



# Sci-On<sup>®</sup> Biology

## S-50

EDVO-Kit #

### Why Do People Look Different?

**Storage:**

Store the entire experiment at  
room temperature.

#### EXPERIMENT CONTENT OBJECTIVE

The objectives of this experiment are for students to learn:

- basic concepts in Mendelian inheritance
- that hereditary information is contained in genes located on the chromosomes of cells
- how to analyze DNA fingerprints

All components are intended for educational research only. They are not to be used for diagnostic or drug purposes, nor administered to or consumed by humans or animals.

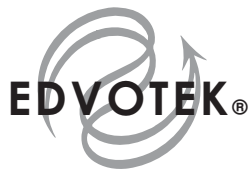


Table of Contents

Experiment Components	3
Experiment Requirements	3
Background and Introduction	4
Experiment Overview	6
Laboratory Safety	8
Activity One - Practice Gel Loading	9
Activity Two - Conducting Electrophoresis	12
Critical Thinking and Hypothesis Development	15
Study Questions	15

**INSTRUCTOR'S GUIDELINES**

Notes to the Instructor	15
Suggestions for Lesson Plan Content	16
Electrophoresis Analysis of Simulated DNA Samples	17
Connections to National Content Standards	18
Connections to National Skills Standards	19
Preparations for the Experiment	20
Notes Regarding Electrophoresis	28
Experiment Results and Analysis	29
Answers to Study Questions	30
Material Safety Data Sheets	31

All experiment components are intended for educational research only. They are not to be used for diagnostic or drug purposes, nor administered to or consumed by humans or animals.



## Why Do People Look Different?

### Experiment Components

**Storage:**

Store this experiment at room temperature.

This experiment is designed for 10 groups.

**Contents**

- A Mother's Simulated DNA sample
- B Father's Simulated DNA sample
- C Child #1 Simulated DNA sample
- D Child #2 Simulated DNA sample
- E Child #3 Simulated DNA sample
- F Child #4 Simulated DNA sample

UltraSpec-Agarose™  
50x Electrophoresis Buffer  
Practice Gel Loading Solution  
Transfer Pipets for Gel Loading

None of the experiment components have been prepared from human sources. Simulated DNA samples are non-toxic, water-based dyes.

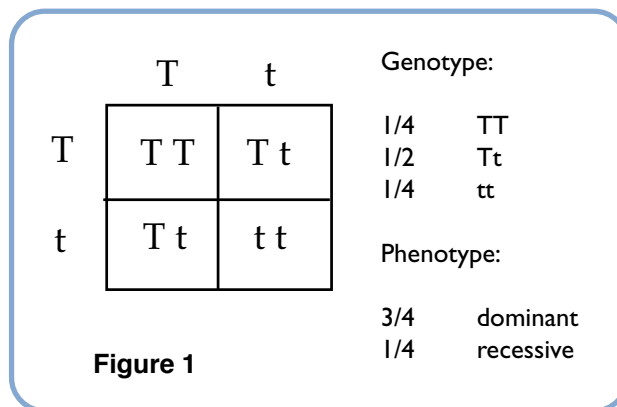
### Experiment Requirements

**Experiment Requirements**

- Electrophoresis Apparatus, M-12 or equivalent
- D.C. Power Supply
- Heat Source
- 500 ml Beaker or Flask
- Hot Gloves
- Distilled Water (used to make buffer solutions)
- Balance
- Automatic Micropipet and tips (optional)

## Background and Introduction

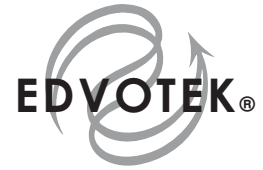
Human genetics follows the basic findings of Augustine monk Gregor Mendel, who studied plant genetics in the mid-1800's. Mendelian genetics predicts traits inherited by offspring and is based on the inheritance of two alleles of a gene. These two alleles are inherited one from each parent.



Alleles, and corresponding traits, can be either dominant or recessive. When a dominant allele is inherited, the trait coded by that allele will be expressed in the offspring. The presence of a dominant allele will, in effect, mask the trait coded by the recessive allele. To observe the recessive trait, it is required that both parental alleles be the recessive type. If both alleles are the same type, either both recessive or both dominant, the individual is said to be homozygous with respect to that trait. If an individual has one dominant and one recessive, the individual is said to be heterozygous for that trait.

Mendelian inheritance can be demonstrated with a 2 X 2 matrix, as shown in Figure 1. Parental alleles are placed on the sides of the matrix, and the genotype (what is genetically inherited) and phenotype (the way we look) of the offspring can be predicted. By convention, the dominant allele is denoted by an upper-case letter and the recessive allele by a lower-case letter. For example, assuming both parents each carry one dominant allele and one recessive allele, we can predict that 3/4 of their children will have the dominant phenotype and 1/4 of their children will have the recessive phenotype. Genotypically, 1/4 of the children will carry two dominant alleles, 1/2 of the children will carry one dominant and one recessive allele, and 1/4 will carry two recessive alleles.

Of course, these are only estimates of what is expected and actual observations may be different. If there are a large number of offspring from two parents, as in the case of insects or plants, actual observations come very close to what is estimated.



