

1. Polymers are composed of quite a lot of (a) **molecule** all linked together to form (b) **really long chains**
2. Why is the word "monomer" the correct word to use when defining polymers?
Not all molecules have the ability to connect together to form long chains / Monomers have the ability to connect together
3. Give **one** example of a natural polymer from plants
One of the following: cellulose / starch / rubber
4. Which protein is the most widely available protein in the human body?
Collagen
5. What cause the creation of synthetic polymers? Give **one** reason.
One of the following: people's curiosity (They looked at those materials they wore or used and wondered what was going on, and why these materials acted the way they do / wanted to make the materials better) / the shortages
6. Why is there a number role given to each polymer?
for recycling purposes
7. Polyethylene terephthalate (PETE) is used in the production of
Two of the following: polyester fabrics / transparent sheets / beverage bottles / eyeglass lenses
8. What are **two** factors that make a difference between the production of HDPE and LDPE?
Any two of the following: pressure / temperature / chemicals used for catalysis
9. Polymer number 3 is called (a) **polyvinyl chloride** and it has chlorine atoms attached at the alternate carbon atoms. This polymer is commonly known as (b) **PVC**
10. Polymer Number 5 is a polypropylene and it is used a lot in the (a) **automotive** industry and (b) **food packaging / home furnishing**
11. Write the commercial names of the following polymers
Polytetrafluoroethylene → a. **teflon**
Polyamide → b. **nylon**
12. What is **one** negative aspect of synthetic polymers?
One of the following: A lot of garbage / obtained from petroleum (a limited, non-renewable resource)
13. What is **one** difficulty related with the recycling of polymers?
One of the following: There is a great variety of polymers / polymeric materials are only recycled once / the cost

Now listen.

Cansu: Hello, Professor Waller, may I come in?

Prof: Hello Cansu. Do come in please... Take a seat... How are you? Are you ready for your presentation?

Cansu: Well, almost. Although I can't pronounce some of the words that I will have to say!

Prof: Well, that happens. I'm sure you'll learn to pronounce them correctly. Right, then, let's look at what you've got. I'm sure by now you've learned what polymers are.

Cansu: Yes. Uhm... They are substances whose molecules have high molar masses and are composed of a large number of repeating units.

Prof: You may need to simplify that definition. Remember that not all of your friends are science students.

Cansu: Okay. How about this one? Polymers are substances which are made up of many many molecules all connected together to form really long chains.

Prof: Actually, the word 'molecule' is misleading. It's not the correct word to use. We use the words monomer, that's M-O-N-O-M-E-R, when talking about polymers.

Cansu: Really. Why is that? I thought a molecule and a monomer were the same thing.

Prof: Well, a monomer is a molecule, but we don't use this word when we're talking about polymers. We use the special name of 'monomer' rather than the word 'molecule' because monomers have the ability to join together. Not all molecules have this ability to connect together to form a chain. And when monomers join together, what they make is called a polymer. ... Now tell me, why do we hear about polymers so often?

Cansu: Because they are everywhere. I used to think that polymers were something that a genius scientist invented. Apparently they are not. There are natural polymers.

Prof: You're right. Polymers have been in nature since the beginning. All living things are made of polymers. DNA is a polymer itself. Have you got examples of natural polymers?

Cansu: Yes, I have. From plants, I've got cellulose, starch and rubber. And from the animal life I have protein.

Prof: Actually protein can be considered as the beginning of the story since it inspired the development of synthetic polymers.

Cansu: I know. I've learned that protein forms some of the things we wear - like leather, silk, and wool. And it's the main thing in skin, organs, muscles, hair and fingernails.

Prof: And do you know the most common protein in the body?

Cansu: Uh... I'm afraid I don't.

Prof: It's collagen - Collagen is used for support and structure. It's in-between all the cells in the body, all around your organs, even in your teeth and bones. Another common protein in the body - although it is not as common as collagen - is keratin. Feathers and fur, hair and nails are made of this protein.

Cansu: I should write these down. I'm sure my audience will be interested to know.

Prof: At least the examples will help them relate to the topic. What else are you planning to share with your friends during your presentation?

Cansu: I'll tell them how natural polymers inspired the production of synthetic polymers.

Prof: And how did they do that?

