Министерство образования Республики Беларусь
Учреждение образования
«Белорусский государственный университет
информатики и радиоэлектроники»

Кафедра иностранных языков №2

ПРАКТИКУМ

по совершенствованию навыков устной речи
на английском языке для аспирантов, магистрантов
и студентов, занимающихся научной работой

TALKING SCIENCE

English Speaking Skill Mastering Guide
for Postgraduate Students

Библиотека БГУИР

Минск 2005

УДК 802.0 (075.8)
ББК 81.432.1 я 73
П 69

Составители:
Е.П. Тарасова, Р.К. Образцова, А.И. Рогачевская

П 69 Практикум по совершенствованию навыков устной речи на английском языке для аспирантов, магистрантов и студентов, занимающихся научной работой / Сост. Е.П. Тарасова, Р.К. Образцова, А.И. Рогачевская. – Мн.: БГУИР, 2005. – 68 с.

ISBN 985-444-859-2

Данный практикум предназначен для аспирантов, магистрантов и студентов, занимающихся научной работой.

Материал практикума объединен в пять тематико-проблемных циклов: «International scientific conterence», «Science in Belarus», «International Scientific Contacts», «Research Work», «International Environmental Problems».

Цикл состоит в основном из однотипных разделов, позволяющих обеспечить одинаковую последовательность работы в рамках цикла, и соответствует этапам становления речевых навыков и умений.

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INTERNATIONAL CONFERENCES

Problem presentation

Science knows no national boundaries and its development becomes faster due to international cooperation. Scientific exchanges and discussions are always useful because they contribute to general scientific advance. Scientific conferences and simposia give sufficient food for thoughts. Special exhibitions are often set up. They are a concrete illustration of scientists' achievements. Members of conferences are requested to present summaries of their presentations which are usually published in a Digest of the conference proceedings.

If the conference is held not in your country and you have to travel abroad you'll have to use English and it is always an adventure. We hope you have become conscious of the need to improve your mastery of the language. The emphasis of this unit is on the spoken language confronting you with the kind of language you are likely to encounter at any international gathering of people engaged in different fields of science. By practising structures and linguistic strategies which are commonly used in such situations you will gain confidence in your use of English and will be able to concentrate more easily on the content of the conference you have to attend.

Let's discuss your experience of attending an international scientific conference.

A. CONFERENCE - TRAVELLING

Useful Words and Phrases

Timetable

- When does the next train to Eastbourne leave?
- What time does the last flight to Dusseldorf leave?
- How long does it take to get to Eastbourne?
- When do we arrive at Eastbourne?
- How often do the trains/buses run to Eastbourne?

Rail

- Which platform does the train to Eastbourne leave from?
- Do I have to change (trains)?

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- Is there a good connection/a connecting train?
- Is the 5.45 an express train/Inter City?
- Is there a restaurant car on the train?
- A first class single to Eastbourne, please.
- Two second class returns to Eastbourne, please.

Bus

- Excuse me, where does the airport coach leave from?
- Could you tell me when to get off, please?
- Does this bus go to the conference centre?

Airport

- Can I change my reservation here?
- I'd like to change my flight booking, please.
- Where does the luggage arrive?
- Could you tell me where I can find a porter/baggage trolley?

Hiring a car

- I'd like to hire a car, please.
- Do you accept credit cards/Eurocheques/traveller's cheques?
- I need a large car for three days.
- Do I have to bring it back to this office?
- Does that include comprehensive / accident insurance?
- Do I have to pay for mileage, or is it unlimited mileage?
- Could I have a receipt, please?

Finding the way

- Excuse me, could you tell me the way to the conference centre, please?
- Is there a post office near here?
- Excuse me, where's the nearest bank, please?

CONVERSATION 1

Focusing on the vocabulary

Read the conversation and say why the stewardess speaking English said goodbye in German.

Stewardess	Ladies and gentlemen. May we kindly ask you to remain seated until the aircraft has reached its final position. The temperature here in London is 15° Centigrade or 59° Fahrenheit. The exact local time is 11.35. Captain Schmidt and his crew would like to say goodbye to you. We hope you enjoyed your flight. Thank you and "Auf Wiedersehen".
Dr Schneider	Well, it must be pleasant for you to be back in England again after six months with us.
Dr Barker	Yes, I'm looking forward to seeing my friends and relatives

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again.

Dr Schneider Where did Dr Grey say he would meet us?

Dr Barker Just outside the baggage claim area. - After you.

Dr Schneider Thanks.

Read the conversation again and say where Dr. Gray was to meet Dr. Barker and Dr. Schneider. Dramatise the conversation.

CONVERSATION 2

Read the conversation and say:
- why Dr.Barker didn't have to fill in the immigration card;
-why Dr. Schneider went through a green channel.

Dr Barker Have you filled in the immigration card?

Dr Schneider Yes. Have you?

Dr Barker No, I don't need to. It's only for non-British citizens.

Dr Schneider Oh, yes. Of course. Is this the way?

Dr Barker No, l go through here - "British Passports", you see. I'm afraid you have to go over there where it says "Commonwealth and EEC Passports".

Dr Schneider All right. I'll see you on the other side, at the customs, then.

Customs officer What have you got to declare?

Dr Schneider Nothing.

Customs officer Then you should go through the green channel, not the red one.

Dr Schneider Oh, I'm sorry. Can I go through?

Customs officer What's the purpose of your visit?

Dr Schneider I'm attending a conference in Eastbourne.

Customs officer I see. Would you mind opening this bag, please?

Dr Schneider There you are.

Customs officer Thank you. Right. That's all. You can go through now.

Dr Schneider Thank you.

- *Where was the conference to be held?*
- *Dramatize the conversation.*

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CONVERSATION 3

Read the conversation between Dr. Baker and Dr. Schneider and say why Dr. Baker was invited to the information desk, what the matter was.

Public Address	Would Dr Barker, passenger from Düsseldorf please come to the information desk. Dr Barker from Düsseldorf, please.
Dr Barker	That was for me, wasn't it?
Dr Schneider	Yes, I think so. Look, there's the information desk over there.
Dr Barker	Excuse me, my name's Barker. I believe you've got a message for me.
Clerk	That's right, Dr Barker. Here you are.
Dr Barker	Thank you. - Oh dear, that's a pity.
Dr Schneider	What's the matter?
Dr Barker	Dr Grey can't meet us this morning. We'll have to make our own way to the conference. I'm to 'phone him this evening.
Dr Schneider	Shall we take the train, then?
Dr Barker	I'm not sure. I had promised to meet someone at the hotel at about three o'clock, and it's twelve o'clock now. Let's ask about train times. - Have you got a train time-table, please?
Clerk	Yes. Where do you want to go?
Dr Barker	To Eastbourne.
Clerk	And when do you want to go?
Dr Barker	This afternoon. As soon as possible.
Clerk	I see.
Dr Schneider	Where do the trains for Eastbourne leave from?
Dr Barker	From Victoria.
Dr Schneider	And how do we get there?
Dr Barker	By Underground.
Clerk	There's one at 12.55.
Dr Barker	No, that's no good, I'm afraid. We'll never make it.
Dr Schneider	How long does it take to Victoria from here?
Dr Barker	About an hour. How often do the trains run from here?
Clerk	About every quarter of an hour.
Dr Barker	Thank you. And when is the next train to Eastbourne after the 12.55?
Clerk	At 13.25, arriving at Eastbourne at 14.40.
Dr Barker	At twenty-five past one and arriving at twenty to three. That'll give me just enough time to keep my appointment.
Dr Schneider	Can we get tickets from here, too?
Clerk	No, I'm afraid not, sir. But perhaps they can help you at the British Airways counter over there.
Dr Barker	Thank you very much. Goodbye.
Clerk	Goodbye.

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1. Read it again and answer the questions:

- Why couldn't Dr Gray meet them that morning?
- How could Dr Barker and Dr Schneider get to Eastbourne?
- Did the trains for Eastbourne leave from Victoria station?

2. Dramatize the conversation.

CONVERSATION 4

Thinking and discussing

Read the conversation and answer the following questions:

– why did Dr. Schneider and Dr. Barker decide to change their booking for the return flight?

– where could they change the booking?

Dr. Schneider	Don't you thing we'd better change our booking for the return flight?
Dr. Barker	Do you thing that's nessessary?
Dr Schneider	Well, Dr Grey may not be able to bring us back to the airport as planned.
Dr Barker	That's true. Yes, let's do that. We can change the booking at the travel agency when we get the train tickets.
Dr Schneider	Here we are. After you.
Dr Barker	Thanks.

CONVERSATION 5

Can you find out from the conversation

– where Dr. Barker had to get railway tickets

– why he had to leave the telephone number of the conference office at the ticket office.

Girl	Good morning. Can I help you?
Dr Barker	Good morning. Do you sell railway tickets here?
Girl	No. I'm afraid not. You'll have to get them at the British Rail desk or at the ticket office at the station.
Dr Barker	I see. Could we change our flight booking here?
Girl	Certainly. May I have your tickets, please? Thank you. When would you like to fly back to Düsseldorf?
Dr Barker	What are the times of the flights after the 12.45?