## Why Do People Look Different?

### Background and Introduction

Some traits are easy to observe in offspring. In plants, they include pigmentation, plant height, seed coat color, and seed texture. In animals, they include coat color, hair texture, dwarfism, and size of certain body parts, such as wings. Eye color in humans is commonly used as an example to demonstrate that brown eyes are dominant and blue eyes are recessive.

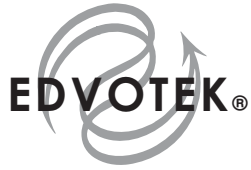
Various genetic traits can be analyzed by DNA analysis. DNA is digested with special proteins called restriction enzymes, which are like little molecular scissors that cut up DNA at specific sites into various sized fragments. These fragments are subjected to agarose gel electrophoresis, a process that is utilized for the analysis of DNA.



In this experiment, DNA is represented by various dyes. The DNA (dyes) that have been fragmented by restriction enzymes are separated in an agarose gel that is placed in an electrical field (electrophoresis). The DNA fragments (dyes) travel through the agarose pores, with smaller fragments snaking their way through the gel faster than the larger fragments. After electrophoresis, the DNA is stained, detected, and analyzed, but in this experiment the dyes representing DNA can be directly visualized without staining.

Every person has a unique fragment pattern but each fragment in an individual's pattern must match a fragment in at least one of the parents. The pattern of these fragments are called a DNA Fingerprint. Often individual genetic traits such as genetic diseases and the predisposition for certain diseases are determined by the mobility of specific DNA fragments that are identified to be associated with a particular trait. A procedure known as Polymerase Chain Reaction (PCR) also makes it possible to determine differences in DNA.

In this experiment, simulated DNA samples (various dyes representing DNA) from two brown-eyed parents and their children will be separated by agarose gel electrophoresis. The object will be to detect the alleles that are inherited by the children. In reality, the genetics of eye colors is quite complicated, but to simplify the discussion, we will use eye color as the trait to be analyzed. Brown will be dominant and blue will be recessive. One should remember that the brown and blue eye colors can represent genes that determine whether an individual will have a disease, or be a carrier of one (have a recessive gene). Examples of genetic diseases include cystic fibrosis, Huntington's Disease (a form of muscular dystrophy), and many types of cancer.



## Experiment Overview

### BEFORE YOU START THE EXPERIMENT

1. Read all instructions before starting the experiment.
2. Write a hypothesis that reflects the experiment and predict experimental outcomes.

### EXPERIMENT CONTENT OBJECTIVE

The objectives of this experiment are to learn:

- basic concepts in Mendelian inheritance
- that hereditary information is contained in genes located on the chromosomes of cells
- how to analyze DNA fingerprints

### WORKING HYPOTHESIS

If a child receives one of the two alleles from each parent, then a DNA fingerprint analysis of blood from mother, father, and child should prove this.

### MATERIALS FOR THE EXPERIMENT

Each Lab Group should have the following materials:

#### Activity One

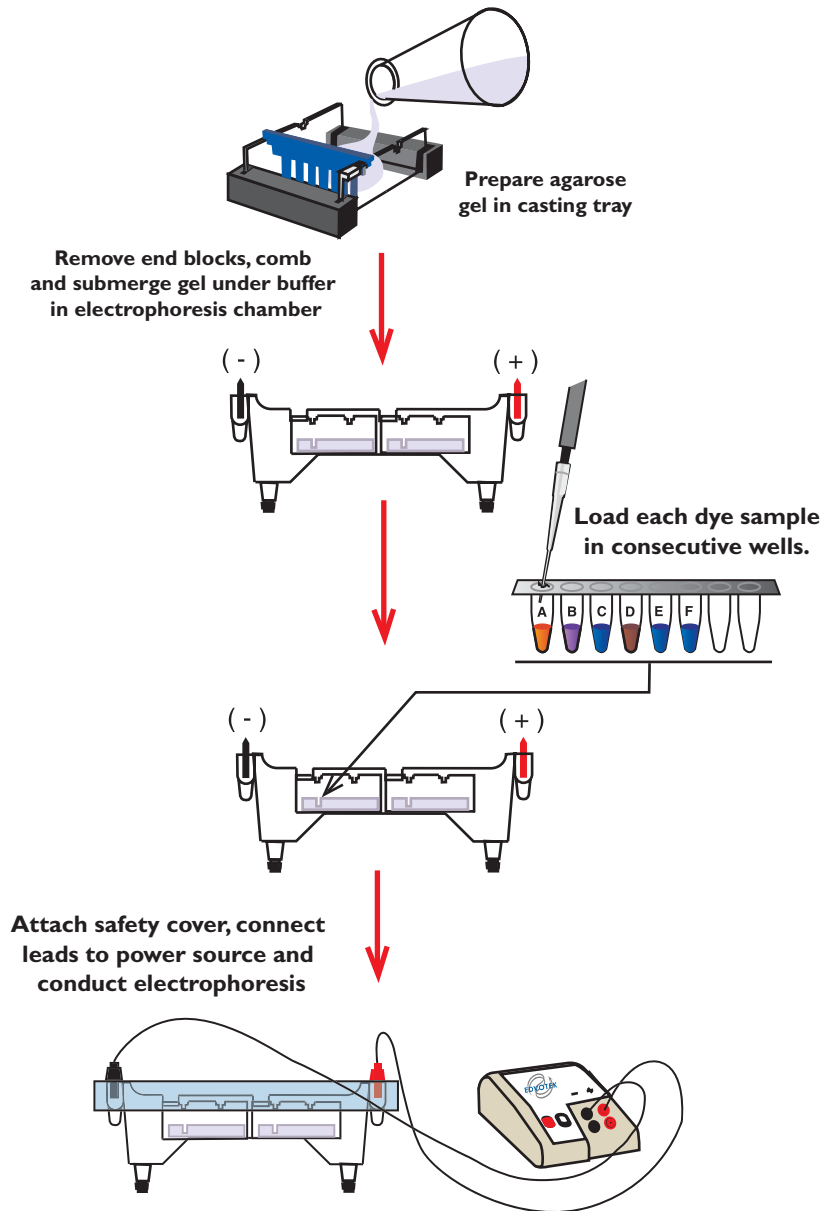
- Electrophoresis Buffer
- Practice gel loading sample
- Sample delivery instrument  
Automatic micropipet and tips, or  
Transfer pipet and beaker of distilled water

