# Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Class \_\_\_\_\_\_\_

# **Blood Types WS**

Your blood is the vital link between your cells and the outside environment. Blood carries oxygen and digested nutrients to your cells. It carries away the waste materials that are produced by the cells. It helps keep your body at the right temperature and contains cells that play an important role in your body's fight against infections.

The blood is commonly "typed" according to the kinds of antigens on the surface of the red blood cells. There are 10 kinds of antigens in all-A antigens, B antigens, and 8 kinds of Rh antigens. Using only the

A and B antigens as a basis for classification, there are four types of blood:

Type A (the surface of the red blood cells have A antigens)

Type B (the surface of the red blood cells have B antigens)

Type AB (the surface of the red blood cells have both A and B antigens)

Type 0 (the surface of the red blood cells have neither A nor B antigens)

Using the Rh antigens as a basis for classification, there are two blood types:

Type Rh+ (the surface of the red cells have the type of Rh antigens that cause severe agglutination

reactions during blood transfusions)

Type Rh- (the surface of the red cells have the type of Rh antigens that do NOT cause severe

agglutination reactions during transfusions)

By combining the four blood types based on the A and B antigens with the two based on the Rh antigens, a

total of eight blood types are produced:

Type A, Rh+ Type B, Rh+ Type AB, Rh+ Type 0, Rh+

Type A, Rh- Type B, Rh- Type AB, Rh- Type 0, Rh-

Before a person can receive a blood transfusion, the medical specialist administering the transfusion must make certain that the blood of the one person (either blood donor or blood receiver) does not contain antibodies for antigens that are present in the other person's blood.

Forty-five percent (45%) of people have type 0 blood, 40% have type A, 12% have type B, and 3% have type AB. Eighty-five percent (85%) have type Rh+ and 15% have Rh-. This information is summarized below:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Blood Type** | **O** | **A** | **B** | **AB** | **Rh+** | **Rh-** |
| **% People Having This Blood Type** | **45%** | **40%** | **12%** | **3%** | **85%** | **15%** |

To determine the percent of people having type 0 who also have type Rh+, multiply the percents for each type together. For example, 45% of all people have type 0 blood. Of these, 85% have type Rh+. When we multiply 45% by 85%, we get 38.25%. Hence, 38.25% of the people have type 0 blood that is Rh+. The arthimetic may be easier for you to understand if you change the percents to decimals, multiply the decimals, and then change your answer to a percent:

Example:

0.45 x 0.85 = 0.3825

0.3825 x 100% = 38.25%

1. Determine how many people have each of the remaining seven types of blood fill out the following table.

Round the percents to the nearest half a percent. (The percents may add up to more or

less than 100 due to rounding.)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Blood Type** | **O+** | **O-** | **A+** | **A-** | **B+** | **B-** | **AB+** | **AB-** |
| **% of People With Blood Type** |  |  |  |  |  |  |  |  |

2. Using the percentages you found for question 1, use Microsoft Excel to make a pie graph. Provide a title

for your graph and label the %’s of the various sections in the graph. Staple the graph to this WS.

**BLOOD VOLUME**

The amount of blood in your body is related to your weight. The heavier you are, the greater the amount of blood in your body. A simple formula relates your weight and the volume of your blood:

V = 70W,

where V = the volume of your blood in milliliters and W = your weight in kilograms. (To calculate your weight in kilograms, divide your weight in pounds by 2.2)

3. Using the formula above, calculate the volume of blood in your body.

Calculations:

Answers:

Blood is made up of several substances. Red blood cells make up 44% of the total volume. Platelets and white blood cells make up 1% of the volume. Plasma makes up 55%.

4. Calculate the volume of each of the following in your blood:

A. Volume occupied by red blood cells –

B. Volume occupied by platelets and white blood cells -

C. Volume of the plasma -

# **INHERITANCE OF BLOOD TYPES**

Geneticists probably know more about blood types than any other inherited human trait. The four

basic blood types are determined by the presence or absence of the A and B antigens, which are proteins found on the surface of the red blood cells. For clarity, consider blood types as being determined by a single

pair of genes. The three alleles are A, B, and O. A and B are dominant to O and co-dominant to each other. Thus, type A blood may be homozygous AA or heterozygous AO. Type B blood may be homozygous BB or heterozygous BO. Type O blood must be homozygous OO, and type AB is a combination of A and B antigens, with the genotype AB, illustrating co-dominance.

Using the table provided, determine all possible genotypes of the parents, all possible genotypes of the children, all possible blood types of the children, and blood types not possible for their children.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Blood Types of Parents** | **Possible Genotypes of Parents** | **Possible Genotypes of Children** | **Possible Blood Types of Children** | **Impossible Blood Types of Children** |
| A and O |  |  |  |  |
| **B and O** |  |  |  |  |
| **A and B** |  |  |  |  |
| **AB and A** |  |  |  |  |
| **AB and B** |  |  |  |  |
| **AB and O** |  |  |  |  |
| **O and O** |  |  |  |  |

When giving blood transfusions, if the donor’s blood contains any antigens that are new to the recipient, the recipient’s immune system will attack and destroy the donated red blood cells causing the transfusion to be unsuccessful. In addition, blood can contain Rh factors, which were named Rh factors because they were first discovered in Rhesus monkeys. People whose blood contains Rh factors (Rh+) may receive blood from either Rh + or Rh- donors, but people whose blood does not contain Rh factors (Rh-) can only receive blood from Rh- donors because their body will attack blood containing Rh factors.

If the blood transfusion would be successful, put an S in the blank. If it would be unsuccessful, put a C in the blank.

### Recipient Donor Recipient Donor

\_\_\_\_\_ 1. A- B- \_\_\_\_\_ 2. O+ O-

\_\_\_\_\_ 3. AB- A- \_\_\_\_\_ 4. B- B+

\_\_\_\_\_ 5. B+ AB+ \_\_\_\_\_ 6. AB+ O+

#### USING GENETlCS TO HELP SOLVE MYSTERIES

Geneticists are often called upon to solve mysteries using some of the tools you have become familiar with in. this chapter. Using genetic clues, give a possible solution for each problem below. The person who typed the wristbands mixed up four newborn babies who were in the delivery room of the hospital at the same time. The blood types of the four babies were known to be AB, 0, A, and B. How did the doctors eventually find out which baby belongs to which set of parents? Parents #1 had blood types O and AB; Parents #2 had blood types AB and B; Parents #3 both had blood type 0; Parents #4 had blood types 0 and A.

Use Punnett squares to determine possible genotypes of offspring.

a. Baby with type AB blood \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

b. Baby with type B blood \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

c. Baby with type A blood \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

d. Baby with type 0 blood \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_