ELAE Practice Materials Key

Cansu: It worked in two ways. First, there was people's curiosity. They looked at those materials they wore or used and wondered what was going on, and why these materials acted the way they did. They asked questions, and tried some ways to make these materials better. Sometimes they planned out an experiment, and sometimes luck - or even accidents - gave them an answer. The second way is the shortages. For example, during World War II there wasn't enough silk or rubber to go around because some countries were at war with the countries that produced them. So those countries that don't have the natural form of these polymers figured out ways to make their own polymers similar to these natural products. And at this point I will start talking about some synthetic polymers.

Prof: Which ones will you be talking about?

Cansu: Well, that is my problem. There are so many.

Prof: Then, maybe you should start by presenting the most common polymers that your friends may be familiar with?

Cansu: That's a good idea. That will help me limit the number.

Prof: Actually, why don't you start with the numbers?

Cansu: Numbers?

Prof: Yes. Synthetic polymers are actually plastics and each type has a number. The number is there to help sort the plastic for recycling purposes.

Cansu: Really? I didn't know that.

Prof: I'm sure you noticed the symbol of a triangle on the different types of plastics you use.

Cansu: Yes, a triangle made up of three arrows. I found it during my research. And there is a number inside the triangle...oh, that's the number that you are referring to, isn't it?

Prof: That's right. Now you tell me what you have on the most common synthetic polymers. Let's start with number 1. Do you have anything on polyethylene terephthalate, which is also called PETE?

Cansu: Let me see... Yes, it's a polymer produced from the monomers ethylene glycol, which is a dialcohol, and dimethyl terephthalate, which is a diester.

Prof: Again, I don't think your non-science student friends will understand that. Why don't you just tell them what is made from this polymer?

Cansu: Okay...uhm... this polymer is used in the manufacture of polyester fabrics,... transparent sheets,... beverage bottles and eyeglass lenses. ... Well, let me continue with numbers then... Number 2 and number 4 polymers are similar in that they are both polyethylene. If ethylene is polymerized under moderate pressure, and moderate temperatures, we get polymer number 2, high density polyethylene, which is referred to as HDPE. HDPE is hard, tough and resilient. And most HDPE is used in the manufacture of containers such as milk bottles. But if ethylene is polymerized at high pressure, and high temperatures we get LDPE, low density polyethylene, which is polymer number 4. LDPE is relatively soft, and most of it is used in the production of plastic films, such as those used in sandwich bags.

Prof: Don't forget to add that in the manufacture of these polymers, chemical used in the polymerization process make a difference. While producing LDPE, they use peroxides for catalysis. And for HDPE, they use organometallic compounds to catalyze the polymer.

Cansu: Okay. I made a note of that... Right, number 3 is a word I can pronounce: polyvinyl chloride. This one is similar to polyethylene, but in the polymer chain, it has chlorine atoms attached at the alternate carbon atoms.

Prof: What is the short form of polymer number 3. Your friends will recognize it immediately if you give it to them.

Cansu: Let me check... Polyvinyl chloride ... I don't think I have it in my notes. But let me look at the initials of the words... polyvinyl chloride...poly...P...vinyl, V...oh, it's PVC, isn't it?

Prof: Yes! And where is PVC used?

Cansu: Ummm... Most of it is used in the manufacture of pipe. It is also used in the production of "vinyl" siding for houses and clear plastic bottles.

ELAE Practice Materials Key

Prof: And if you blend it with a plasticizer such as a phthalate ester, PVC becomes more flexible and it is used to make articles such as raincoats and shower curtains.

Cansu: Okay, I've made a note of that too. Now where was I? I talked about number 4, so Number 5, polypropylene. And polypropylene is used extensively in the automotive industry for interior trim, for things like instrument panels, and it is also used a lot in food packaging, for things like yogurt containers. And because it can be formed into fibers which have very low absorbance and high stain resistance, it is used in clothing and home furnishings, especially carpeting. Polymer Number 6...

Prof: Cansu, you seem to have too much already. Do you think you will have enough time to go over all of what you've got in your notes?

Cansu: I don't think so. What do you suggest that I do? Shall I leave out some?

Prof: Well, why don't you put all the rest in the form of a table? If you want you can leave some parts blank and ask your friends to provide the missing information. This way, the presentation will be more engaging for them.

Cansu: That's true. And in this case, I won't have to explain everything myself. I can put most of the confusing or difficult information in the table! This way I can talk about all the other kinds of polymers I have notes on.