#### Activity Two

- Agarose gel
- Electrophoresis apparatus
- DC power source
- Dye Samples (A - F) representing DNA
- Sample delivery instrument  
Automatic micropipet and tips, or  
Transfer pipet and beaker of distilled water

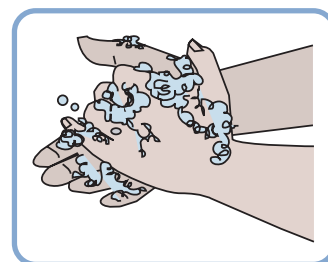
## Why Do People Look Different?

### Experiment Overview



**Laboratory Safety**

1. Gloves and goggles should be worn routinely as good laboratory practice.
2. Exercise extreme caution when working with equipment that is used in conjunction with the heating and/or melting of reagents.
3. DO NOT MOUTH PIPET REAGENTS - USE PIPET PUMPS.
4. Exercise caution when using any electrical equipment in the laboratory.
  - Although electrical current from the power source is automatically disrupted when the cover is removed from the apparatus, first turn off the power, then unplug the power source before disconnecting the leads and removing the cover.
  - Turn off power and unplug the equipment when not in use.
5. EDVOTEK injection-molded electrophoresis units do not have glued junctions that can develop potential leaks. However, in the unlikely event that a leak develops in any electrophoresis apparatus you are using, IMMEDIATELY SHUT OFF POWER. Do not use the apparatus.
6. Always wash hands thoroughly with soap and water after handling reagents or biological materials in the laboratory.



## Why Do People Look Different?

### Activity One - Practice Gel Loading

Accurate sample delivery technique ensures the best possible gel results. Pipeting mistakes can cause the sample to become diluted with buffer, or cause damage to the wells with the pipet tip while loading the gel.

If you are unfamiliar with loading samples in agarose gels, it is recommended that you practice sample delivery techniques before conducting the actual experiment. EDVOTEK electrophoresis experiments contain a tube of practice gel loading solution for this purpose. Casting of a separate practice gel is highly recommended. One suggested activity is outlined below:

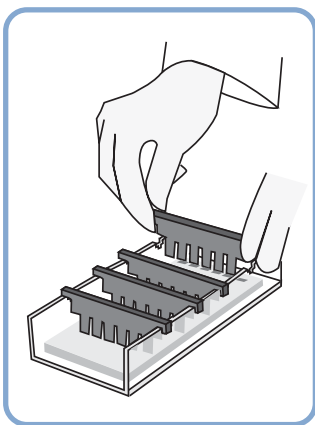
1. Cast a gel with the maximum number of wells possible.
2. After the gel solidifies, place it under buffer in an electrophoresis apparatus chamber.

Alternatively, your teacher may have cut the gel in sections between the rows of wells. Place a gel section with wells into a small, shallow tray and submerge it under buffer or water.

**Note:** The agarose gel is sometimes called a "submarine gel" because it is submerged under buffer for sample loading and electrophoretic separation.

3. Practice delivering the practice gel loading solution to the sample wells. Take care not to damage or puncture the wells with the pipet tip.
  - For electrophoresis of dyes, load the sample well with 35-38 microliters of sample.
  - If using transfer pipets for sample delivery, load each sample well until it is full.
4. If you need more practice, remove the practice gel loading solution by squirting buffer into the wells with a transfer pipet.
5. Replace the practice gel with a fresh gel for the actual experiment.

**Note:** If practicing gel loading in the electrophoresis chamber, the practice gel loading solution will become diluted in the buffer in the apparatus. It will not interfere with the experiment, so it is not necessary to prepare fresh buffer.



