Hgb- 13.9

HCT- 40.4

MCV

MCH

MCHC

b. RBC- 5.21

Hgb-7.1

HCT- 23.4

MVC

MCH

MCHC

c. RBC- 5.21

Hgb- 13.9

HCT- 40.4

MCV

MCH

MCHC

d. RBC- 3.97

Hgb- 13.7

HCT- 33.6

MCV

MCH

MCHC

12. Rule of three

j. How do you apply the “rule of three”

k. According to rule of three, determine if the patient have an acceptable range for the hematocrit.

Hemoglobin g/dL	Hematocrit %	Hematocrit acceptable Yes/No?
8.2	27.9	
11.3	43.5	
8.0	26.0	
12.0	24.0	
13.6	31.9	

13. The formula to obtain corrected WBC in presence of nRBCs?

14. Calculate the following WBC counts for the nRBCs interference.

Analyzer WBC k/uL	# of NRBCs present / 100 WBC counted	Corrected WBC count
6.89	12	
5.44	9	
25.0	25	
39.5	59	
15.8	33	

15. How do you calculate absolute reticulocyte count? (List the formula)

16. Calculate the absolute retic count for the following patients.

RBC count from analyzer	Retic%	Absolute value
2.70	9.96	
5.59	16.8	
3.78	22.8	
4.25	5.08	
4.53	11.2	

17. Manual white blood cell count

- a. Diluent-
- b. Dilution factor-
- c. Area counted-
- d. Formula-

18. Manual platelet count

- a. Diluent-
- b. Dilution factor-
- c. Area counted-
- d. Formula-

19. Reticulocyte count

- a. Define-
- b. Are they considered fully mature cells once in peripheral blood? *No*
- c. How long do they spend in marrow and blood circulation before transforming into mature cell?
- d. Mostly used to assess?
- e. Anticoagulant used?
- f. Manual retic count
 - i. Stain-
 - ii. What does this stain detect?

iii. Formula-

g. Hemoglobin content of reticulocytes-

20. What is the formula to calculate the corrected retic count? Using this formula perform the calculations for the following patients.

Patient	Retic %	Hematocrit	Corrected retic count
1	12.2	23.7	
2	9.4	26.8	
3	11.2	19.9	
4	8.5	28.4	
5	10.5	29.7	

21. What information is used to determine the appropriate correction factor (reticulocyte maturation time in days)?

a. List the correction factor for the followings patient's value.

Patient's hematocrit value (%)	Correction factor(maturation time in days)
40-45	
35-29	
25-34	
15-24	
<15	

22. What is the formula to calculate reticulocyte production index? Using this formula perform the calculations for the following patients.

Retic count	Hematocrit%	Reticulocyte production index
7.8	29	
9.2	33	
10.2	15	
4.2	41	
12.5	28	

23. Erythrocytes Sedimentation Rate(ESR)

a. What does it measures? Is it specific or non-specific test?

b. Clinical Significance-

c. Falsely decreased ESR

d. Falsely elevated ESR

24. Wright Stain and smear making

Problem	How do you fix it?
Smear too thick/thin	
Smear too long/short	
Holes in the slide	

Some of the areas of smear flakes off during staining	
Macroscopically the smear looks blue	
Grainy appearance macroscopically	
Bluish RBCs	
Bright red RBCs, pale nuclei in WBCs	
Precipitate	
No platelets seen	
Platelets surrounding neutrophils	

25. Changes in blood at room temperature

- a. MCV-
- b. MCHC-
- c. Hematocrit-
- d. ESR-
- e. WBC morphology-

26. Interfering factors on most automated hematology analyzers

Condition	Effect	Affected Parameter(s)	Resolution
Marked increased WBCs			

Cold agglutinins			
Nucleated RBCs			
Lipemia			
Hemolysis			
Platelet clumps, significant increased of giant platelets or satellitism			
Significant increased of schistocytes or microcytes			

