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NAME _____ LAB TIME/DATE _____

REVIEW SHEET
exercise
29A

Blood

Composition of Blood

1. What is the blood volume of an average-size adult male? *5–6* liters An average adult female? *4–5* liters

2. What determines whether blood is bright red or a dull brick-red? *Its degree of oxygenation. The more oxygen it carries, the brighter red it is.*

3. Use the key to identify the cell type(s) or blood elements that fit the following descriptive statements.

Key:
a. red blood cell
b. megakaryocyte
c. eosinophil
d. basophil
e. monocyte
f. neutrophil
g. lymphocyte
h. formed elements
i. plasma

f; neutrophil 1. most numerous leukocyte

c; eosinophil, *d; basophil*, and

f; neutrophil 2. granulocytes

a; red blood cell 3. also called an erythrocyte; anucleate formed element

e; monocyte, *f; neutrophil* 4. actively phagocytic leukocytes

e; monocyte, *g; lymphocyte* 5. agranulocytes

b; megakaryocyte 6. ancestral cell of platelets

h; formed elements 7. (a) through (g) are all examples of these

c; eosinophil 8. number rises during parasite infections

d; basophil 9. releases histamine; promotes inflammation

g; lymphocyte 10. many formed in lymphoid tissue

a; red blood cell 11. transports oxygen

i; plasma 12. primarily water, noncellular; the fluid matrix of blood

e; monocyte 13. increases in number during prolonged infections

c; eosinophil, *d; basophil*, *e; monocyte*,

f; neutrophil, *g; lymphocyte* 14. also called white blood cells

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4. List four classes of nutrients normally found in plasma: *sugar (e.g. glucose)*, *amino acids*, *lipids (fatty acids)*, and *vitamins*

Name two gases. *oxygen* and *carbon dioxide (nitrogen)*

Name three ions. Na^+, Cl^-, and $Mg^{2+}(HCO_3^-)$

5. Describe the consistency and color of the plasma you observed in the laboratory. *Viscous and sticky; straw-colored*

6. What is the average life span of a red blood cell? How does its anucleate condition affect this life span?

100–120 days. When the RBC's ATP reserves have been exhausted, the membrane begins to fragment. Without DNA to direct mRNA (therefore protein) synthesis, needed enzymes cannot be made.

7. From memory, describe the structural characteristics of each of the following blood cell types as accurately as possible, and note the percentage of each in the total white blood cell population.

eosinophils: *Large, red-staining cytoplasmic granules; figure 8 or bilobed nucleus; 1–4% of WBC.*

neutrophils: *Pale pink cytoplasm with fine granules; nucleus is multilobed and stains deep purple; 40–70% of WBC.*

lymphocytes: *Small cell with sparse pale blue cytoplasm and dark purple-staining spherical nucleus; 20–45% of WBC.*

basophils: *Sparse dark blue cytoplasmic granules; large U-shaped nucleus which stains dark blue; 0.5% or less of WBC.*

monocytes: *Abundant gray-blue cytoplasm, dark blue-purple nucleus (often kidney-shaped); 4–8% of WBC.*

8. Correctly identify the blood pathologies described in column A by matching them with selections from column B:

	Column A	Column B
b; leukocytosis	1. abnormal increase in the number of WBCs	a. anemia
d; polycythemia	2. abnormal increase in the number of RBCs	b. leukocytosis
a; anemia	3. condition of too few RBCs or of RBCs with hemoglobin deficiencies	c. leukopenia
c; leukopenia	4. abnormal decrease in the number of WBCs	d. polycythemia

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Hematologic Tests

9. Broadly speaking, why are hematologic studies of blood so important in the diagnosis of disease?

Specific changes from the normal numbers/types of formed elements and/or plasma constituents are characteristic of certain disease states.

10. In the chart below, record information from the blood tests you read about or conducted. Complete the chart by recording values for healthy male adults and indicating the significance of high or low values for each test.

Test	Student test results	Normal values (healthy male adults)	Significance	
			High values	Low values
Total WBC count	*No data*	*4000–11,000/mm^3*	*infectious process; leukemia*	*decreased body protection; may indicate chemical toxicity, agranulocytosis*
Total RBC count	*No data*	*$5 \times 10^6/mm^3$*	*polycythemia due to high altitude or pulmonary disease*	*anemia bone marrow cancer*
Hematocrit		*42–52 volume %*	*polycythemia hemoconcentration or abnormally large RBCs*	*anemia*
Hemoglobin determination		*13–18g/100 ml blood*	*polycythemia*	*anemia (particularly iron deficiency anemia)*
Bleeding time	*No data*	*2–7 min (Ivy) 0–5 min (Duke)*	*deficient or abnormal platelets*	*high platelet count*
Sedimentation rate		*0–6 mm/hr*	*nonspecific anemia, infection, tissue damage*	*abnormally shaped RBCs, polycythemia, and others*
Coagulation time		*3–6 min*	*hemophilia, leukemia, increased clotting time*	*thromboembolytic disorders*