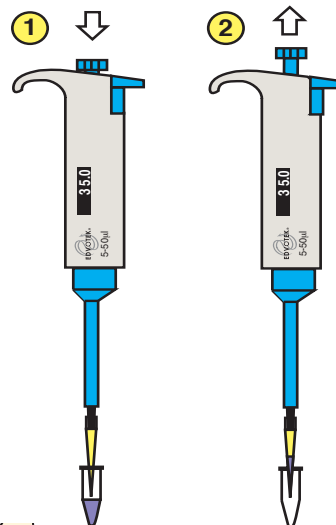
Activity One - Practice Gel Loading

**SAMPLE DELIVERY WITH VARIABLE AUTOMATIC MICROPIPETS:**

1. Set the micropipet to the appropriate volume and place a clean tip on the micropipet.

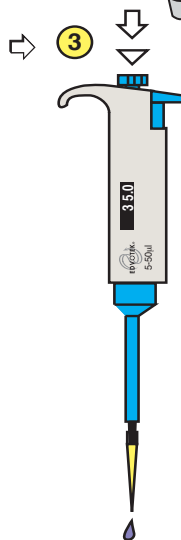
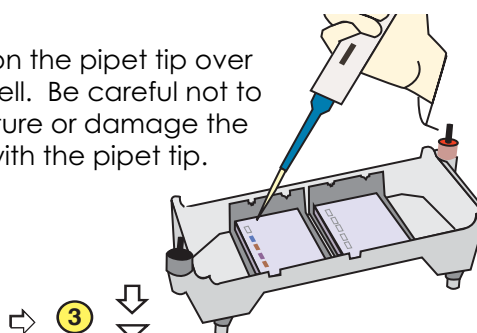
Press the top button down to the first stop. then immerse the tip into the sample.

2. Once the tip is immersed in the sample, release the button slowly to draw sample into the tip.

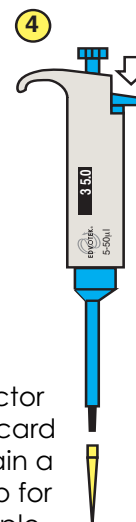


3A. Position the pipet tip over the well. Be careful not to puncture or damage the well with the pipet tip.

3B. Deliver the sample by pressing the button to the first stop - then empty the entire contents of the tip by pressing to the second stop.



3C. After delivering the sample, do not release the top button until the tip is out of the buffer.



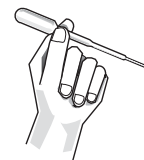
4. Press the ejector button to discard the tip. Obtain a new clean tip for the next sample.

**Why Do People Look Different?****Activity One - Practice Gel Loading****SAMPLE DELIVERY WITH PLASTIC TRANSFER PIPETS:**

1. Gently squeeze the pipet stem to slowly draw the sample up into the pipet. The sample should remain in the lower portion of the pipet.

If the sample is overdrawn and becomes lodged in the bulb or on the walls, tap until the sample moves down into the lower stem of the pipet. Eject it back into the tube. Try step 1 again.

To control the delivery of small sample volumes with transfer pipets, gently squeeze the pipet stem, instead of the bulb.



2. While holding the pipet tip above the sample tube, slowly squeeze until the sample is nearly at the opening of the pipet tip.
3. Place the pipet tip in the electrophoresis buffer so it is directly above barely inside the sample well.

Avoid placing the pipet tip all the way inside the well - this will minimize the chances of inadvertently piercing the bottom of the well.

4. MAINTAIN STEADY PRESSURE on the pipet stem to prevent buffer from being drawn in and diluting the sample.
5. Slowly squeeze to eject the sample. Stop squeezing when the well is completely full. Put any remaining sample in the pipet back into the sample tube.
6. Rinse the pipet with distilled water before obtaining the next sample for gel loading.

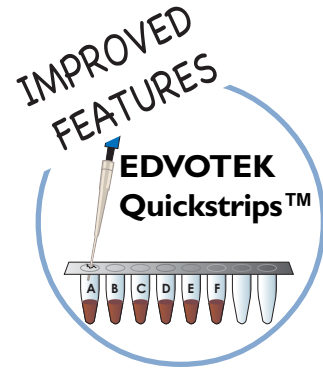
Activity Two - Conducting Agarose Gel Electrophoresis

**ELECTROPHORESIS SAMPLES**

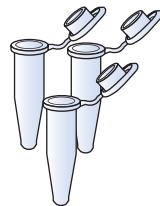
Samples in EDVOTEK Series 100 and S-series electrophoresis experiments are packaged in one of two different formats:

1. Pre-aliquoted Quickstrip™ connected tubes (new format)

To remove samples from the Quickstrip™ tubes, simply pierce the foil top with the micropipet tip and withdraw the sample.

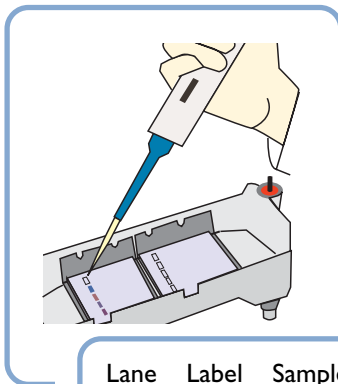


Quickstrips patent pending



2. Individual 1.5 ml or 0.5 ml microtest tubes

Your instructor may have aliquoted these into a set of sample tubes for each lab group. Alternatively, you may be required to withdraw the appropriate amount from the experiment stock tubes.



**LOADING THE SAMPLES**

1. Check the Sample Volumes

Sometimes a small amount of sample will cling to the walls of the tubes. Make sure the entire volume of sample is at the the bottom of the tubes before starting to load the gel.

- If your samples are in Quickstrip™ connected tubes, tap the foil top of the strip so samples fall to the bottom of the tubes.
- If your samples are in individual 1.5 ml or 0.5 ml microtest tubes, briefly centrifuge the sample tubes, or tap each tube on the tabletop to get all the sample to the bottom of the tube.