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Girl	Do you mean on Friday 7th?
Dr Barker	Yes, that's right.
Girl	There's one at 15.40, another at 17.45, and the last one is at 20.50.
Dr Barker	When does the 20.50 arrive?
Girl	At 22.00.
Dr Barker	Good. We'll take that one, then. Is that all right for you, Dr Schneider?
Dr Schneider	Yes, yes, that's fine, thanks.
Girl	That's confirmed then, sir. Have you got a telephone number in this country where you can be contacted?
Dr Barker	Yes. Here's the number of the conference office in Eastbourne where we will be until Thursday evening.
Girl	Eastbourne 389247. Thank you. Here are your tickets.
Dr Barker	Thank you very much. Goodbye.
Girl	Goodbye.

Dramatize the conversation.

CONVERSATION 6

Read the conversation and say to your friend how Dr. Barker coud find out from which platform the train left.

Dr. Schneider	Shall I get the tickets?
Dr. Barker	Yes, please. I'll find out which platform the train leaves from. There's the booking office over there.
Dr Schneider	I'd like two tickets to Eastbourne, please. Is it cheaper to buy a return ticket than two singles.
Railway clerk	How long are you going for?
Dr Schneider	Five days.
Railway clerk	In that case there's no difference between two singles and an ordinary return.
Dr Schneider	Two first class singles to Eastbourne, then, please.
Railway clerk	£ 10.30, please. Thank you.
Dr. Schneider	Thank you.
Dr Barker	The 13.25 leaves from platform 7. This way.

CONVERSATION 7

Read the conversation and say whether Dr. Barker's name was on the list of the conference participants and if not why. Dramatise the conversation.

Receptionist	Good afternoon.

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Dr Schneider	Good afternoon. I believe you have two rooms booked for us: Dr Barker and Dr Schneider.
Receptionist	Ah, yes, Dr Schneider. You're here on the list of conference participants, but I'm afraid I can't find Dr Barker's name.
Dr Barker	That's strange. I know that my secretary made both bookings at the same time. I was in the office when she phoned.
Receptionist	Just a moment, please. I have a Dr Parker from the "Zentrum fur Umweltforschung", Munster.
Dr Schneider	Well, that must be Dr Barker. We both work at the "Zentrum fur Umweltforschung", and we haven't got a Parker.
Receptionist	I'm sorry. We must have got the wrong name. Room 424 and 425 on the fourth floor. Shall I call the porter?
Dr Barker	No, thank you. We've only got this hand luggage.

PHOJECT

1. Interview your friends, relatives about their travelling experience. Analyse and discuss the results.

2. Have debates in your class on the best way to travel. Prove your ideas.

3. Discuss the idea of travelling abroad being a stranger in a strange country where you are expected to see strange things.

B. CONFERENCE – MAKING SOCIAL CONTACTS

Useful words and phrases

On the telephone

Caller

- Could I speak to Dr Grey, please?
- Hello. Is that Dr Grey? This is Alan Barker speaking ...
- Who's that speaking, please?
- May I have extension 235, please?
- Would you tell Dr Grey that I 'phoned, please?
- I'll ring back later.
- Would you ask him to ring back?

Operator/Secretary

- Hold the line, please.
- Just one moment, I'll put you through.
- I'm afraid the line's busy/engaged.
- Can I take a message? Or shall we ring you back?

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Initiating contact

- Excuse me, aren't you Professor Lindberg?
- I wonder if I could have a word with you, Dr Grey?

Introductions

Introducing

- May I introduce you to Dr Barker, a colleague of mine?
- Dr Grey, I'd like you to meet Professor Kneipp.
- I don't think you've met Dr Schneider yet, have you?
- I'm sure you've already heard of each other.

Reacting to Introductions

- How do you do?
- Nice to meet you, Dr Grey.
- I'm delighted to meet you, Dr Grey.
- I'm pleased to meet you at last. I've heard so much about you.

Invitations

Inviting

- I'd appreciate the chance to talk to you some time.
- Do you think you could spare a few minutes?
- May I invite you to lunch/dinner?
- Would you like a drink?

Reacting to invitations

- That's very kind of you.
- I'm terribly sorry, but I'm pressed for time at the moment.
- Perhaps we could meet tomorrow?

Conversational Gambits

- What do you think of the programme?
- What's your opinion of Dr Green's hypothesis?
- As I see it, …
- Did you enjoy the morning session?
- It's been most interesting so far, hasn't it?

Focusing on the vocabulary

Here are some conversations which can serve you as good examples of how social contacts are held. Practice them with your partners.

CONVERSATION 1

Dr Barker	Ah, there you are Dr Schneider. Is your room all right?
Dr Schneider	Yes, it's fine, thanks. What about yours?

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Dr Barker	It's very pleasant, thank you. Now, have you found out the way to the conference centre?
Dr Schneider	No, I'm afraid I haven't. Perhaps we'd better ask the receptionist.
Dr Barker	Yes. I'll do that. - Excuse me, could you tell us how to get to the conference centre, please?
Receptionist	Yes, certainly. Are you going to walk or are you going to go by car?
Dr Barker	Well, the office opens in about half an hour, so there's plenty of time. How far is it?
Receptionist	It's about ten minutes on foot, I think.
Dr Barker	In that case I think we'll walk. Is that all right by you, Dr Schneider?
Dr Schneider	Certainly. The fresh air will do us good.
Dr Barker	Fine. Which way is it, then, please?
Receptionist	Go out of the hotel and turn left. Go straight along Church Road until you reach the traffic lights. Then turn right into North Street and you'll see the conference centre in front of you at the top of the hill. It's a big, modern building. You can't miss it.
Dr Barker	So, it's left outside the hotel, right at the traffic lights, and then straight on?
Receptionist	Yes, that's right.
Dr Barker	Thank you very much.
Receptionist	Not at all. Goodbye Dr Barker.
Dr Barker	Goodbye.

Exercise 1. As you can see only one part of the dialogue is given in English, the other one – in Russian. Produce the dialogue making both parts English.

Dr Smith	Oh, at last I have found you, Dr Dick. Do you live in this hotel too?
Dr Dick	Да. И кажется, мы живем на одном этаже.
Dr Smith	I'm glad to meet you. We haven't seen each other since last conference.
Dr Dick	Я тоже рад. Кстати, Вы знаете как пройти в центральное здание, где будет проходить конференция?
Dr Smith	Perhaps we'd better ask the receptionist.
Dr Dick	Да. Я сделаю это. Извините, не могли бы Вы сказать нам, как добраться до зала, где будет проходить конференция?
Receptionist	Yes, certainly. You are going to walk, aren't you?
Dr Dick	Да, я думаю, мы пойдем пешком, если это не далеко.

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Receptionist	It's about fifteen minutes on foot. The fresh air will do you good.
Dr Dick	Хорошо. Так как нам идти?
Receptionist	Go out of the hotel and turn left. Go straight along Oxford Road until you reach the traffic lights. Then turn right into Baner Street and you'll see the conference centre in front of you. It's a big, modern building.
Dr Dick	Значит, выходя из отеля налево, у светофора направо и затем прямо?
Receptionist	Yes, that's right.
Dr Dick	Спасибо. До свидания.
Receptionist	Not all. Good bye, Dr Dick.

Exercise 2. Only one part is given in the dialogue. Ask your partner to respond.

Dr Grey	Could you tell us way to the conference centre?
Receptionist	…….
Dr Grey	We'd better walk there.
Receptionist	……..
Dr Grey	So, it's left outside the hotel, right at the traffic lights and then straight on?
Receptionist	……
Dr Grey	Thank you very much. Good bye.
Receptionist	…….

CONVERSATION 2

Read the conversation and say who gave Dr. Barker and Dr. Shneider their name tags and copies of the conference papers while they were registering for the conference?

Dr Schneider	Good afternoon. Dr Barker and Dr Schneider. We'd like to register for the conference.
Girl	Certainly, sir. Ah, here we are. Dr Barker and Dr Schneider from the 'Zentrum für Umweltforschung', Münster.
Dr Schneider	Yes, that's right.
Girl	Here are your name tags, gentlemen. My colleague will give you copies of the conference papers. Oh, Dr Barker, there is a message for you.
Dr Barker	A message for me?
Girl	Yes. A Dr Grey phoned about an hour ago and asked you to

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	ring him back. Here's his number.
Dr Barker	Thank you. Can I phone from here?
Girl	Yes, there's a public 'phone box over there, near the entrance.
Dr Barker	Thank you. - Oh, Dr Schneider, could you change this 50p, please?
Dr Schneider	Yes, I think so. What do you need?
Dr Barker	Well, it's only a local call, so I'll only need one or two 2p pieces.
Dr Schneider	Here you are.
Dr Barker	Thank you very much.

Exercise 3. Ask the girl where you can phone from to your colleague. Practice the conversation with your partner.

CONVERSATION 3

This is an example of a telephone talk and making an appointment. Dramatise it.

Telephonist	Grand Hotel.
Dr Barker	Could I speak to Dr Grey, please?
Telephonist	Dr Grey? Just one moment, I'll put you through.
Dr Grey	Hello.
Dr Barker	Hello, is that Dr Grey?
Dr Grey	Yes, speaking.
Dr Barker	Hello, Donald. This is Alan Barker.
Dr Grey	Alan! It's good to hear you again. Look, I'm sorry I couldn't meet you at the airport, but I had to look after another visitor. But I'll explain all that later. Where are you now?
Dr Barker	At the conference centre.
Dr Grey	I see. And where are you staying?
Dr Barker	At the Royal Dolphin.
Dr Grey	Can we meet there at about six?
Dr Barker	Yes, six o'clock suits me fine.
Dr Grey	Right. Six o'clock at the Royal Dolphin.
Dr Backer	Fine. I'm looking forward to seeing you again.
Dr Grey	So am I. Until six, then, Alan. Goodbye.
Dr Barker	Cheerio.
Dr Schneider	What did he say?
Dr Barker	He said he'll meet us at the hotel at six o'clock.
Dr Schneider	Good, then we've got time for a quick walk along the

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seafront.