Prof: What else do you have?

Cansu: I have polystyrene, which is used in the making of Styrofoam in the bead form and refrigerator interiors in the hardened form. Then there is polytetrafluoroethylene. God it's hard to say! This one is so strong that it has complete resistance to attack by virtually all chemicals... and it maintains its physical properties over a large temperature range. These properties make it especially useful for components that must operate under harsh chemical conditions and at temperature extremes. It's most familiar household use is as a coating on cooking utensils.

Prof: What is its commercial name?

Cansu: I know it. It's somewhere here... Teflon! It's called Teflon. I also have information on polyurethane, but we commonly know it as Lycra. And polyamide which we know as Nylon. The final one is polyacrylamide. To be honest I didn't understand the explanations for this one. All I can tell is that it absorbs water like a sponge.

Prof: That should be enough for your friends. That's a lot of information. You have done a very good work so far. But aren't you going to say anything about its environmental dimension? After all, these are all synthetic materials. They're plastics. And that's why there's a lot of talk about them.

Cansu: Yes, I'd like to point out that all these polymers came to exist because we didn't have enough of the natural materials... or natural ones didn't completely serve our purpose. Synthetic polymers are extremely useful for different purposes, but they have their disadvantages.

Prof: Which are...?

Cansu: Well, the use of polymers in disposable consumer goods has grown a lot and this means a lot of garbage. Also, the raw materials for these polymers are obtained from petroleum, which is a limited, non-renewable resource. Because of these two reasons, we need to recycle polymers.

Prof: Well it's not that simple.

Cansu: Why not?

Prof: First, there is a great variety of polymers in use. You can't all put them together and recycle them. Different types need to be separated. That's why there are all these numbers we talked about. They are intended to help consumers separate the waste polymers according to type before disposing of them. You see, recycling of polymers is different from recycling of, say, aluminum. When you recycle aluminum, you get all the aluminum waste you got, put them in a pot and heat them. And you get aluminum again. But with polymers, it's different. They have different molecules in the chain, so they cannot be put together. Secondly, most polymeric materials are recycled only once. You cannot recycle them again. And the product made of recycled polymer is thrown away after use. So, to obtain the maximum benefit from recycled polymer, they usually produce things that will have a long useful life... For example, cafeteria trays are recycled polymers. And some other examples that I can think of are... uhhhmm... large plastic toys, impact absorbing highway barriers, and carpeting.

Thirdly, there's also the problem of cost. In general, products made from recycled polymers are more expensive than those made from new plastic. This is the case because current manufacturing facilities are geared to production from new materials.

Cansu: I didn't know that. It's interesting that the recycling of something should be more expensive than manufacturing of a new one.

Prof: Unfortunately, this is the case right now. Anyway, I think you've got plenty of information to share. Don't forget the table idea we discussed if you think you won't have enough time to go over everything. Is there anything else?

Cansu: Uhm... I think this is all. Thank you very much, Professor Waller. The whole thing is clearer in my mind now.

Prof: You're welcome. See you in class tomorrow.

Cansu: Bye.

MICROCREDIT - ANSWER KEY

- Why can poor people not get a bank loan?
They can't show collateral / They don't own property that can be shown as collateral
- Define what microcredit is.
- extremely small loans given to poor borrowers for self employment projects
- a very small amount of money that a poor person borrows from a bank to start a business or expand a business
- Why is the repayment rate of microcredit loans higher than regular bank loans?
Due to group pressure / Borrowers are put in groups and there is group pressure there to make sure that the loans are paid
- Muhammad Yunus' bank has (a) subsidized borrowers and repayment rate of (b) 36%
- What is one reason why Yunus initially wanted 50 % of his borrowers to be women?
One of the following:
• Traditional banks reject them as women don't own property to show as collateral
• They are good credit risks (because they are good at managing family finances)
- How can microcredit reduce vulnerability among the poor?
Through microcredit, poor people acquire assets that can be sold in cases of crisis
- Give two examples from 'collective efficiency' that microcredit brings.
Any two of the following
• a cluster is more attractive for outside traders (People in the clusters tend to do the same work traders are attracted by the possibility of making cheap, bulk purchases)
• cooperation is better in a cluster (Since people in a cluster are in the same area, it allows for labor sharing, order sharing or subcontracting in the cluster.)
• There is the ease of sharing information and technological innovations within clusters. (Members can exchange information and learn from each other, which gives them competitive advantages over people who are not in a cluster.)
- What is one thing that makes the poorest of the poor a bad credit risk?
They have fewer income sources, bad health or they lack education
- What is one piece of data that shows a borrower's dependency on microcredit programs?
One of the following: The high repayment rates / repeated borrowing
- Give one reason why microcredit might fail to end the poverty of the borrower?
One of the following:
• The money might be used for consumption purposes (which increase their living standards for a short period. But when the time comes to repay the debt, they will have to cut from future consumption, which means cutting from nutrition and health expenses.)
• If they do not make a net profit from their business, they will have to borrow money again and become dependent on the program.
- In what way are microcredit programs bad for female children?
female children then stay out of school so that they can help their mothers