2. Load Samples

Load each of the dye samples in tubes A - F into the wells in consecutive order. The amount of sample that should be loaded is 35-38 µl.

Lane	Label	Sample
1	A	Mother's DNA Sample
2	B	Father's DNA sample
3	C	Child 1 DNA sample
4	D	Child 2 DNA sample
5	E	Child 3 DNA sample
6	F	Child 4 DNA sample

## Why Do People Look Different?

### Activity Two - Conducting Agarose Gel Electrophoresis

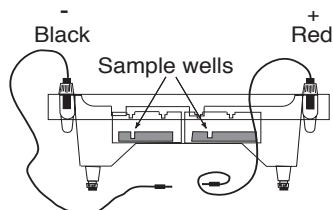
#### RUNNING THE GEL

- After the samples are loaded, carefully snap the cover down onto the electrode terminals.

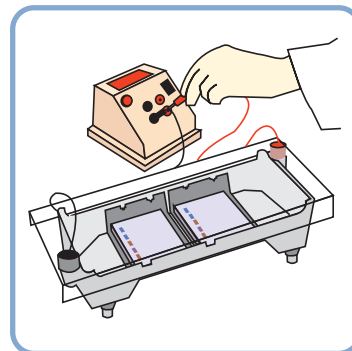
Make sure that the negative and positive color-coded indicators on the cover and apparatus chamber are properly oriented.

#### Reminders:

During electrophoresis, the samples will migrate through the agarose gel towards the positive electrode. Before loading the samples, make sure the gel is properly oriented in the apparatus chamber.



- Insert the plug of the black wire into the black input of the power source (negative input). Insert the plug of the red wire into the red input of the power source (positive input).
- Set the power source at the required voltage and conduct electrophoresis for the length of time determined by your instructor. General guidelines are presented in Table C.
- Check to see that current is flowing properly - you should see bubbles forming on the two platinum electrodes.



**Table C** Time and Voltage

#### Electrophoresis of Dyes

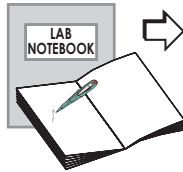
Volts	Recommended Time
125	20 min
70	45 min
50	1 hr 30 min

- After approximately 10 minutes, you will begin to see separation of the colored dyes.
- After the electrophoresis is completed, turn off the power, unplug the power source, disconnect the leads and remove the cover.
- Document the gel results.

A variety of documentation methods can be used, including drawing a picture of the gel, taking a photograph, or scanning an image of the gel on a flatbed scanner.

**Staining is not required for Experiment # S-50, but results must be analyzed upon completion of the electrophoretic separation. Because dye molecules are extremely small they will diffuse out of the gel. Therefore, the gel cannot be saved.**

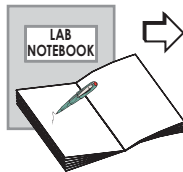
**Critical Thinking and Hypothesis Development**



Record the following in your Laboratory Notebook or on a separate sheet of paper:


1. Based on the evidence obtained from analysis of the gel, which child belongs to the mother and father? Explain.
2. What is the variable in this experiment?
3. What would you change in the experiment if you had to do it over again?
4. Write a hypothesis that would reflect these changes.

**Study Questions**




Record the answers to the following Study Questions in your Laboratory Notebook or on a separate sheet of paper, as instructed by your teacher:


1. Define genotype.
2. Define phenotype.
3. Define homozygous.
4. Define heterozygous.
5. Using B for the brown allele and b for the blue allele, what is the genotype of the parents? Using the genotypes, create a 2 X 2 matrix to predict the phenotypes of the children.
6. For all four children, what are their genotypes?
7. From the gel, can you determine the eye color of the grandparents?
8. If two blue-eyed people had a child, what would you predict the eye color of the child to be? Demonstrate this with a 2 X 2 matrix.

 <b>Material Safety Data Sheet</b> May be used to comply with OSHA's Hazard Communication Standard. 29 CFR 1910.1200 Standard must be consulted for specific requirements.			
IDENTITY (As Used on Label and List) Agarose			
Note: Blank spaces are not permitted. If any item is not applicable, or no information is available, the space must be marked to indicate that.			
<b>Section I</b>			
Manufacturer's Name <b>EDVOTEK, Inc.</b> Address (Number, Street, City, State, Zip Code) <b>14676 Rothgeb Drive          Rockville, MD 20850</b>	Emergency Telephone Number <b>(301) 251-5990</b> Telephone Number for information <b>(301) 251-5990</b> Date Prepared 07/01/03 Signature of Preparer (optional)		
<b>Section II - Hazardous Ingredients/Identify Information</b>			
Hazardous Components [Specific Chemical Identity: Common Name(s)] OSHA PEL ACGIH TLV Other Limits Recommended % (Optional)			
This product contains no hazardous materials as defined by the OSHA Hazard Communication Standard. CAS #9012-36-6			
<b>Section III - Physical/Chemical Characteristics</b>			
Boiling Point For 1% solution	194° F	Specific Gravity (H <sub>2</sub> O = 1)	No data
Vapor Pressure (mm Hg.)	No data	Melting Point	No data
Vapor Density (AIR = 1)	No data	Evaporation Rate (Butyl Acetate = 1)	No data
Solubility in Water Insoluble - cold		Appearance and Odor White powder, no odor	
<b>Section IV - Physical/Chemical Characteristics</b> N.D. = No data			
Flash Point (Method Used)	No data	Flammable Limits	LEL N.D. UEL N.D.
Extinguishing Media Water spray, dry chemical, carbon dioxide, halon or standard foam			
Special Fire Fighting Procedures Possible fire hazard when exposed to heat or flame			
Unusual Fire and Explosion Hazards None			


