Science and Technology—555-306

Secondary Cycle Two, Year One

June 2009

Doctors Unlimited
A Summer in Colombia

Theory Examination

Student Information Document

Doctors Unlimited is an international relief organization that provides medical help to people in different countries.

You are a volunteer with *Doctors Unlimited,* assisting in a rural health clinic in Colombia, South America.

In your first week, you are introduced to people who work in the clinic and they tell you about their situation.

"We do the best that we can here, but we have limited resources. Just last week, for example, we did not have enough blood in the blood banks for an injured farmer who needed a transfusion," explains Dr. Juanita Davalos.

Dr. Davalos tells you about some of her tasks at the health clinic, which include seeing patients and advising the Ministry of Health.

"I spend most of my time dealing with Chagas disease, a common disease in this area. Chagas disease can cause serious heart and stomach illnesses."

You will be helping Dr. Davalos with her various projects during your time in Colombia.

You have four tasks to complete. For each task, analyze the background information provided and answer the questions in your answer booklet.

Task 1: Fernando's fatigue

Fernando is a 15-year-old boy with Chagas disease. He is complaining that he feels tired all of the time.

People with Chagas disease can develop **cardiomyopathy**, an inflammation and thickening of the heart muscle. The heart muscle may also become more rigid. You suspect that the reason Fernando is feeling so tired is because he has developed cardiomyopathy.

Your task is to describe the functions of the circulatory and respiratory systems to Fernando. Then, explain to him how the cardiomyopathy may be affecting these systems and making him feel so tired.

Task 2: Fernando's Abdominal Pain

Fernando has an enlarged and painful abdomen that is caused by an inflammation of the large intestine (colon). The inflamed large intestine is a complication of Chagas disease.

Your task is to explain to Fernando how food is normally digested and absorbed within the digestive tract. Then, explain how an inflamed large intestine (colon) could interfere with digestion.

Task 3: A Blood Transfusion

Irene is another patient at the clinic. She is badly injured and will need a blood transfusion. Irene's blood type is A–. Dr. Davalos would like you to check the blood available from the National Blood Bank to see if it is possible for Irene to safely receive a blood transfusion.

Your task is to analyze the blood available in the blood bank and to explain whether it is possible for Irene to safely receive a transfusion.

Task 4: Money for Blood?

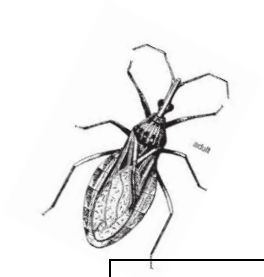
Blood banks cannot always keep up with the demand for blood. Shortages in the blood supply are a common problem in Colombia and many other countries. At least 5% of the world's population must donate blood to prevent shortages in blood supplies. However, only 1.4% of the world's population donates blood on a voluntary basis. Finding donors in some countries is made more difficult because people infected by diseases such as Chagas or hepatitis are not allowed to donate blood.

The Ministry of Health wants the opinion of doctors and other experts on how to increase the number of people who donate blood in the country.

The government is considering whether it should allow blood banks to ***pay*** blood donors. You have been asked to give your opinion on the issue.

Your task is to:

- Read the background information and newspaper articles provided.
- State the advantages and disadvantages of paying blood donors.
- State whether you are *for* or *against* allowing blood banks to pay for donors.
- Justify your opinion using arguments based on scientific and technological concepts and using arguments based on at least two different aspects presented in the documents provided.



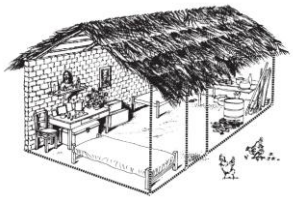
Chagas Disease Fact Sheet

What is Chagas Disease?

- A disease that occurs when humans are infected with the parasite *Trypanosoma cruzi*
- A disease spread by contact with an infected bug known as the “Kissing bug”
- A disease that can cause serious heart and stomach illness
- A disease that has killed more people than any other parasitic disease in the Americas

Who can get Chagas disease?

- Anyone can, but there is a greater risk for people living in rural areas of Mexico and Central or South America
- People living in houses with a thatched roof or walls that have cracks or crevices where the Kissing Bug can hide



How does someone get Chagas disease?

- Usually by being bitten by a Kissing Bug that is infected with the parasite that causes Chagas Disease
- The disease can also be spread through:
  - Mother to baby
  - Blood transfusion
  - Organ transplant

What are the Symptoms?

- A few weeks or months after people get bitten, they may have mild symptoms such as:
  - Fever and body aches
  - Swelling at the bite mark, which is usually the eye

- After this first stage of the illness, most people have no symptoms and many never get sick.
- Some people do get sick later, and they may have:
  - An enlarged heart and irregular heart beats
  - Problems with digestion and bowel movements
  - An increased chance of having a stroke

What tests can be done to diagnose Chagas disease?