- What is one reason why micro-clusters fail to specialize?
One of the following:
• because there is no demand for higher quality goods
• because they don't have the technology to produce higher quality goods
- How could parochialism cause businesses in cluster to go out of business?
It may cause them to fail to adopt innovations that outside businesses have adopted
- What erases the positive effect of microcredit in poor countries like Bangladesh?
Population growth
- Why does the speaker say microcredit cannot end world poverty?
There are different causes of poverty and this type of credit only appeals to those who have the ability to run a business.

ELAE Practice – Lecture on Microcredit

Good morning. We have been studying the banking system in the world for a while. We have looked at how banks function in economy. In our last session we looked at the kinds of loans and credits that banks give to their regular clients and today we are going to finish this topic. The kind of credit which we will be looking at today is not in your book, but it is such a successful scheme that it earned a banker from Bangladesh a Nobel Prize. It's called microcredit. Has anyone heard of this topic before?... I see a few hands... That's good.

Well, we will start our lesson by explaining what microcredit is and how it functions. Then, we will look at the benefits of microcredit and the advantages of clustering. In other words, grouping, microcredit financed enterprises. Next we will look at the problems associated with microcredit and microenterprise clusters. And finally we will conclude with an analysis of the drawbacks of microcredit and give some idea of its prospects for reducing world poverty.

Okay... Lets' start by defining what microcredit is. As we saw in our previous sessions, banks give loans to people who have got something to show as collateral. Do you remember what collateral was? It is valuable property owned by someone who wants to borrow money from a bank. They agree that if the person cannot pay the money back, the property will become the property of the bank. So in order to borrow money from a bank, a person has to own something. This means poor people who cannot show collateral cannot borrow money from a regular bank. But there are now new schemes where some banks lend money to poor borrowers under different conditions. 'Microcredit' is the name given to extremely small loans given to poor borrowers for self employment projects. In other words, microcredit is a very small amount of money that a poor person borrows from a bank to start a business or to expand a business.

As I said, the conditions for microcredit are different. Let's now go over these differences and explain how microcredit functions. A microcredit scheme involves giving out an unsecured loan. It means, the bank does not ask for collateral. Poor people don't have much property anyway, if they did, they would get a regular loan. There is no collateral, but, similar to other bank loans, the bank gives the money at interest. Actually the interest rate is really high. You may think that in this case we are not helping the poor, but we are exploiting them. You must remember that if poor people who need money cannot get a bank loan, they go to private business people who lend money at greater interest rates.

One other feature of microcredit is clustering of the borrowers. Borrowers are put in groups of 10-20 people. These people substitute for collateral. These borrowers are all in the same business. They meet regularly, and each one agrees to be held responsible if one person in the group does not pay their debt to the bank. This is where the success of the system comes from. Repayment rate of microcredit loans are usually above 95%. This is of because of clustering; there is group pressure there to make sure that the loans are paid. Borrowers monitor each other and make sure that no one is in danger of failing to pay their debt.

Maybe I should give you a little background before we go on. The modern story of microcredit started in 1976, when Muhammad Yunus, who was an Economics professor in a Bangladeshi university, lent 27 dollars to 42 villagers. The villagers used the money to develop informal businesses such as making soap or weaving baskets to

sell at the local market. After the success of this experiment, Yunus founded Grameen Bank – that's G-R-A-M-E-E-N if you want to Google it in your own time. Today, Grameen Bank has more than 5 million borrowers and it has a repayment rate of 98%, and so far it has lent out some 6.5 billion dollars. Okay, Bangladesh is a big country with a huge population, but it is also a very poor country. 5 million borrowers and a 98% repayment rate is extremely good. This shows how successful the scheme is.