CONVERSATION 4

Read the conversation and practice it.

Dr Grey	Alan! It's good to see you again. How are you?
Dr Barker	I'm fine, thanks, Donald. And how are you?
Dr Grey	I'm very well, too, thank you. And how's Mary?
Dr Barker	Oh, she's well, too. How's the family?
Dr Grey	Oh, the usual problems. But they're all in good health, thanks. Now, what about a drink?
Dr Barker	That sounds like a good idea. The bar's this way.

Exercise 4. In this dialogue only one part is given. Ask your partner to respond.

Dr Grey	Oh, I'm so glad to to see you again. Dr Petrov. How are you?
Dr Petrov	…….
Dr Grey	How's your family?
Dr Petrov	…….
Dr Grey	I am glad you are all in good health. Now, what about a a drink?
Dr Petrov	…….

CONVERSATION 5

Practice the conversation with your partner. Where did it take place?

Dr Grey	What would you like?
Dr Barker	A gin and tonic, please.
Dr Grey	One gin and tonic and a dry sherry, please.
Barman	One gin and tonic, one dry sherry.
Dr Grey	I'm sorry I couldn't meet you at the airport. I had to pick up Dr Lindberg and bring him here.
Dr Barker	That doesn't matter. Dr Lindberg? Isn't he the main speaker tomorrow?
Dr Grey	Yes, that's right. He's the Swedish specialist on pulmonary damage caused by air pollutants. Graham Wright should have picked him up, but he had an accident yesterday morning. Nothing serious, but his car was badly damaged.
Dr Barker	Lucky man! Well, what's new at the institute since I left?
Dr Grey	Oh, nothing, really. Jones has taken up a post at the Department of the Environment, but otherwise the team is the

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	same. How are you enjoying the work?
Dr Barker	Oh, it's very interesting, I must say. I've learnt a lot. Perhaps we'll find time to talk about it tomorrow. We've had some interesting results.

Exercise 5. Imagine you are in the bar with Dr. Gray who takes a post at the department of the Environment. Find out about his job. Interview him.

CONVERSATION 6

Read the conversation and practice it.

Dr Barker	Yes. Ah, here is Dr Schneider. Dr Schneider, may I introduce you to Dr Grey? Dr Grey, Dr Schneider.
Dr Schneider	How do you do.
Dr Grey	How do you do.
Dr Schneider	I'm pleased to meet you at last. I've heard so much about you from Dr Barker. I believe you're doing research in the field of sulphur dioxide emissions.
Dr Grey	That's right. I'm in charge of a small research team working for the Central Electricity Generating Board. And Dr Barker is working together with you, I believe.
Dr Schneider	Yes. I'm head of the department which Dr Barker has been assigned to.
Dr Grey	I was most interested to hear about your recent paper on photochemical air pollution in the Federal Republic. Do you think you could let me have a copy?
Dr Schneider	I'd be delighted to. In fact, I've got a few spare copies with me. I'll bring one with me tomorrow.
Dr Grey	Thank you very much. By the way, does Dr Becker still work at your institute?
Dr Schneider	Do you mean Karl Becker?
Dr Grey	Yes, that's right. I met him at the last International Clean Air Congress in Düsseldorf.
Dr Schneider	Yes, I know him very well. He's a good friend of mine. He's just made an application for funds from the Ministry for a new project.
Dr Grey	Well, I certainly hope he's successful ... Please give him my best regards when you see him.
Dr Schneider	I'll be glad to, Dr Grey.
Dr Barker	I hate to interrupt you, gentlemen, but my stomach tells me that it's time for dinner.

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Dr Grey Right you are, Alan!

Read the conversation again and answer the following questions.

1. What field of science was Dr. Linberg a great specialist in?
2. What kind of research was Dr. Schneider doing?
3. What kind of application did Karl Becker make for a new project?

Exercise 6. Play the role-game.

Role 1. You are Dr. Petrov. You've come to the USA to take part in the International Scientific Conference devoted to the problems of environmental protection. You are in the bar now with Dr. Grey. You are talking about your recent paper on air pollution.

Role 2. You are Dr. Grey. You want to have a spare copy of Dr. Petrov's report. You ask him about that. Dr. Barker comes up to you. You introduce him to Dr. Petrov. Make up a conversation.

SITUATIONS

1. *You've arrived in London to take part in the international conference (devoted to problems of Artifical Intelligence). You've stayed at the hotel and have met Dr. Johnson. Talk about the problem how to get to the conference centre.*
2. *You've come to the conference centre and want to register for the conference. The girl gives you copies of the conference paper. You are polite.*
3. *You are phoning to Dr. Grey. You want to invite him to dinner. He doesn't agree because he is pressed for time at the moment.*
4. *You are pleased to meet Dr Grey at last. You've heard so much about him from your friend. He is doing research in the field you take interest in. Discuss things.*
5. *You've come to the bar with Dr Grey. You are choosing what to drink. Then you are talking about problems of the conference and arranging dinner for your German colleagues.*

C. CONFERENCE – PLENARY SESSION

Useful Words and Phrases

Opening a meeting

- I declare the meeting open.

Introducing a speaker

- I have great pleasure in introducing Professor Lindberg.
- Our first speaker, Dr Brown, will speak on …

Discussion in plenary session

Establishing the topic

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- What we have to discuss is …
- The first thing we have to consider is …

Referring to papers

- May I draw your attention to page 6 of the report?
- If I could ask you to look at page 6 for a moment.
- *Blocking discussion*
- I'm afraid I need notice of that question.
- I'll have to refer that question to the steering committee.
- *Interrupting a speaker*
- May I just draw your attention to the fact that this point will be dis cussed in the working groups later?

Adding information

- I think it's relevant to mention here that.

Bringing a speaker back to the subject

- I'm afraid that this is not terribly relevant, Dr Jones.

Ending a discussion

- Perhaps we ought to take a formal vote on this.
- May I propose that this be accepted?
- May I propose that we stop there?

Putting an issue to the vote

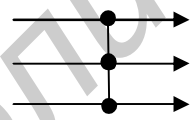
- Can we move to a vote on this?
- That is carried then, with 49 in favour of the motion, 12 against, and 3 abstentions.

Summarizing

- Our position can be summed up as follows: ....

Thanking

- I'm sure I'm speaking for everyone when I say how grateful we are to Professor Lindberg for his



- I should like to thank Professor Lindberg for. . .

Ending a meeting

- I declare the meeting adjourned until 2 p.m. this afternoon.
- I declare the meeting closed.

Focusing on the vocabulary

1. Read the Chairman's speech at the Plenary Session of the Conference and say what the programme for that morning's session was concerned with

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Part I

Chairman

Ladies and gentlemen. Ladies and gentlemen, may I have your attention, please? The programme for this morning's session will be concerned with the broad heading of "Technology, the Environment and Man", where the strategy is to divide the sessions into two major groups: one concerned with progress in the control of air pollution, and the second with the effects of air pollution on the human organism. We'll be dealing largely with the same themes, but under different aspects. Initially, we'll be discussing the present position, and then we're going to go on to consider what, might be done to alleviate the situation.

Well, now, in the first session, we're going to begin by considering the relationship between air pollution and premature mortality, and this theme will be introduced by our first speaker.

Ladies and gentlemen, I have great pleasure in introducing Professor Lindberg, who is well-known for his numerous learned articles in this field and for his active support of the International Clean Air Society. Professor Lindberg's subject today is: "Health Aspects of Air Pollution caused by Sulphur Dioxide". Professor Lindberg!

Prof. Lindberg

Thank you, Mr Chairman. Rather than repeating parts of my background paper, in which I outlined the main problems in this area, I thought I would like to present three hypotheses which could be taken up in the group-discussions after this talk. The first hypothesis is … …

These, then, are the main points I would like to see discussed in your deliberations in the working groups.

Chairman

Thank you, Professor Lindberg. I'm sure that my colleagues join me in thanking you for an extremely lucid presentation of the main problems confronting us, and for the persuasive way in which you put your case. Now, as we have a few moments in hand, may I ask if there are any questions to the speaker? No? Well, if that's the case, I should like to make one or two announcements concerning the organization of the rest of the conference.

First, there's been a request to form an additional group to those on the programme. This group will basically be interdisciplinary in nature and will deal broadly with urban planning and environmental control. Participants interested in joining this group should contact Dr Grey, who has kindly offered to chair the first meeting. Dr Grey has suggested that this group should meet

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immediately after this plenary session in the small room next to the main lecture hall. So, once again: that is a new, interdisciplinary group on urban planning and environmental control under the chairmanship of Dr Grey, in the small room next to the main lecture hall. Second, there are one or two minor alterations to the programme for this afternoon. Dr O'Dwyer will be unable to act as chairman for working group A III. His place will be taken by Dr Harrison. Registrations for Professor Dubrovnik's group were so numerous that we had to change the venue from Room II/1 a to Room III/2 b. You'll find a plan of the rooms in your conference brochure. May I take this opportunity of reminding the chairmen of the working groups that they should report to the rapporteurs immediately after their working group has finished its deliberations, and this should be no later than 12.15. Thank you.