<b>Section V - Reactivity Data</b>			
Stability	Unstable		Conditions to Avoid
	Stable	X	None
Incompatibility No data available			
Hazardous Decomposition or Byproducts			
Hazardous Polymerization	May Occur		Conditions to Avoid
	Will Not Occur	X	None
<b>Section VI - Health Hazard Data</b>			
Route(s) of Entry: Inhalation? Yes Skin? Yes Ingestion? Yes			
Health Hazards (Acute and Chronic) Inhalation: No data available Ingestion: Large amounts may cause diarrhea			
Carcinogenicity: NTP? IARC Monographs? OSHA Regulation?			
Signs and Symptoms of Exposure No data available			
Medical Conditions Generally Aggravated by Exposure No data available			
Emergency First Aid Procedures Treat symptomatically and supportively			
<b>Section VII - Precautions for Safe Handling and Use</b>			
Steps to be Taken in case Material is Released for Spilled Sweep up and place in suitable container for disposal			
Waste Disposal Method Normal solid waste disposal			
Precautions to be Taken in Handling and Storing None			
Other Precautions None			
<b>Section VIII - Control Measures</b>			
Respiratory Protection (Specify Type) Chemical cartridge respirator with full facepiece.			
Ventilation	Local Exhaust		Special
	Mechanical (General)	Gen. dilution ventilation	Other
Protective Gloves	Yes	Eye Protection	Splash proof goggles
Other Protective Clothing or Equipment Impervious clothing to prevent skin contact			
Work/Hygienic Practices None			

 <b>Material Safety Data Sheet</b> May be used to comply with OSHA's Hazard Communication Standard. 29 CFR 1910.1200 Standard must be consulted for specific requirements.			
IDENTITY (As Used on Label and List) 50x Electrophoresis Buffer			
Note: Blank spaces are not permitted. If any item is not applicable, or no information is available, the space must be marked to indicate that.			
<b>Section I</b>			
Manufacturer's Name <b>EDVOTEK, Inc.</b> Address (Number, Street, City, State, Zip Code) <b>14676 Rothgeb Drive          Rockville, MD 20850</b>	Emergency Telephone Number <b>(301) 251-5990</b> Telephone Number for information <b>(301) 251-5990</b> Date Prepared 07/01/03 Signature of Preparer (optional)		
<b>Section II - Hazardous Ingredients/Identify Information</b>			
Hazardous Components [Specific Chemical Identity: Common Name(s)] OSHA PEL ACGIH TLV Other Limits Recommended % (Optional)			
This product contains no hazardous materials as defined by the OSHA Hazard Communication Standard.			
<b>Section III - Physical/Chemical Characteristics</b>			
Boiling Point	No data	Specific Gravity (H <sub>2</sub> O = 1)	No data
Vapor Pressure (mm Hg.)	No data	Melting Point	No data
Vapor Density (AIR = 1)	No data	Evaporation Rate (Butyl Acetate = 1)	No data
Solubility in Water Appreciable, (greater than 10%)		Appearance and Odor Clear, liquid, slight vinegar odor	
<b>Section IV - Physical/Chemical Characteristics</b> N.D. = No data			
Flash Point (Method Used)	No data	Flammable Limits	LEL N.D. UEL N.D.
Extinguishing Media Use extinguishing media appropriate for surrounding fire.			
Special Fire Fighting Procedures Wear protective equipment and SCBA with full facepiece operated in positive pressure mode.			
Unusual Fire and Explosion Hazards None identified			

<b>Section V - Reactivity Data</b>			
Stability	Unstable		Conditions to Avoid
	Stable	X	None
Incompatibility Strong oxidizing agents			
Hazardous Decomposition or Byproducts Carbon monoxide, Carbon dioxide			
Hazardous Polymerization	May Occur		Conditions to Avoid
	Will Not Occur	X	None
<b>Section VI - Health Hazard Data</b>			
Route(s) of Entry: Inhalation? Yes Skin? Yes Ingestion?			
Health Hazards (Acute and Chronic) None			
Carcinogenicity: None identified NTP? IARC Monographs? OSHA Regulation?			
Signs and Symptoms of Exposure Irritation to upper respiratory tract, skin, eyes			
Medical Conditions Generally Aggravated by Exposure None			
Emergency First Aid Procedures Ingestion: If conscious, give large amounts of water Eyes: Flush with water Inhalation: Move to fresh air Skin: Wash with soap and water			
<b>Section VII - Precautions for Safe Handling and Use</b>			
Steps to be Taken in case Material is Released for Spilled Wear suitable protective clothing. Mop up spill and rinse with water, or collect in absorptive material and dispose of the absorptive material.			
Waste Disposal Method Dispose in accordance with all applicable federal, state, and local environmental regulations.			
Precautions to be Taken in Handling and Storing Avoid eye and skin contact.			
Other Precautions None			
<b>Section VIII - Control Measures</b>			
Respiratory Protection (Specify Type)			
Ventilation	Local Exhaust	Yes	Special None
	Mechanical (General)	Yes	Other None
Protective Gloves	Yes	Eye Protection	Safety goggles
Other Protective Clothing or Equipment None			
Work/Hygienic Practices None			