27. Hematology testing

- a. Specimen type-
- b. Anticoagulant-
- c. Unacceptable specimen-

28. Technique of making peripheral blood smear

29. The use of immature platelet fraction –

30. Hematology Analyzer Technology

- a. Electrical Impedance

I. How does it work?

II. What can this analysis provide and cannot distinguish?

III. How does three part differentials are determined?

b. Flow Cytometry

I. How does it work?

II. What can be determined from this analysis?

III. How does five part differentials are determined?

c. Fluorescent flow cytometry

I. How this analysis is useful?

31. Proprietary Technologies

I. Simens Advia -

II. Sysmex -

III. Abbott -

32. Forward scatter:

33. Side scatter

34. Different manufactures (most common ones) for hematology analyzers?

35. Automated analyzer(s) that calculate indices?

36. Describe how you would perform platelet estimate on a blood smear?

37. A platelet estimate is performed at 100x. After scanning 10 fields, the average number of platelets/field seen is 29 per field. What is the platelet estimate based on the scan?
38. A platelet estimate is performed at 100x. After scanning 10 fields, the average number of platelets/field seen is 2 per field. What is the platelet estimate based on the scan?
39. Alternative to platelet clumps in the blood smear?
40. Sysmex analyzer:
- a. How many reagents are used for the enumeration of nucleated RBCs? What are they?
41. How many histograms are there when using automated analyzer? What are they?
42. What is the shape of the histogram when RBCs are normal?
43. When histogram has shifted left or right of the mean, what does it indicate?
44. When WBC histogram is available?
45. What is the coulter principle?
- a. First step of the principle?
 - b. What happens after cells are pulled through an aperture?
46. Describe the following CBC results using the proper terminology.
- WBC- 15.8 k

RBC - 4.93

Hgb - 14.8

HCT- 45.1

MCV- 91.5

MCH- 30

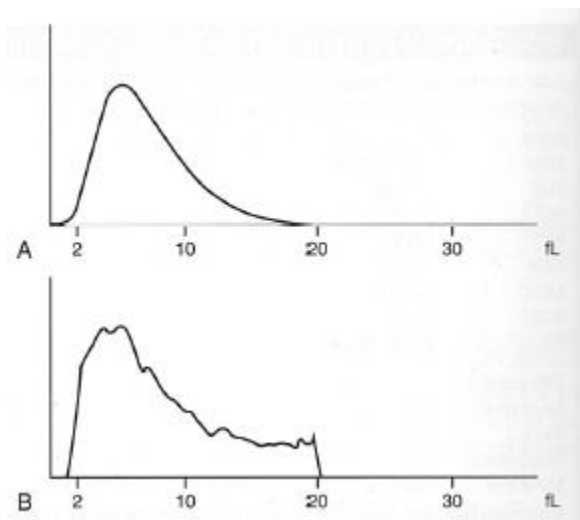
MCHC- 32.8

RDW- 14.2

PLT- 34

47. If an average of five white blood cells were observed per field using 50 oil immersion objective, what is the WBC estimate?

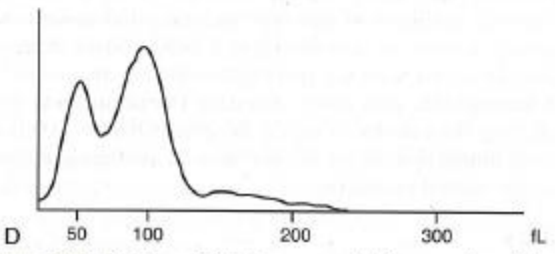
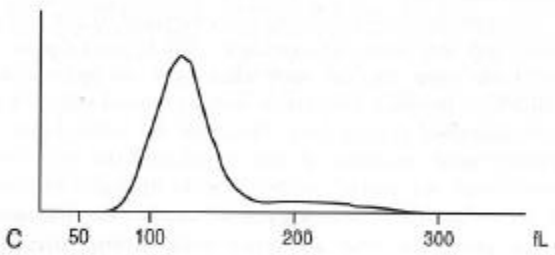
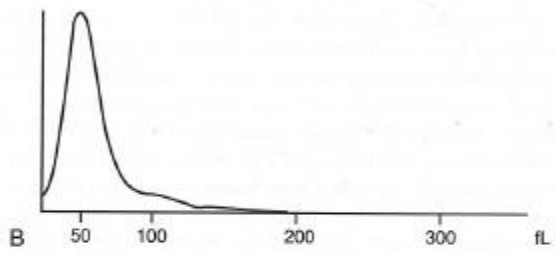
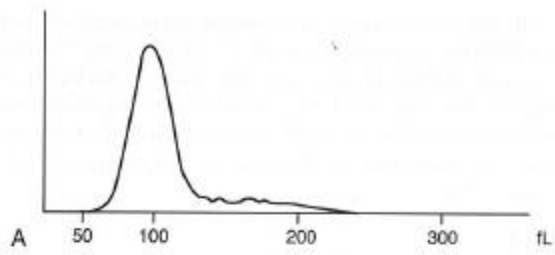
48. Interpret the following platelet histograms:



A:

B:

49. Interpret the following RBC histograms:



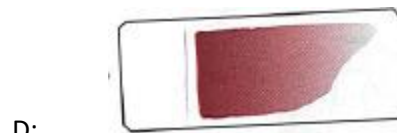
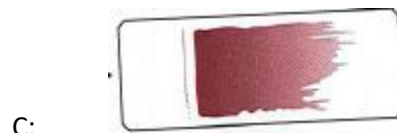
A:

B:

C:

D:

50. You received blood smears that looks just like the ones below, what change in technique you would consider to improve the films?



51. The reagent(s) used for hemoglobin by automated analyzer in general:

52. What is drabkin reagents used for and how does it works?

53. Hemoglobin not measured by cyanmethemoglobin method?