Which of the given sentences describes best what the speakers said.

1. The chairman says that the two major groups will be dealing with
   a) completely different themes.
   b) very similar themes.
2. Professor Lindberg wishes to
   a) first repeat his background paper and then present his hypothests.
   b) present only his hypothests for discussion
3. There is no discussion after Professor Lindberg's talk because
   a) there is no time.
   b) the chairman wants to make some announcements.
4. The new interdisciplinary group will deal with
   a) environmental control in nature.
   b) environmental problems in towns and cities.
5. The chairmen of the working groups
   a) are to meet the rapporteurs by 12.15.
   b) should finish their deliberations together before 12.15.

Discuss with your partner the following:

1. What was the first speaker's theme of the report at the plenary session?
2. Was the presentation of the main problems confronting the participants extremely lucid?
3. Why was an additional working group formed at the conference and what problems did it deal with?

Part II

In his speech the chairman of the conference mentioned some reasons why they had planned an interdisciplinary conference on the complex subject of air pollution

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and the environment. What were the reasons?

Chairman — Ladies and gentlemen. As we all know, there are great problems inherent in specialist conferences concentrating on specific areas of scientific research. This was the chief reason for us to plan a truly interdisciplinary conference on the complex subject of air pollution and the environment. Equally, however, there are dangers in bringing together so many experts from so many different disciplines. It takes a genuine effort for a person in one discipline to listen to something else which may be totally unfamiliar to him. Not only to listen, but to absorb. The benefits from it are, however, substantial. The work of others may help us delineate our own work more clearly and may give us ideas for future work which we would not otherwise be able to obtain.
I should now like to call upon Dr Alassio, who would like to make a statement on behalf of the rapporteurs. Dr Alassio.

Dr Alassio — Thank you, Mr Chairman. In attempting to prepare our summaries of the groups' deliberations, my fellow rapporteurs and I have found the task to be considerably more difficult than we had envisaged. We would like to be able to present in brief and rather simple language the main themes of your deliberations and the questions remaining in particular areas. We have discovered that the different vocabularies used by the different groups of experts have caused considerable confusion among many of the conference participants. For this reason we would like to ask the main speakers from the different sections to meet the rapporteurs in Room 1/1 a immediately after this session. Thank you, Mr Chairman.

Chairman — In view of these difficulties, I propose that we adjourn until after the coffee break. Are there any questions? Yes? The gentleman at the far end of the hall. Would you please identify yourself and let us know where you are from?

Voice — My name's …

Chairman — I am afraid we can't hear you. Would you please make use of one of the microphones standing near the centre of the hall?

Voice — I am Jean Leboeuf, Professor of Physics at the University of Nancy, France. I have a question to put to the last speaker, or rather, a request. Would it be possible for these reports to be made available in French, too. As you said yourself, the vocabularies of some groups are highly specialized, and it would be difficult for some of us to follow the reports if they were only in English.

Chairman — Dr Aiassio, would you like to answer this point?

Dr Alassio — Certainly, Mr Chairman. I can assure Professor Lebceuf that the translators will also be taking part in our discussion, and that all the conference languages will be used in the summaries.

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Chairman — Thank you, Dr Alassio. I now declare the meeting closed. We'll meet again in plenary session here at 4.5 to hear the summaries by the rapporteurs.

Start a short talk with someone using the following situations.

1. You are interviewing Prof Grey who is not satisfied with the results of the conference.
2. You, are Dr Grey and your colleagues are interested to form an additional group to the programme of the conference. Give your reasons.
3. Act as Dr. Alossio who discovered certain difficulties in presenting the summaries of the groups' deliberations.
4. Act as Dr Schneider who objects to taking notes and preparing a summary of the deliberations.

D. CONFERENCE B – WORKING GROUPS

Useful Words and Phrases

Opening a meeting

- Shall we be getting started?
- Shall we get down to business?

Introducing a speaker

- I'm sure you all know Dr Green.
- It's a great honour for us to have Professor Kneipp with us in our group today.

Discussion

Establishing the topic

- Perhaps we should first look at ... .
- Now the first area we have chosen is ... .

Clarification/ Explanation

- I'd like to ask Dr Smith what he means by ... .
- Do you think you could explain what you mean by … , please?

Questions

- There are a number of questions I'd like to ask.
- There's just a point I'd like to raise here.

Repetition

- Would you mind repeating (your last point), please?

Requests

- Would it be possible for us to obtain copies of your paper?
- If you don't mind I'd like to have time to read this paper.

Suggestions

- I wonder if I might suggest (that we deal with that later)?

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- Wouldn't it be better to … ?
- Wouldn't it be a good idea to … ?

Inviting comment

- Has anyone anything further he wishes to say?
- Has anyone got any suggestions?
- Please feel free to (interrupt, if you wish).
- Dr Barker, would you like to comment on this?

Blocking

- That's a difficult question to answer.
- Perhaps we could return to that later.
- I'd rather not answer that, if you don't mind.
- I'd like to think about that for a while, if you don't mind.

Objecting

- You're probably right in saying that, but ....
- With all due respect, I think ….

Expressing reservation

- I can't help feeling (that) ....

Interrupting

- Excuse me, but I'd just like to point out....
- Could I just say a word on this?
- I wonder if I might just....

Making an apology

- I'm (so) sorry.
- I beg your pardon.
- Please forgive the interruption.

Bringing the discussion back to the point

- I'm afraid you seem to have missed the point.
- You mentioned before that....

Moving on/Changing the subject

- I thought I'd now like to ... .
- Can we move on to ... ?
- Can we now turn our attention to ... ?

Ending a discussion

- Can we leave the matter there, then?

Summarizing

- We seem to be agreed that... .

Thanking

- I'd like to thank you all for a stimulating discussion.
- Well, thank you (gentlemen).

Ending a meeting

- Well, I think that's all there is to say at present.
- Well, I think that covers everything.

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- Well, I think we might break off there.

CONVERSATION I

Such conversation can take place at the beginning of a working group meeting. Read it in parts.

Voice 1	Excuse me, could you tell me where Professor Dubrovnik's talk will be held?
Dr Schneider	I beg your pardon?
Voice 1	I didn't quite understand the announcement in the plenary session.
Dr Schneider	I'm sorry, but I didn't quite understand you. Would you mind repeating that, please?
Voice 1	I would like to know where Professor Dubrovnik is.
Dr Schneider	Ah, Professor Dubrovnik! He's in III/2b.
Voice 1	Thank you very much.
Dr Schneider	Not at all. - Do you know, Dr Barker, I believe my English is getting worse, not better.
Dr Barker	No, no, Dr Schneider. I'm afraid I didn't understand that gentleman, either.
Dr Schneider	Well, thank goodness for that. Now, where is that new interdisciplinary group meeting?
Dr Barker	I think they said in the small room next to the main lecture hall.
Dr Schneider	Ah, yes. There it is. Thank you.
Dr Barker	I'll see you later for lunch, then. I hope you enjoy the morning session.
Dr Schneider	Thanks. I'm sure I will. Same to you!
Dr Barker	Oh, Dr Schneider.
Dr Schneider	Yes?
Dr Barker	If you wait for me after the session, I'll come and pick you up.
Dr Schneider	Fine, I'll do that.

I. Which of the sentences describes best what the speaker said.

The man with strong foreign accent wants to know

a) if Dr Schneider is at the conference;
b) where Professor Dubrovnik's group is meeting.

II. Why do you think Dr. Schneider didn't understand where the new interdisciplinary group meeting was held.

III. Dramatize the conversation.

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CONVERSATION 2

This is an example of a conversation which usually takes place during a working group meeting. Read it and say whether the meeting was a success.

Dr Grey	Right, gentlemen. Shall we be getting started? First, may I start by thanking you for the interest which you have shown in this particular working group? There is a small group of us who felt strongly that an interdisciplinary group of this nature would have a lot to contribute to the conference as a whole, and that we should take advantage of the possibility of working together with colleagues who are all experts in their own specialized fields. Now, the first area which we've carved out for ourselves, but which wasn't really on the programme, is the relationship between urban planning and the environment, with particular reference to Professor Lindberg's contribution this morning.
Voice 2	Excuse me, Mr Chairman. Don't you think we should appoint someone to take the minutes?
Dr Grey	Oh yes, of course. I must apolodize. I completely forgot about appointing a secretary. Dr Schneider, perhaps you would be so kind as to take notes and prepare a summary of our deliberations?
Dr Schneider	I'd rather not, if you don't mind, Dr Grey. There are bound to be a lot of expressions I'm not familiar with, and, besides, my English is still a little rusty.
Dr Grey	I quite understand, Dr Schneider. It was unfair of me to ask you. Mr Hesketh, would you be prepared to take on this task?
Dr Hesketh	Certainly, Mr Chairman.
Dr Grey	Thank you very much.

I. Which of the sentences describes best what the speakers said?

1. Dr Grey and some of his colleagues formed the special working group because they felt
   a) they would gain a lot from talking to colleagues from different fields of research;
   b) they had nothing to contribute to the conference as a whole.
2. Dr Schneider does not want to take the minutes of the meeting because
   a) he wants to become familiar with the expressions in English;
   b) he feels that his English is not good enough.