 <b>Material Safety Data Sheet</b> May be used to comply with OSHA's Hazard Communication Standard. 29 CFR 1910.1200 Standard must be consulted for specific requirements.			
IDENTITY (As Used on Label and List)		Note: Blank spaces are not permitted. If any item is not applicable, or no information is available, the space must be marked to indicate that.	
<b>Practice Gel Loading Solution</b>			
<b>Section I</b>			
Manufacturer's Name		Emergency Telephone Number	
EDVOTEK, Inc.		(301) 251-5990	
Address (Number, Street, City, State, Zip Code)		Telephone Number for information	
14676 Rothgeb Drive		(301) 251-5990	
Rockville, MD 20850		Date Prepared 07/01/03	
		Signature of Preparer (optional)	
<b>Section II - Hazardous Ingredients/Identify Information</b>			
Hazardous Components [Specific Chemical Identity; Common Name(s)] OSHA PEL ACGIH TLV Other Limits Recommended % (Optional)			
This product contains no hazardous materials as defined by the OSHA Hazard Communication Standard.			
<b>Section III - Physical/Chemical Characteristics</b>			
Boiling Point	No data	Specific Gravity (H <sub>2</sub> O = 1)	No data
Vapor Pressure (mm Hg.)	No data	Melting Point	No data
Vapor Density (AIR = 1)	No data	Evaporation Rate (Butyl Acetate = 1)	No data
Solubility in Water Soluble			
Appearance and Odor Blue liquid, no odor			
<b>Section IV - Physical/Chemical Characteristics</b>			
Flash Point (Method Used)	No data	Flammable Limits	LEL No data UEL No data
Extinguishing Media Dry chemical, carbon dioxide, water spray or foam			
Special Fire Fighting Procedures Use agents suitable for type of surrounding fire. Keep upwind, avoid breathing hazardous sulfur oxides and bromides. Wear SCBA.			
Unusual Fire and Explosion Hazards Unknown			

<b>Section V - Reactivity Data</b>			
Stability	Unstable		Conditions to Avoid
	Stable	X	None
Incompatibility None			
Hazardous Decomposition or Byproducts Sulfur oxides, and bromides			
Hazardous Polymerization	May Occur		Conditions to Avoid
	Will Not Occur	X	None
<b>Section VI - Health Hazard Data</b>			
Route(s) of Entry: Inhalation? Yes Skin? Yes Ingestion? Yes			
Health Hazards (Acute and Chronic) Acute eye contact: May cause irritation. No data available for other routes.			
Carcinogenicity: No data available NTP? IARC Monographs? OSHA Regulation?			
Signs and Symptoms of Exposure May cause skin or eye irritation			
Medical Conditions Generally Aggravated by Exposure None reported			
Emergency First Aid Procedures Treat symptomatically and supportively. Rinse contacted area with copious amounts of water.			
<b>Section VII - Precautions for Safe Handling and Use</b>			
Steps to be Taken in case Material is Released for Spilled			
Wear eye and skin protection and mop spill area. Rinse with water.			
Waste Disposal Method Observe all federal, state, and local regulations.			
Precautions to be Taken in Handling and Storing Avoid eye and skin contact.			
Other Precautions None			
<b>Section VIII - Control Measures</b>			
Respiratory Protection (Specify Type)			
Ventilation	Local Exhaust	Yes	Special None
	Mechanical (General)	Yes	Other None
Protective Gloves	Yes	Eye Protection	Splash proof goggles
Other Protective Clothing or Equipment None required			
Work/Hygienic Practices Avoid eye and skin contact			

 <b>Material Safety Data Sheet</b> May be used to comply with OSHA's Hazard Communication Standard. 29 CFR 1910.1200 Standard must be consulted for specific requirements.			
IDENTITY (As Used on Label and List)		Note: Blank spaces are not permitted. If any item is not applicable, or no information is available, the space must be marked to indicate that.	
Xylene Cyanol			
<b>Section I</b>			
Manufacturer's Name		Emergency Telephone Number	
EDVOTEK, Inc.		(301) 251-5990	
Address (Number, Street, City, State, Zip Code)		Telephone Number for information	
14676 Rothgeb Drive		(301) 251-5990	
Rockville, MD 20850		Date Prepared 07/01/03	
		Signature of Preparer (optional)	
<b>Section II - Hazardous Ingredients/Identify Information</b>			
Hazardous Components [Specific Chemical Identity; Common Name(s)] OSHA PEL ACGIH TLV Other Limits Recommended % (Optional)			
This product contains no hazardous materials as defined by the OSHA Hazard Communication Standard. CAS # 2650-17-1			
<b>Section III - Physical/Chemical Characteristics</b>			
Boiling Point	No data	Specific Gravity (H <sub>2</sub> O = 1)	No data
Vapor Pressure (mm Hg.)	No data	Melting Point	N/A
Vapor Density (AIR = 1)	No data	Evaporation Rate (Butyl Acetate = 1)	No data
Solubility in Water Soluble			
Appearance and Odor _____ color, liquid, no odor			
<b>Section IV - Physical/Chemical Characteristics</b>			
Flash Point (Method Used)	No data	Flammable Limits	LEL No data UEL No data
Extinguishing Media N/A			
Special Fire Fighting Procedures N/A			
Unusual Fire and Explosion Hazards None			