- A blood smear can be examined under the microscope to check for the presence of the Chagas- causing parasite in the blood.

View of *Trypanosoma cruzi* parasites in the blood

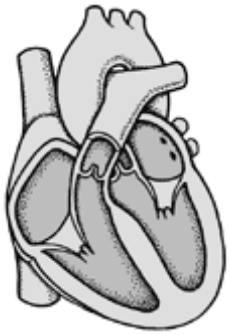
- The blood serum can be tested for the presence of antibodies that are formed in response to the Chagas-causing parasite.

Task 1: Fernando's Fatigue

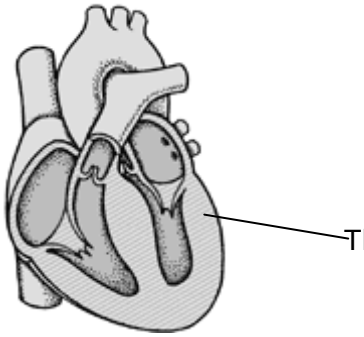
Cardiomyopathy

Cardiomyopathy is an inflammation and thickening of the heart muscle. The heart muscle may also become more rigid.

Normal Heart

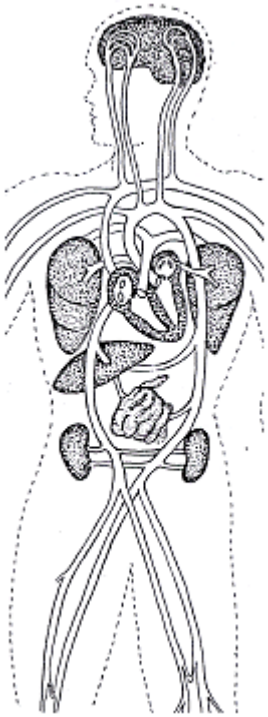


Cardiomyopathy



http://www.daviddarling.info/images/cardiomyopathy.gif

Circulatory System



Respiratory System

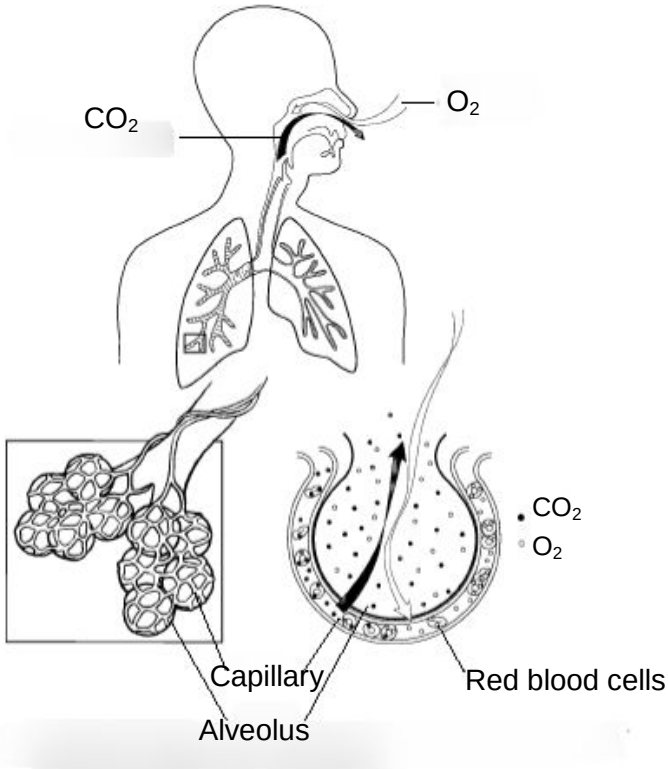
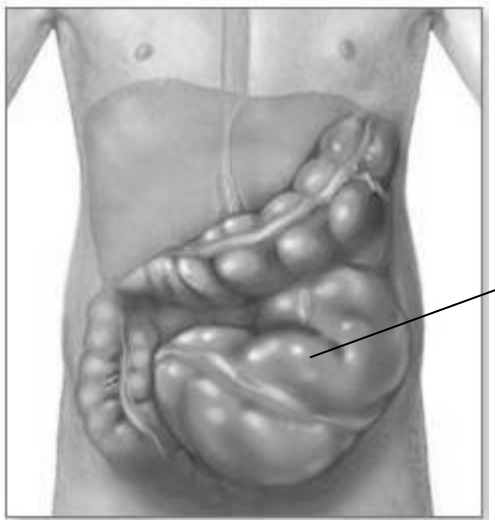


Diagram courtesy of National Heart, Lung, and Blood Institute

Task 2: Fernando's Abdominal Pain

An enlarged large intestine is a complication of Chagas disease.