II. Practice the conversation with your partner.

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CONVERSATION 3

Read the conversation and say what problem the preliminary statement which Dr. Grey read dealt with.

Dr Gray	Well, for the next three quarters of an hour or so, we'll be dealing with the concept of pollution in relation to town planning. We'd appreciate input from anyone here who has a contribution to make, of course. Now, I'd like to read a preliminary statement which I invite you to interrupt at any time. Please feel free to interject questions, comments or corrections.
Voice 3	Er, Mr Chairman, there's just a point I'd like to raise here.
Dr Grey	Yes?
Voice 3	Would it be possible for us to obtain copies of the document you are reading from?
Dr Grey	I haven't had this paper photocopied because, as I said at the outset, it's only intended as a preliminary statement which I hope we'll be modifying in the course of discussion.
Voice 3	I see. Please forgive the interruption.
Dr Grey	That's quite all right. Well, with your permission, I'll now read out the statement prepared by Professor Wilcox, Dr Anselm, Mr Green and myself. "In view of the ... ... Well, thank you, gentlemen. We seem to be agreed that the present text is now acceptable as a common basis for future discussion, and that it should be presented to the plenary session in its present form. May I now call upon Mr Hesketh to give a summary of our deliberations?
Mr Hesketh	Thank you, Mr Chairman. We began by outlining what we thought were the most important characteristic features of… ... Finally, it was agreed that the resolution I have just read out should be presented to the plenary session for the consideration of all participants at this conference. Thank you, Mr Chairman.
Dr Grey	Thank you, Mr Hesketh. Has anyone anything further he wishes to add to Mr Hesketh's summary? No? Then I should like to thank Mr Hesketh for such an excellent summary. Well, then, I think that's all there is to say on the subject at present. We'll meet again this afternoon, after the plenary session. Thank you for your attention.

I. Which sentence describes best what the speakers said.

1. a) Dr Grey wishes to read his statement before any discussion takes place.

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b) Dr Grey tells the members of the group that he would like them to ask questions or raise points while he is reading his statement, if they wish.

2. Dr Grey prepared the preliminary statement
   a) by himself;
   b) together with a group of colleagues.
3. a) Dr Grey asks Mr Hesketh to summarize what the group has discussed.
   b) Dr Grey asks someone to call Mr Hesketh to give a summary.

II. Read the conversation again and answer the following questions:

1. What problem was the morning meeting of the working group of the conference devoted to?
2. Was anyone appointed as a secretary to take the minutes there?
3. Is the concept of pollution important in relation to town planning?
4. Was it possible for the participants to obtain copies of the report discussed.
5. Was the resolution of the working group presented to the plenary session for the consideration of all participants at the conference?

Read the information about the World Conference on Computers in Education. Say why the problem discussed is very important.

The World Conference on Computers in Education.

The World Conference on Computers in Education took place in Switzerland some years ago. This Congress brought together more than 1000 people concerned with the development and use of computers in primary, secondary and university education, as well as in vocational training. This Conference was organized by the Swiss Federation of Automatic Control, on behalf of the International Federation for Information Processing (IFIP), and had the backing of UNESCO and the Intergovernmental Bureau for Informatics (IBI, Rome), which were offering to support participants from developing countries, preferentially those who wished to present a paper.

In addition to the Congress, a youth world computer programming tournament was being held in different countries; the national winners were invited to present their entry at the Conference. At the same time, an exhibition was set up to present educational material and a range of hardware and software, going from the smallest personal computer to the largest distributed informatics network , a concrete illustration of the multiple resources of these techniques applied to teaching and education.

The Conference put the accent on the relations between informatics and the teaching of other disciplines (computers in the teaching of physics, humanities at school, engineering, economics and social sciences), on instructional techniques, (large scale experiments in computer aided learning – CAL) and on the impact of new technologies. Moreover, the social impact of informatics on teachers and

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students, as well as on leisure were discussed during the conference.

Other contributions presented reviews of national policies and models of computer education; a special emphasis was put on the identification of the needs of developing countries and on the definition of the means to meet them.

Make a list of the most important points of the text. Use them as a plan of your retelling.

PROJECT

You are a specialist in the field of computer technology.
You have come to the International scientific conference.
You are to make a report there. Make a list of the most important points of the research you are doing at the moment which will serve you as a plan of your report, Make the report.

INTERNATIONAL ENVIRONMENTAL PROBLEMS

Problem presentation

In recent years, questions concerning the environment, both at a domestic level and on a global scale, have gained much media attention.

There are a lot of problems facing people on the planet Earth nowadays. The problems that demand world action are: the growth of world population, economic crises, ethnic conflicts. But the most urgent problem concerning the people of the whole world is an ecological one. Ecology in the science that studies the conditions of the habitat of man, animals and plants for the benefit of present and future generations. The environment is everything around us. It includes all living things. It also includes everything that is not alive, such as the soil, the air and the water. Human activities can make the environment unhealthy. The gasoline burned inside car engines produces gases that pollute the air. Factories burn fuels, too, put poisons into the air. Human activities also pollute water. Some factories produce liquid wastes that run into rivers. Often, these wastes contain poisons. Sometimes, useful chemicals cause problems in the environment.

Many scientists study the environment. When there is a problem, they try to find out why. Then they look for ways to solve them.

Scientists have also helped find ways to reduce air and water pollution. New cars burn fuel better and produce fewer poisons. Factories, too, produce fuel poisons. There are laws against dumping poisons into rivers and lakes. And there are many organizations such as “Greenpeace” that try to fight against pollutants.

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Useful words and phrases you need

Environment	ozone layer	destroying	protect
pollution	deforestation	dangerous	destroy
global warming	radiation	safe	pollute
exhaust fumes	rainforests	damaging	damage
conservation	fossil fuels	harmful	recycle
protection	protection	global	threaten
scid rains	endangered species	invisible	get rid of
dumping	pristine environment	efficient	spray
recycling	waste		drain

Focusing on the vocabulary

<<Ecology>> is a very popular word today. But what does it mean? Ecology is a science which studies the relationships between all forms of life on our planet and the environment. This word came from the Greek <<oikos>> which means <<home>>. This idea of <<home>> includes our whole planet, its population, Nature, animals, birds, fish, insects and all other living beings, and even the atmosphere around our planet. People are more worried about the environment (=the air, water, and land around us) as a result of the harmful (=dangerous/damaging) effects of human activity. Some of these activities cause pollution (=dirty air, land and water) and some are destroying the environment (=damaging it so badly that soon parts will not exist). Here are some of the problems:

the ozone layer: a layer of gases which stop harmful radiation from the sun reaching the earth; recent research shows that there is now a hole in parts of the ozone layer;

global warming: an increase in world temperature caused by an increase in carbon dioxide;

acid rain: rain that contains dangerous chemicals; this is caused by smoke from factories;

The “greens”.

Because of these problems, there are many groups of people whose aim is conservation (=the protection of natural things, e.g. plants and animals). They are often referred to as greens, e.g. ‘Greenpeace’ and ‘Friends of the Earth’.

Common causes of damage: smoke from factories, car exhaust fumes, dumping (=throwing away) industrial waste (=unwanted material) in seas and rivers, aerosol cans (usually called sprays). Some of these contain CFCs (=a chemical) which can damage the ozone layer, cutting down tropical rainforests (e.g. The Amazon).This increases carbon dioxide in the atmosphere.

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Exercises

1. *Fill the gaps to form a compound noun or phrase mentioned above.*

1. the ……. layer	5. ……. warming
2. ……... rain	6. ……. fumes
3. ……... waste	7. ……. rainforests
4. a bottle ……..	8. natural or human ……

2. *Complete these word-building tables. If necessary, use a dictionary to help you.*

Noun	Verb	Noun	Adjective
waste	…….	damage	…….
…….	protect	environment	…….
…….	destroy	harm	…….
pollution	……...	danger	…….
damage	……...	……	safe

3. *Complete the definitions.*
   1. Conservation is the protection of natural things, e.g. ……. and ……... .
   2. Acid rain is rain that contains dangerous chemicals. It is caused by ……. .
   3. The ozone layer is a layer of gases that stop dangerous radiation from the sun from reaching …… .
   4. Global warming is an increase in world temperature caused by an increase in …… .
   5. CFC (chlorofluorocarbon) is a chemical which …….. .

4. *If we want to look after the environment, there are certain things we should and shouldn't do. Complete these two lists in suitable ways.*

   We should:

   …… paper, bottles and clothes.
   …… tropical rainforests.
   …… more trees.
   …… water and energy.

   We shouldn't:

   …… paper, bottles and clothes.
   …… the ozone layer.
   …… water and energy.
   …… tropical rainforests.

5. *Test your knowledge of words. Are these statements **true** or **false**?*
   1. CFCs protect the ozone layer.
   2. "Greens" believe in conservation.
   3. A hole in the ozone layer could increase skin cancer.
   4. Cutting down tropical rainforests increases the amount of carbon dioxide in the atmosphere.
   5. Plastic cannot be recycled.

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ENVIRONMENT AND CONSERVATION.

You probably already know a lot of words for talking about the environment, pollution, and so on. Look at words that are often used together (collocations). Try to learn some of these expressions and use them in your speech.