<b>Section V - Reactivity Data</b>			
Stability	Unstable		Conditions to Avoid
	Stable	X	Unknown
Incompatibility None			
Hazardous Decomposition or Byproducts Sulfur oxides and bromides			
Hazardous Polymerization	May Occur		Conditions to Avoid
	Will Not Occur	X	None
<b>Section VI - Health Hazard Data</b>			
Route(s) of Entry: Inhalation? No Skin? Yes Ingestion? Yes			
Health Hazards (Acute and Chronic) Acute eye contact: may cause irritation			
Carcinogenicity: None NTP? No data IARC Monographs? No data OSHA Regulation? No			
Signs and Symptoms of Exposure May cause skin or eye irritation			
Medical Conditions Generally Aggravated by Exposure None reported			
Emergency First Aid Procedures Rinse contacted areas with copious amounts of water			
<b>Section VII - Precautions for Safe Handling and Use</b>			
Steps to be Taken in case Material is Released for Spilled			
Wear eye and skin protection and mop/wipe spill area. Rinse with water.			
Waste Disposal Method Can be disposed in the trash or down the sink			
Precautions to be Taken in Handling and Storing Avoid eye and skin contact			
Other Precautions None			
<b>Section VIII - Control Measures</b>			
Respiratory Protection (Specify Type) NIOSH/MSHA - approved respirator			
Ventilation	Local Exhaust	No	Special None
	Mechanical (General)	No	Other None
Protective Gloves	Yes	Eye Protection	Splash prof goggles
Other Protective Clothing or Equipment None required			
Work/Hygienic Practices Avoid eye and skin contact			



**Material Safety Data Sheet**  
 May be used to comply with OSHA's Hazard Communication Standard. 29 CFR 1910.1200 Standard must be consulted for specific requirements.

IDENTITY (As Used on Label and List)  
 R-40 Food dye

Note: Blank spaces are not permitted. If any item is not applicable, or no information is available, the space must be marked to indicate that.

**Section I**

Manufacturer's Name  
**EDVOTEK, Inc.**

Address (Number, Street, City, State, Zip Code)  
**14676 Rothgeb Drive  
 Rockville, MD 20850**

Emergency Telephone Number  
**(301) 251-5990**

Telephone Number for information  
**(301) 251-5990**

Date Prepared  
**07/01/03**

Signature of Preparer (optional)

**Section II - Hazardous Ingredients/Identify Information**

Hazardous Components [Specific Chemical Identity, Common Name(s)] OSHA PEL ACGIH TLV Other Limits Recommended % (Optional)

This product contains no hazardous materials as defined by the OSHA Hazard Communication Standard.

**Section III - Physical/Chemical Characteristics**

Boiling Point	No data	Specific Gravity (H <sub>2</sub> O = 1)	No data
Vapor Pressure (mm Hg.)	No data	Melting Point	N/A
Vapor Density (AIR = 1)	No data	Evaporation Rate (Butyl Acetate = 1)	No data
Solubility in Water	Soluble		
Appearance and Odor	Red color, liquid, no odor		

**Section IV - Physical/Chemical Characteristics**

Flash Point (Method Used)	No data	Flammable Limits	LEL No data	UEL No data
Extinguishing Media	N/A			
Special Fire Fighting Procedures	N/A			
Unusual Fire and Explosion Hazards	None			

**Section V - Reactivity Data**

Stability	Unstable		Conditions to Avoid
	Stable	X	Unknown
Incompatibility	None		
Hazardous Decomposition or Byproducts	Sulfur oxides and bromides		
Hazardous Polymerization	May Occur		Conditions to Avoid
	Will Not Occur	X	None

**Section VI - Health Hazard Data**

Route(s) of Entry: Inhalation? No Skin? Yes Ingestion? Yes

Health Hazards (Acute and Chronic) Acute eye contact: may cause irritation

Carcinogenicity: NTP? No data IARC Monographs? No data OSHA Regulation? No

Signs and Symptoms of Exposure May cause skin or eye irritation

Medical Conditions Generally Aggravated by Exposure None reported

Emergency First Aid Procedures Rinse contacted areas with copious amounts of water

**Section VII - Precautions for Safe Handling and Use**

Steps to be Taken in case Material is Released for Spilled  
 Wear eye and skin protection and mop/wipe spill area. Rinse with water.

Waste Disposal Method  
 Can be disposed in the trash or down the sink

Precautions to be Taken in Handling and Storing  
 Avoid eye and skin contact

Other Precautions  
 None

**Section VIII - Control Measures**

Respiratory Protection (Specify Type) NIOSH/MSHA - approved respirator

Ventilation	Local Exhaust	No	Special	None
	Mechanical (General)	No	Other	None

Protective Gloves Yes Eye Protection Splash prof goggles

Other Protective Clothing or Equipment None required

Work/Hygienic Practices Avoid eye and skin contact