- The enlarged colon is caused by a loss of the normal smooth muscle tone of the wall of the large intestine.

Task 3: A Blood Transfusion

Table of available blood types from the National Blood Bank.

TYPE	O^+	O^-	A^+	A-	B^+	B-	AB^+	AB-
Availability ☒/☑ No / Yes	☑	☑	☑	☒	☑	☑	☒	☑

Task 4: Money for blood?

Blood Donation in Colombia

Blood Donor Type	Definition	% of Donors (2002)
Replacement donors	Donors who give blood when someone in his/her family needs blood.	57
Paid donors	Donors who receive money for their blood donations	2
Voluntary, unpaid donors	Donors who give blood because they want to help fellow citizens	41

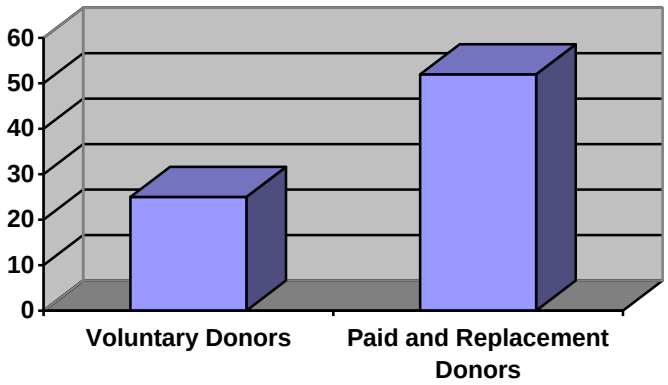
Blood Donation Facts

- One blood donation can save up to three lives.
- Donors are allowed to give blood every 8 weeks.
- A donor's blood components are replaced within three weeks.
- The number one reason voluntary donors say they give blood is that they "want to help others".
- Two most common reasons given for not donating blood are: "Never thought about it", and "I don't like needles".

Screening Blood for Diseases

- Donated blood should be screened for infections such as HIV, hepatitis, Chagas Disease.
- 31 out of 145 countries surveyed reported that they are not able to screen all donated blood for infections.

Number of donors per 10 000 infected with Chagas Disease



The Los Angeles Times

Blood Banks Consider Paying Donors

A national blood shortage is forcing some hospitals and blood banks to ask: Should we pay our blood donors?

Some blood bankers and doctors see “donor incentive programs” as the most practical response to decreasing blood supplies.

“Now that we’re seeing shortages and increased demands, I think we’ve got to consider paying donors. This might make it worth people’s while to come in to donate blood,” said Dr. Janice Nelson.

Many ethicists and health officials are against the idea, saying it could make the blood supply unsafe. They argue that paying donors would encourage them to lie about their medical or behavioural history, making it more likely for infectious diseases to enter the supply.

“The safest blood donor is the volunteer donor,” said Jackie Fredrick, a vice president with the Red Cross.

Supporters of for-pay programs argue that today’s blood testing is so advanced – screening for everything from Chagas to HIV – that the blood supply would stay safe.

The World News

Glad to Earn Cash for Blood

In some countries, blood-collecting centres pay money for blood, and many people, such as the farmer in the story below, are happy to earn cash for blood.

Every few weeks, the farmer goes into the nearest town to sell the one precious thing she has **–** her blood.

"I have sold my blood so many times I can't remember – about twice a month for the last three years," said the 36-year-old woman, with a wave of her hand. "I get about $10 for a bottle, and I'm using the money to pay for school fees for my three children."

Her situation reflects the desperation of many poor people in rural areas, where economic opportunities are few. Collection centers routinely take more blood than they should from the sellers, which makes them very weak and unable to live healthy lives.

In some countries, large profits can be made from the blood-selling business because of the demand for blood plasma from unscrupulous drug companies. Local officials are often financially involved in the blood-selling business and fail to enforce safety regulations, exposing donors to diseases.

The Hema Globe

Blood Donor Campaigns - a Success!

Blood collection agencies are finding new ways to get people to donate blood on a regular basis.

The Canadian Blood Services created a media campaign to promote voluntary blood donation. This campaign included a set of commercials to raise the awareness of the need for blood donation. Viewers were reminded that they might need blood someday. The campaign resulted in a 10% increase in new donors.

Teens are People Savers was another successful campaign. This campaign supported blood drives in high schools and colleges and encouraged blood donations by eligible students. Participating high schools and colleges were awarded grants for projects as well as scholarships. By the end of the campaign, donations by 17-and18-year olds had increased by 177%.