A. Threats and potential threats to the environment

Shrinking habitats[1] are a threat to both plants and animals, and **endangered species**[2] need legal protection if they are to survive. Meanwhile, **global warming**[3] will produce rising sea levels and **climatic changes**[4], and **carbon dioxide emissions**[5] from the burning of **fossil fuels**[6] are contributing to the **greenhouse effect**[7]. In addition, population growth **exerts severe pressure on**[8] **finite resources**[9], and the ecological **balance**[10] may be upset by uncontrolled **deforestation**[11]. **Demographic projections**[12] suggest the world population will grow before it begins to stabilise. **One of the worst case scenarios**[13] is that there will be no tropical forests left by the year 2050. Our only hope is that **pristine environments**[14] such as Antarctica can be protected from development and damage.

1 places where animals live and breed which are decreasing in size.
2 types of animals/plants which are in danger of no longer existing
3 steady rise in average world temperatures
4 changes in the weather/climate
5 carbon dioxide gas from factories, cars, etc.
6 coal, oil, etc.
7 warming of the Earth's surface caused by pollution
8 formal: puts pressure on
9 limited resources
10 balance of natural relationships in the environment
11 destruction/clearing of forests
12 forecasts about the population
13 the possibilities for the future
14 perfectly clean/untouched/areas

B. Responses to environmental issues and problems

Look at these newspaper headlines and note the useful phrases.

GOVERNING PARTY
IN BID TO IMPROVE
GREEN CREDENTIALS*
* reputation for positive support of the environment

PROPHETS OF DOOM AND GLOOM*
SHOULD LISTEN TO SCIENTIFIC
EVIDENCE, SAYS PRIME MINISTER
* people who always make the most depressing or pessimistic forecasts for the future

SUSTAINABLE DEVELOPMENT*
THE ONLY ANSWER FOR EMERGING COUNTRIES, SAYS UN COMMISSION

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- development of industry, etc. which does not threaten the environment or social and economic stability

PIECEMEAL CONSERVATION*
INEFFECTIVE – NATIONAL POLICY NEEDED, SAYS NEW REPORT
* carrying out conservation one bit at a time, with no overall plan

Exercises

1. Make these sentences formal by using words and phrases from A opposite instead of the underlined words. Make any other necessary changes to produce a correct sentence.

1. **All that carbon-what's-it-called gas put or by** cars and factories is a major problem.
2. These flowers here are **a type there's not many left of**, so it's illegal to pick them.
3. A lot of wild animals have to survive in smaller and **smaller areas where they can live**.
4. Most of Patagonia is **a completely spotless area that's never been touched**.
5. We have to look after **the things we use on this planet because they won't last forever**.
6. **If the cutting down of trees** continues, there will be no forest left ten years from now.
7. Burning **coal and oil and stuff like that** causes a lot of pollution.
8. **The sea will get higher if this heating up of the world** continues.
9. Increasing population puts really big pressure on economic resources.
10. **The way things all balance one another in nature** is very delicate.

2. Complete the following table where possible using a dictionary.

noun	*verb*	*adjective*	*adverb*
climate			
demography			
	sustain		
	project		

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Thinking and discussing

NATURE AND ENVIRONMENT

A i r p o l l u t i o n

We need certain things to stay alive and healthy. We need clean air to breathe and pure water to drink. We need also food that is safe to eat and housing to shelter us. But we can't get all these things by ourselves. We live in community so we can solve our health problems only working together.

Polluted air is a community problem. Air becomes polluted in many ways. Cars, trucks busses and airplanes are among the worst polluters. They send partly burned gases into the air. Air can be also polluted by smoke and gases from factories; some of harmful gases that pour into the air are invisible. Dirt, smoke, and gases in the air may be carried away by wind and by air currents, or settle over as a blanket of smog.

Air pollution can cause, or make worse diseases. They usually affect older people. But everyone may feel uncomfortable and lack energy when air isn't clean.

What do people do to cut down on air pollution?

Today, many factories use devices to reduce the smoke, dust, or harmful gases.

Special kinds of gasoline for cars can help reduce air pollution. More efficient engines can help too.

Answer the following questions:

1. What pollutes the air we breathe?
2. How can air pollution affect our health?
3. What can be done to help cut on air pollution?

CLIMATE CRISIS

H o l e s i n t h e s k y

The satellite photographs showed the hole in the ozone layer over Antarctica. The hole is pink and white on the computer photograph. **The ozone layer** stops some of the **ultraviolet radiation** from the sun. Ultraviolet radiation causes a suntan. Too much ultraviolet radiation causes sunburn and **skin cancer**.

CFCs (chlorofluorocarbons) in the atmosphere have caused the hole. Scientists first discovered the hole in 1982, and it is getting bigger. Thirty per cent of CFCs come from aerosol cans, thirty per cent from fridges and air-conditioning, and thirty-four per cent from the manufacture of some plastic products.

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The Greenhouse Effect

Sunlight gives us heat. Some of the heat warms the atmosphere, and some of the heat **escapes back** into space.

During the last 100 years we have produced a huge amount of carbon dioxide. The **carbon dioxide** in the atmosphere works like the glass in a greenhouse. It allows heat to get in, but it doesn't allow much heat to get out. So the atmosphere becomes warmer because less heat can escape.

Where does the carbon dioxide come from? People and animals breathe in oxygen and breathe out carbon dioxide. Trees take carbon dioxide from the air, and produce oxygen. We produce carbon dioxide when we **burn coal**, oil, petrol, gas or wood. In the last few years, people have burned huge areas of **rain forest**. This means there are fewer trees, and, of course, more carbon dioxide!

1. *What changes in our life will these problems cause?*
2. *What could be done to improve the environment and to reverse these facts?*

Water pollution

Water pollution is caused by dumping wastes into lakes, rivers, and other bodies of water. Harmful wastes may also get into the soil or drain off fields that have been sprayed with pesticides. Pesticides are often used to kill insects and weeds in cities or on farms.

Polluted water can spread many diseases.

How does water get polluted?

Acid rain

What causes rainwater to be acidic? The most important cause of the **excessive acidity** of rainwater has been the **burning of fossil fuels** such as petroleum and coal. Burning fossil fuels produces not only carbon dioxide, but also gases such as nitrogen oxide and sulphur dioxide, which go high into the atmosphere. These gases combine with water molecules and form acid. These acidic water droplets then can travel hundreds of miles before they return to earth as rain or snow.

This will not be an easy problem to solve. As more and more countries become industrialized, there will be more and more competition for petroleum for cars, home heating, and industry. While burning petroleum contributes greatly to acid rain, it is less polluting than coal. Unfortunately, petroleum is more expensive that coal and the supply of petroleum will eventually **run out**. Therefore, there will be more and more pressure to burn coal for energy. Coal is a much dirtier energy source than petroleum. Since we already know how **destructive** acid rain is, it's very important that we increase our efforts to find a **non-polluting source** of energy as quickly as possible, so that we can avoid **further environmental damage**.

What will be the consequences of acid rains?

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Solid wastes

Every day people throw away amazing amounts of **garbage** and **trash**. What happens to these wastes after they are picked up by garbage trucks? Trucks take the garbage to the out-of-the way places. Sometimes the trash is burned, causing air pollution. But the more healthy way **to get rid of** solid wastes is to spread them over the land and pack them down. After that a thick layer of earth can be put down over the garbage and trees and grass can be planted.

1. *What is wrong with dumping garbage in open dumps?*
2. *What are some healthy ways to get rid of solid wastes?*

Greenpeace

Against all odds, Creenpeace has brought the plight of the natural world to the attention of caring people. Terrible abuses to the environment, often carried out in remote places or far out to sea have been headlined on television and in the press. Greenpeace began with a protest voyage into a nuclear test zone. The test was disrupted.

Then Greenpeace sent its tiny inflatable boats to protect the whales. They took up position between the harpoons and the fleeing whales. Today, commercial whaling is banned.

On the ice floes of Newfoundland, Greenpeace volunteers placed their bodies between the gaffs of the seal hunters and the helpless seal pups. The hunt was subsequently called off.

In the North Atlantic, Green-peace drove its inflatables underneath falling barrels of radioactive waste. Now nuclear waste dumping at sea has been stopped.

In the North Sea, Greenpeace swimmers turned back dump ships carrying chemical wastes. New laws to protect the North Sea have been promised. Peaceful direct action by Greenpeace has invoked the power of public opinion which in turn has forced changes in the law to protect wildlife and to stop the pollution of the natural world.

1. *What else do you know about the activity of Greenpeace?*
2. *What actions of Greenpeace do not appeal to you?*
3. *What actions could Greenpeace take in Belarus (except Chernobyl, of course)?*

Problem solving

ENVIRONMENTAL PROTECTION IN BELARUS

Improving the system of utilizing nature, protecting the environment are the main priorities of the state policy of the Republic of Belarus. The basic purpose of

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this policy is the maintenance of ecologically safe conditions for habitation by the population, protection and rational use of natural resources of the country in the interests of the present and future generations. To achieve this goal, a system of state management for environmental protection in the industrial sphere with consecutive transition to conserving resources, low waste and non-waste technologies, improvement of environmental legislation, are needed. The basic ecological problems of the Republic of Belarus are:

- high level of radioactive pollution of a significant part of the territory of the republic after the disaster at the Chernobyl power plant;
- slow reduction of wastes and dumps of polluting substances into the environment;
- irrational use of natural resources. The Republic of Belarus uses a much larger amount of raw materials, power resources per unit of production than advanced industrial countries do;
- reduction in some species of animals like elks, wild boars, musk-rats, beavers, etc. A complex republican program of environmental protection, "Ecology", for 1991-2000, includes measures, directed at improving ecological conditions, preserving and strengthening the natural potential of the republic.