One interesting thing to note about Yunus's scheme is that, at the beginning decided that half of the borrowers would be women. He had seen that women were excluded from the banking system. He had realized that traditional banking rejects women because, remember they ask for collateral, and women don't own property to show as collateral. So it wasn't possible for them to borrow money from a bank to start a business. But Yunus wanted to make them part of the system. But he also discovered that women are good credit risks. He had seen how good women were at managing family finances. And he was proven right. Today 95% of the clients of the Grameen Bank are women and they have higher rates of repayment than men.

Let's now move onto the benefits of microcredit. There are three main benefits of this scheme. The first one is that its ability to reduce vulnerability among the poor. This is not it happens; through microcredit, poor people acquire assets that can be sold in cases of crisis. For example, if a family just worked on the land and there was drought, they wouldn't have anything to sell. But with microcredit, they could buy a cow and that cow would be their income source during the times of difficulty. So, in a way microcredit is like an insurance against challenging situations.

The second benefit of microcredit programs is the increase in household consumption. Now this is important because it means that poor people have better health and nutrition. They have the income to buy food and access health services and medicine. Even small increases in consumption and increased regularity in consumption can lead to better health and nutrition.

The third benefit is that microcredit programs reduce income poverty. That is, borrowers actually tend to make more money over time. Once they start making money, they go on to make more profitable investments and lift themselves out of poverty.

As long as we are talking about the benefits, let's also talk about the advantages of clustering in the microcredit schemes. In most microcredit programs, borrowers are put into groups, which are called microclusters. And putting them in groups is good because it brings collective efficiency. Firstly, a cluster is more attractive for outside traders. The people in the clusters tend to do the same work, so traders are attracted by the possibility of making cheap, bulk purchases from a cluster of producers. Instead of looking for many many small producers, a trader can just work with one cluster, which is more practical for him. Secondly, cooperation is better in a cluster. Since people in a cluster are in the same area, it allows for labor sharing. They can work together and help each other. Finally, there is the ease of sharing information and technological innovations within clusters. Members can exchange information and learn from each other, which gives them competitive advantages over people who are not in a cluster.

In short, microcredit programs are quite good programs which have certain benefits. But all is not so well. They have some drawbacks which can reduce their impact.

The first drawback is not using loans effectively. The business enterprise might not turn out a profit that would pay the loan and the high interest rate. Then they would have to find money from another source or reduce their family consumption, which would worsen their situation. Or the loan might not be used for a business. For example, a male relative might take the money a woman borrowed, and use it for something else. Yet the woman, who may not see any benefit of this money, is responsible for repayment of the loan.

The second problem related with microcredit is the inability to reach the poorest of the poor. The poorest members of society have a number of constraints. They have fewer income sources. They also have bad health or they lack education. In short they lack important features that play an important role in running a successful business. All these negativities make them unsuitable borrowers; they present a bad credit risk.

The third drawback is microcredit dependency. There are two clear signs of microcredit dependency. These are high repayment rates and repeated borrowing. The people dependent on microcredit pay the money back, but they borrow money from the bank again because they haven't really increased their income with the first loan. Very few borrowers can really increase their incomes and become independent. Many borrowers can not afford to stop borrowing. They have no alternative to borrowing from microcredit programs because there is nowhere else for them to go.

And finally there is the question of the durability of poverty reduction. The aim of microcredit programs is to lift people out of poverty by helping them start or expand a small business. They may increase their income, but that doesn't mean that the increase will be permanent. There are two reasons for this. First, the money might be used for consumption purposes rather than to start a business. Using the money for consumption will increase their living standards for a short period. But when the time comes to repay the debt, they will have to cut from future

consumption, which means cutting from nutrition and health expenses. Second, if the borrowers do not make a net profit from their business, they will have to borrow money again and become dependent on the program. They will not be lifted out of poverty.

Maybe I should mention one other problem related with women-led microcredit programs. As I mentioned earlier the money a woman borrows may be taken away from her by a male family member and the woman is left with the burden of repaying the debt. That's only one problem. Another problem is the increase in the burden of women. Women work inside the home doing their regular chores. When they borrow money for a business, it means they will have to find time and energy to run their business as well. This will mean more work for these women. The final and the most important problem is related with girls' education. The microcredit loans usually finance some type of "women's work", which is not seen as fit for men to do. This leads women to rely on their female children for supplemental labor. And we know what this means: female children then stay out of school so that they can help their mothers.