Competency 2
Makes the most of his/her knowledge of science & technology
Non-descriptive Scale

Evaluation Criteria	Observable Elements	Scale 5 4 3 2 1
Criterion 2 **Appropriate use of scientific concepts, laws, models and theories**	• Makes use of concepts related to tasks to be performed	
Criterion 3 **Relevant explanations or solutions**	• Provides appropriate explanations, related to the tasks to be performed, by using the concepts, models, laws, and theories of science and technology.	
Criterion 4 **Suitable justification of explanations, solutions, decisions or opinions**	• Provides justification for his/her opinion or decision based on the background information and scientific or technological principles. • Identifies realistic consequences related to their decisions.	
	Overall Evaluation	

Legend:
5. Advanced 4. Thorough 3. Acceptable 2. Partial 1. Minimal

Competency 3: Communicates in the Languages Used in Science and Technology
Non-descriptive Scale

Evaluation Criteria	Observable Elements	Scale 5 4 3 2 1
Criterion 1 **Accurate interpretation of scientific and technological messages**	• Selects and interprets the elements needed for the task	
Criterion 2 **Appropriate production or sharing of scientific and technological messages**	• Organizes the elements of his/her message and • Adapts message to target audience	
Criterion 3 **Use of appropriate scientific and technological terminology, rules and conventions**	• Uses scientific and technological terminology	
	Overall Evaluation	

Legend:
5. Advanced 4. Thorough 3. Acceptable 2. Partial 1. Minimal

Competency 2: Makes the most of his/her knowledge of science & technology

Observable Elements --- Evaluation Criteria	**Advanced 5**	**Thorough 4**	**Acceptable 3**	**Partial 2**	**Minimal 1**
Criterion 2 **Appropriate use of scientific concepts, laws, models and theories**	❑ Makes judicious use of concepts, which sometimes go beyond the requirements of the tasks to be performed	❑ Makes appropriate use of the main concepts related to tasks to be performed	❑ Makes use of some of the main concepts that are related to the tasks to be performed.	❑ Makes use of concepts that are partially related to the tasks to be performed.	❑ Makes use of concepts that are entirely inappropriate to the tasks to be performed
Criterion 3 **Relevant explanations or solutions**	❑ Provides clear and detailed explanations related to the tasks to be performed, using the concepts, models, laws, and theories of science and technology.	❑ Provides appropriate explanations, related to the tasks to be performed, by using concepts, models, laws, and theories of science and technology.	❑ Provides limited explanations related to the tasks to be performed by using concepts, models, laws, and theories of science and technology.	❑ Provides explanations that are sometimes incorrect or not very appropriate to the tasks to be performed	❑ Provides incoherent explanations that are unrelated to the task to be performed or does not provide explanations.
Criterion 4 **Suitable justification of explanations, solutions, decisions or opinions**	❑ Justifies and defends his/her opinion or solution clearly by going beyond the background information and the scientific or technological principles involved ❑ Identifies positive and negative consequences related to his/her decision.	❑ Justifies his/her opinion or solution based on at least two of the aspects in the background information as well as scientific or technological principles. ❑ Identifies realistic consequences related to his/her decision.	❑ Justifies his/her opinion or solution with arguments based in part on the different aspects in the background information as well as scientific or technological principles. ❑ Identifies secondary consequences related to his/her decision	❑ Justifies his/her opinion or decision by using arguments not related to background information and scientific or technological principles. ❑ Identifies consequences unrelated to his/her decision	❑ Presents an incoherent and unfounded justification or solution that does not take the background information into account. ❑ Does not identify consequences related to his/her decision

Competency 3: Communicates in the Languages Used in Science and Technology

Observable Elements --- Evaluation Criteria	**Advanced 5**	**Through 4**	**Acceptable 3**	**Partial 2**	**Minimal 1**
Criterion 1 **Accurate interpretation of scientific and technological messages**	❑ Rigorously selects and interprets all of the elements needed for the task, the selected elements are described in detail	❑ Selects and interprets the main elements needed for the task	❑ Selects and interprets some of the elements needed for the task	❑ Selects elements that are not very useful for the task	❑ Selects elements that are irrelevant to the task
Criterion 2 **Appropriate production or sharing of scientific and technological messages**	❑ Rigorously and coherently organizes the elements of his/her message ❑ Adapts message to target audience and clearly communicates it	❑ Correctly organizes the elements of his/her message ❑ Adapts message to target audience	❑ Organizes some of the elements of his/her message ❑ Partially adapts his/her message to target audience	❑ Lists the elements of the message without organizing them ❑ Does not adapt his/her message to target audience	❑ Lists an insufficient number of seemingly unrelated elements ❑ Does not adapt his/her message to target audience
Criterion 3 **Use of appropriate scientific and technological terminology, rules and conventions**	❑ Makes judicious and rigorous use of scientific and technological terminology, rules and conventions	❑ Uses appropriate scientific and technological terminology for all the concepts involved	❑ Uses scientific and technological terminology for the simplest concepts	❑ Uses basic terminology	❑ Uses inappropriate terminology