The basis of environmental legislation is laid by the Law of the Republic of Belarus "On environmental protection" (1992). As a means of its further development the following laws of the Republic of Belarus were adopted: "On taxation for use of natural resources" (1991), "On state ecological expertise" (1993), "On wastes of manufacture and consumption" (1993), "The Law on protection of atmospheric air" (1997). State control in the field of environmental protection is carried out by the Ministry of Natural Resources and Environmental Protection of the Republic of Belarus, and in the field of radiological control – by the Ministry on Emergencies and Protection of Population from the aftermath of the disaster at the Chernobyl power plant. The responsibility for the state of natural environment rests on territorial bodies of state management and subjects of power.

The republic has powerful scientific potential in the field of environmental protection. Ecological problems are the subject of 5 scientific institutions of the Ministry of Natural Resources and Environmental Protection, 10 scientific-research academies of sciences of Belarus and many scientific groups of higher educational institutions. A Committee on hydrometeorology within the Ministry on Emergencies and Protection of Population from the aftermath of the disaster at the Chernobyl power plant and scientific group carry out ecological monitoring. The perspectives, having priority in terms of investing in the field of environmental protection, are the improvement of technologies in the sphere of production, ensuring more rational use of natural resources and reduction in wastes and dumps into the environmental; the expansion of the network of enterprises on secondary waste utilization and processing; the erection and reconstruction of purification facilities; the expansion of industrial production of appropriate equipment; the expansion of production of ecological control devices. The Republic of Belarus is a member of many conventions and international agreements in the area of environmental protection.

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1. *What are the main ecological problems?*
2. *What sources of air, land and soil pollution can you name?*
3. *How can they be protected?*
4. *What can you say about ecological situation in Belarus?*
5. *What should be done to create a system of ecological security?*
6. *Would you like to take part in its activities?*
7. *What can you do to keep our environment safe and clean?*

Chernobyl's deadly legacy

Chernobyl was not the first accident at a nuclear power plant. Serious accidental releases of radioactivity occurred at Chalk River, Canada in 1952, Windscale (now Sellafield), UK in 1957, and Three Mile Island in Pennsylvania, USA in 1979. But these events were overshadowed by the accident at the Chernobyl nuclear power station in the Ukraine, which was then part of the Soviet Union. It was the most serious accident to have occurred at a nuclear power plant, and an event which has haunted the world's nuclear industry since.

Although all four of the nuclear reactors at Chernobyl have now been closed down, it is by no means the end of the matter. Full decommissioning of the station is expected to take up to 50 years. Meanwhile, scientists will continue to monitor the accident's legacy for human and ecological health for many decades to come.

The accident

In the early hours of the morning of 26 April 1986, operators at the nuclear reactor complex about 130 km north of Kiev lost control of the Chernobyl Unit 4 nuclear reactor while conducting some experiments. The reactor core erupted in a gigantic explosion, injecting huge amounts of heat and disintegrated radioactive fuel into the atmosphere. Some 3,5 million people, over a third of them children, are thought to have suffered illnesses as result of contamination from the deadly cloud of radioactivity.

The authorities in the Soviet Union were slow to tell neighbouring countries of the disaster, due both to the atmosphere of secrecy that characterised the country and to uncertainties over the true scale of possible effects. An atomic fire burned at Chernobyl for days before Swedish authorities alerted the world to the nuclear fallout that had been injected high into the atmosphere.

Radioactive contamination from the explosion was greatest in the northern Ukraine, neighbouring southern Belarus and in the parts of the Russian Federation that are close to the Belarussian/Ukrainian borders. But Chernobyl radionuclides were also dispersed throughout the northern hemisphere in small amounts, with particular 'hotspots' in areas where rainfall washed radioactive material from clouds: parts of Austria, Bulgaria, Finland, Germany, Norway, Romania, Sweden, Switzerland, the UK and Yugoslavia.

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Most cocern has focused on the medical dangers to humans from the deposition of radionuclides. Fruit and vegetables from fields near the plant were destroyed, as was milk from cows grazing on nearby contaminated grassland. Initial fears focused on iodine-131 but this breaks down quickly. The time taken for half its atoms to decay, its half-life, is just 8 days. Attention soon shifted to caesium-134 and caesium-137, the latter with a half-life of 30 years. Caesium accumulates up the food chain from the soil through vegetation to contaminate meat. Special measures were required as far from the accident as Scandinavia and Britain to restrict the movement and sale for consumption of livestock. Other dangerous radionuclides involved include strontium-90 (half-life 29 years) and plutonium-239 (half-life 24,000 years).

Lingering effects

Restrictions on food are still in place in some areas up to 3,000 km from Chernobyl, because radioactive caesium from the accident is lingering in the environment much longer than scientists had anticipated. A survey last year found unexpectedly high levels of radioactivity in western Europe which will last for 50 more years, 100 times longer than expected. The high levels of radioactive caesium were found in fish in lakes in Cumbria (northern England), and in Norway. During the first 5 years after Chernobyl, the concentrations of radioactive caesium measured in most foods and in water declined by ten times, but in the last few years they have changed very little.

Although the health risk to consumers is thought to be small, restrictions on foodstuffs from parts of Europe and the former Soviet Union will need to be maintained for at least another 10-15 years. Even in Britain, 389 farms still have restrictions on the sale and slaughter of sheep which will have to continue until 30 years after the accident. In more contaminated parts of the Ukraine and Belarus, bans will need to continue for longer. Restrictions on the human consumption of forest berries, fungi and fish, which contribute significantly to people's radiation exposure, will have to continue for at least further 50 years.

Other long-term effects of the Chernobyl accident are evident in people who lived around the power plant at the time of the explosion. A dramatic increase in the number of cases of thyroid cancer has been recorded among children in northern Ukraine and in Belarus, mainly due to the accumulation in the thyroid gland of iodine-131 inhaled from the initial radioactive cloud or taken in with food. In the first 10 years after the accident at Chernobyl, well over 500 cases of thyroid cancer were reported in Belarussian children. Before 1986, only one or two cases a year occurred.

Environmental effects

Despite these terrible consequences, there do appear to be some aspects of the environment that have actually benefited from such a devastating human-induced catastrophe. Although local wildlife suffered from the severe irradiation immediately following the accident, when small areas of ghostly 'red forest' appeared as dead pine

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leaves turned a rusty brown colour, the long-term impacts so far seem to be beneficial, mainly thanks to the forced depopulation of farms and villages. All inhabitants from on area of 2,800 km around the power station, consisting of parts of the Ukraine and Belarus, were evacuated in the aftermath of the explosion. Human occupation of this exclusion zone is still banned for medical reasons. Although the area has been subjected to some of the worst radioactive contamination in history, wildlife has proved to be remarkably resistant to the known biological effects of radiation, notably mutations and birth deformities.

Scientists from the International Radioecology Laboratory just outside the exclusion zone have noted a general increase in the diversity of wild plants and animals and the unexpected return of rare species to the area. Wild boar, moose, wolves, deer, beavers, otters and lynx have become well established in the zone, while species associated with its previous human occupation – such as rats, house mice, sparrows and pigeons – have declined. No less that 48 species listed in the international Red Book of endangered animals and plants are now thriving in the Chernobyl exclusion zone. A rich community of aquatic wildlife has even been recorded living in one of the contaminated cooling ponds at the power station site itself.

The surprising resilience of the local ecology has led to calls for the exclusion zone to be designated a permanent nature reserve where endangered plants and animals can be free to breed as the land reverts to its original forested state thanks to the absence of human interference.

Political consequences

The disaster at Chernobyl also had serious political implications for the nuclear power industry. When energy generated by nuclear fission was first developed for civilian use in the 1950s, it was heralded as cheap, clean and safe. The image of nuclear power has changed considerably since those times, and today it is one of the most controversial forms of energy from both economic and environmental perspectives.

The financial cost of closing Chernobyl is colossal and the Ukraine is relying heavily on aid donations from the West to help. The overall cost of the closure could be around US$2 billion and full decommissioning of the station will take up to 50 years. Meanwhile, Switzerland and Spain have imposed moratoriums on further construction of nuclear reactors, while Belgium has adopted a long-term phase-out plan for its seven plants. The Dutch government has called for the closure of its last atomic power station and Germany has decided to phase out atomic energy in something over two decades. The deadly lessons learned from the world's most notorious power plant at Chernobyl played a part in all of these decisions.

1. *Was Chernobyl the first accident at a nuclear power plant?*
2. *When did it happen?*
3. *What was the reason of the accident?*

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4. *What were the consequences of the Chernobyl disaster?*
5. *How did it influence the ecology?*
6. *What political implications for the nuclear power industry did the disaster at Chernobyl have?*

Talking it over

TEN REASONS WHY IEPs ARE HARD TO SOLVE

1. The number of countries involved

This varies from one IEP to another. In general, the fewer the countries involved the easier it is to reach an agreement over how to solve the problem in question.

Many contemporary IEPs involve dozens of countries. Global warming is the most obvious example, since it is a genuinely global problem. Practically speaking, it is extremely difficult to get over 160 governments to agree on a common action plan to tackle this problem – which is one reason why there is currently no legally binding global agreement on global warming.