There are also problems related to the clusters. One of the problems related with the clusters is the inability to progress. It is relatively easy to begin a cluster. Typically, a group of craftspeople will simply set up shop near each other, with each one handling the entire manufacturing process for the goods being produced. And, the goods will usually be fairly simple- textiles, baskets, roofing tiles, etc. This is enough to draw in suppliers and buyers. The problem is that many clusters do not progress beyond this stage. Ideally, clustered producers should specialize over time, but this does not always happen. I mean we expect them to specialize on only one part of the manufacturing process and the whole cluster becoming like an assembly line, but this doesn't happen. Specialization doesn't happen maybe because there is no demand for higher quality goods, which would require different people focusing on only one part of the manufacture process. They produce simple goods on their own and this is enough. Specialization may not happen also because these producers simply don't have the technology to produce higher quality goods. Since they don't have the technology, they go on as before. As a result, clusters may stagnate over time and they may even collapse.

Another problem with the clusters is parochialism. That's P-A-R-O-C-H-I-A-L-I-M, if you're writing it down.

Parochialism means being interested in a narrow range of matters. Let me explain what it means. In a cluster people running businesses interact with each other and they learn from each other as we explained earlier. But sometimes this happens at the expense of interactions with outside businesses. It stops them from interacting with businesses outside the cluster and this is dangerous because it may cause them to fail to adopt innovations that outside businesses have adopted. This may be fatal for the cluster if they are in competition with more advanced producers. And the businesses in the cluster may go out of business.

As you see, both microcredit programs and microenterprise clusters have a number of drawbacks which may reduce the positive effects they are intended to produce. So, then the question before us is "How effective are microcredit programs in the campaign to reduce world poverty?"

Let me explain this by giving an example from Bangladesh. Microcredit programs claim that they can lift as many as 5% of the program participants out of poverty each year. Unfortunately, this figure fails to mention that, in Bangladesh, microcredit programs only reach about 20% of the population. Therefore, only about 1% of the population can rise from poverty each year under microcredit programs. But we have to consider the rate of population growth in Bangladesh. The population is increasing by 1.8% every year, and this increase is mostly in the poorer classes. So the effect of lifting people out of poverty is erased with the increased population growth. This is the case in other poor countries where microcredit programs have been set up.

The other issue is related with female empowerment. Here the results are mixed. Women gain confidence from handling money, operating their own business and earning money for the family. But as we discussed earlier, the benefits come at the expense of their time and their daughters' education. They have to spare time for their business while at the same time performing their traditional role as housewives and if they have difficulty, they rely on their daughter's help, in which case the girls drop out of school.

To sum up we can say that microcredit programs have mixed blessings. So should they be spread and supported? This is a delicate issue. One thing is that they are not suited to all poor people equally. Studies show that poor people who have the ability and skills to run businesses benefit more from microcredit programs. If a person has good oral skills and they are good at math, he or she seems to participate more in these programs. People without good oral or math skills don't apply for a microcredit. These findings suggest that microcredit programs alone will never succeed in solving the poverty problem.

As you see, although microcredit programs are good programs, although they have value since they help moderately poor people lift themselves out of poverty and help women become independent economically, they cannot end the poverty in the world as Muhammad Yunus imagined. There are different causes of poverty and this type of credit only appeals to those who have the ability to run a business.

Right, this is all I have to say about this topic. Are there any questions?

LIFE OUTSIDE THE EARTH

Paragraph
Number

Heading

6	e.g. Conditions needed for organisms to photosynthesize food.
3	a) Chemical requirements for life to exist outside Earth.
9	b) Evidence of life on Earth provided by analyzing radiation.
22	c) The body in space which is most likely to contain life.
17	d) An argument once used to show the existence of life on Mars.
24	e) The bodies in the solar system which are most unlikely to contain life.
14	f) The impossibility of the existence of life on the moon.
8	g) The capacity of distant photography to reveal the existence of life on Earth.
10	h) Searching for organisms on the Earth's surface.
12	i) Difficulties in gaining reliable data from organic material.