11. Why is a differential WBC count more valuable than a total WBC count when trying to pin down the specific source of pathology? *A differential count determines the relative percent of each type of WBC. Increases or decreases in specific WBC populations are often indicative (diagnostic) of specific pathologies.*

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12. What name is given to the process of RBC production? *Erythropoiesis*

What hormone acts as a stimulus for this process? *Erythropietin*

What organ provides this stimulus and under what conditions? *The kidneys produce erythropoietin under conditions of low oxygen tension in the blood.*

13. Discuss the effect of each of the following factors on RBC count. Consult an appropriate reference as necessary, and explain your reasoning.

long-term effect of athletic training (for example, running 4 to 5 miles per day over a period of six to nine months)

Increases the RBC count. An athlete has relatively large muscle mass and needs an efficient oxygen delivery to the muscles when they are working.

a permanent move from sea level to a high-altitude area *Increased RBC count. The air is thinner at high altitudes and contains less O_2. The body compensates by producing more RBCs so that the same relative amount of O_2 can be picked up and transported by the blood.*

14. Define *hematocrit:* *Packed cell volume; volume percent of RBCs in 100 ml of blood.*

15. If you had a high hematocrit, would you expect your hemoglobin determination to be high or low? *High*

Why? *Assuming the RBCs have a normal hemoglobin content, the higher the RBC volume, the higher the hemoglobin determination.*

16. What is an anticoagulant? *A substance that inhibits blood clotting.*

Name two anticoagulants used in conducting the hematologic tests. *Heparin (in capillary tubes)* and *sodium citrate*

What is the body's natural anticoagulant? *Heparin*

17. If your blood clumped with both anti-A and anti-B sera, your ABO blood type would be *AB*

To what ABO blood groups could you give blood? *AB*

From which ABO donor types could you receive blood? *A, B, AB, O*

Which ABO blood type is most common? *O* Least common? *AB*

18. What blood type is theoretically considered the universal donor? O^- Why? *These RBCs have no A, B or Rh antigens on the cell membrane, reducing the chance of a transfusion reaction.*

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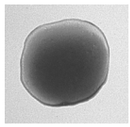
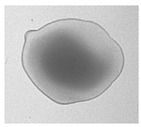
19. Assume the blood of two patients has been typed for ABO blood type.

Typing results
Mr. Adams:

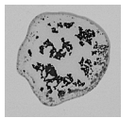


Blood drop and anti-A serum

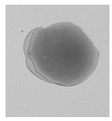


Blood drop and anti-B serum

Typing results
Mr. Calhoon:



Blood drop and anti-A serum



Blood drop and anti-B serum

On the basis of these results, Mr. Adams has type *O* blood, and Mr. Calhoon has type *A* blood.

20. Explain why an Rh-negative person does not have a transfusion reaction on the first exposure to Rh-positive blood but *does* have a reaction on the second exposure. *There are no preformed anti-Rh antibodies in his/her blood. Antibodies are formed after the first exposure to Rh^+ blood.*

What happens when an ABO blood type is mismatched for the first time? *A transfusion reaction occurs the first and every time.*

21. Record your observations of the five demonstration slides viewed.

a. Macrocytic hypochromic anemia: *RBCs are large and pale.*

b. Microcytic hypochromic anemia: *RBCs are small and pale.*

c. Sickle-cell anemia: *RBCs are crescent shaped.*

d. Lymphocytic leukemia (chronic): *Large number of small abnormal lymphocytes.*

e. Eosinophilia: *Increased number of eosinophils.*

Which of slides a through e above corresponds with the following conditions?

b 1. iron-deficient diet

d 2. a type of bone marrow cancer

c 3. genetic defect that causes hemoglobin to become sharp/spiky

a 4. lack of vitamin B_{12}

e 5. a tapeworm infestation in the body

b 6. a bleeding ulcer

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22. Provide the normal, or at least "desirable," range for plasma cholesterol concentration:

130–200 mg/100 ml

23. Describe the relationship between high blood cholesterol levels and cardiovascular diseases such as hypertension, heart attacks, and strokes.

High LDL levels favor cholesterol uptake and deposit in arteriosclerotic plaques, which, in turn: (1) narrow the vessel, reducing blood flow to more distal tissues, and (2) increase the risk of thrombus formation. Narrowing of blood vessels is one cause of hypertension. Attached thrombi or detached thrombi (emboli) are common causes of heart attack and stroke.