2. Problem recognition

An IEP cannot be solved unless all the relevant countries agree that there is a problem in the first place. Global warming is, once again, a good example. Scientists can certainly measure the rise in greenhouse gas concentrations in the atmosphere. But they find it much more difficult to measure the effects of this increase upon global temperatures. Since the atmosphere is a large and complex system it is not at all easy to assess the likely impacts of increased emissions of carbon dioxide and other pollutants. Indeed, some scientists believe that a cooling might result from these emissions. Initial global warming might later lead to more global evaporation, creating a negative feedback in which solar radiation would be prevented from reaching the Earth's surface by increased cloud cover.

Because of this scientific uncertainty, many countries are currently unwilling to spend money finding alternatives to the burning of fossil fuels – let alone cooperate in a world agreement to tackle global warming.

3. Political differences between governments

Governments can find it very hard to cooperate over an IEP when the are serious political differences between them. A good present-day example concerns Jordan, Israel and the use of the River Jordan. Like other Middle Eastern countries, both Jordan and Israel have a semi-arid climate, meaning that fresh water is scarce. On top of this both countries have experienced high rates of economic growth over the last 40 years, especially Israel which is fast becoming an advanced economy.

The logical solution would be for Jordan and Israel to cooperate and share river

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water on a fair and equitable basis before supplies dwindle. Instead, Israel has for many years occupied the so-called West Bank – which runs between the Jordan River and the Jordan-Israel border. This remains a political sticking-point in reaching a water-sharing agreement. Until Israel is willing to discuss returning parts of the West Bank to Jordan – and there are no signs of this happening – the two countries will continue to compete over, rather than share, River Jordan water.

4. Public perceptions

For governments to tackle an IEP it is usually important to have public backing. However, not all IEPs have the same impact on the general public. Those that do tend to be 'emotionally loaded' – in other words they have a direct and emotional impact on the general public.

It is taking a very long time for the general public to feel strongly about a problem such as global warming. Unlike whaling, global warming is harder to see and its emotional impact is more muted. In turn, because governments are not under strong public pressure to tackle the problem, they can drag their feet.

5. Wealth inequalities between countries

Levels of wealth and development between countries remain as uneven as ever. While countries such as the USA and Japan are phenomenally rich and others – such as Taiwan and Mexico – are fast-developing, some countries are desperately poor and will remain so for the foreseeable future (e.g. Ethiopia, Burkina Faso and Burundi). For many of these poorer countries protecting the environment is as expensive luxury.

6. Unequal responsibilities

Some IEPs involve unequal responsibilities that hinder inter-governmental cooperation. both ozone-layer destruction and global warming are good examples. The main culprits in both these transnational environmental problems are just a few developed countries (chiefly the USA, Canada, Germany, France, Japan and the UK). These countries have spewed vast quantities of CFCs (clorofluorocarbons, which attack atmospheric ozone) and greenhouse gases into the atmosphere. Yet they have been asking developing countries to find alternatives to using CFCs and to burning fossil fuels. Given the problems of poverty these countries face, they argue that it is mainly the developed world, not the developing, which should be switching to 'non-polluting' technologies.

7. Strong leadership

Some IEPs are tackled because the countries involved either rally around or are influenced by a strong leader.

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8. A global governmental body

Leading on from point 7, cooperation over IEPs is frequently hindered by the lack of a global governmental body which can compel national governments to act in concert. The United Nations is currently the closest thing we have to such a body. It is, however, only quasi-governmental. This means that while it represents most countries worldwide it is invested with none of the powers of a national government. Consequently, it can be ignored by national governments if they so choose. For instance, the UN urged all countries worldwide to sign a Convention on Biodiversity in 1992. The convention was designed to protect plant, animal and insect species against damage and extinction. But the USA refused to sign up because the convention did not meet its own national requirements.

9. Soft international law

Most international environmental agreements are, currently, not legally binding upon countries. They are, in other words, "soft" and lack the power of normal or "hard" law because international bodies like the UN are not invested with the legal powers of national governments.

10. Monitoring problems

Even where all the relevant countries sign up to an international environmental agreement or action plan, it is often hard to monitor which country is doing what to the environment. For instance, while the UK has a highly sophisticated system for measuring carbon dioxide emissions, a country like Zimbabwe does not. How can carbon dioxide pollution be controlled if we do not always know how much carbon dioxide is being discharged by particular countries?

T h e f u t u r e

Readers might think, having considered the ten obstacles discussed above, that most contemporary IEPs are virtually impossible to solve. But this pessimistic view would be misplaced for four reasons.

- First, some IEPs involving many countries are now being effectively tackled. For instance, the 1987 Montreal Protocol on CFCs began a process of virtually eradicating CFC use in many countries worldwide.
- Second, this and other examples mean many governments are now realising that IEPs are just too serious to ignore.
- Third, the UN has established a fund – the Global Environmental Facility – to help countries, especially poorer ones, pay for cleaner forms of development as part of international agreements.

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- Finally, one should not underestimate the capacity of countries to compromise in the interests of international cooperation. For example, the new carbon tax system for tackling global warming will cost the developed world hundreds of millions of pounds in carbon taxes, but this has not prevented the USA, Britain and other key players from supporting this system with some enthusiasm.

Discuss the reasons why IEPs are hard to solve.

PROJECT

1. Rank the following in order of importance in terms of danger to the average citzen and explain your answer:

a) pesticide residue on foods eaten by humans
b) hazardous waste sites (in use)
c) the greenhouse warming effect
d) radiation from nuclear power plant accidents
e) hazardous waste sites (abandoned)
f) radiation from x-rays
g) industrial accidents releasing pollutants into the air, water, or soil
h) exposure to toxic chemicals in the workplace
i) destruction of protective ozone layer
j) non-hazardous wastes, like trash disposal
k) underground storage tanks leaking gasoline and other substances
l) pesticides harming farmers, farm workers, and consumers who work with them.

2. Imagine that you are invited to take part in an international scientific conference. The subject of your report is supposed to be: "What should be done to create a system of ecological security in the world". Write your report and make it in your group.

SCIENCE

Problem presentation

Science is both a process of gaining knowledge, and the organized body of knowledge gained by this process. The scientific process is the systematic acquisition of new **knowledge** about a **system**. This systematic acquisition is generally the **scientific method**, and the system is generally **nature** of science

Despite popular impressions of science, it is not the goal of science to answer all questions, only those that pertain to physical reality (measurable empirical

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experience). Also, science cannot possibly address all possible questions, so the choice of which questions to answer becomes important. Science does not and can not produce absolute and unquestionable truth. Rather, science consistently tests the currently best **hypothesis** about some aspect of the physical world, and when necessary revises or replaces it in light of new observations or data.

Science does not make any statements about how nature actually "is"; science can only **make conclusions** about our **observations** of nature. The developments of quantum mechanics in the early 20th century showed that observations are not independent of interactions, and the implications of wave-particle duality have challenged the traditional notion of "**objectivity**" in science.Science is not a source of subjective value judgements, though it can certainly speak on matters of ethics and public policy by pointing to the likely consequences of actions. However, science can't tell us which of those consequences to desire or which is 'best'. What one projects from the currently most reasonable scientific hypothesis onto other realms of interest is not a **scientific issue**, and the scientific method offers no assistance for those who wish to do so. **Scientific justification** (or refutation) for many things is, nevertheless, often claimed.

The words you need

field, area	develop	important
opportunity	expand	vital
means	improve	serious
consequences	achieve	available
environment	design	fundamental
transition	implement	drastically
infrastructure	increase	considerably
key issues	focus	
aspect	transform	
reduction	rank	
allocation of funds		

SCIENCE IN BELARUS

Belarusian science was actually started in 1922 as the Institute of Belarusian Culture was set up. At present the National Academy of Sciences of Belarus (NASB) is in charge of organizing, conducting and coordinating the fundamental and applied scientific research and development. The Academy of Sciences was founded in 1929 and incorporated the Institutes of Philosophy, Economics, History, Constitution and Law, Linguistics, Literature and Art, Chemistry, Biological Sciences, Agricultural, Physico-Engineering Institutes and others. It was awarded the status “National” in 1997, and now comprises 94 Full Members (Academicians), 130 Corresponding Members, 3 Honorary and 16 Foreign Members of the NASB. The NASB comprises

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over 130 organizations and enterprises including 70 research institutes, divisions and centers. It employs 16 thousand people.

In 2002, the Academy of Sciences comprised Departments of Physics, Mathematics and Informatics; Department of Physical and Engineering Sciences; Department of Chemical Sciences and Earth Sciences; Department of Biological Sciences; Department of Medical and Biological Sciences, Department of Agrarian Sciences; Department of Humanitarian Sciences and Arts, It is planned to establish the Department of Economics and Management.

The Academy of Sciences is headed by the NASB President who is the member of the Council of Ministers of the Republic of Belarus and is appointed by the President of the Republic of Belarus.

The NASB is in charge of conducting and coordinating research and development in the most important spheres of natural, engineering, humanitarian, social sciences and arts.

Over the last 10 years, nearly 6 thousand patents for inventions, useful models and designs, over 12 thousand trademarks, 1,140 licensing agreements have been registered.

Over the same period the academic degree of Doctor of Sciences was awarded to 652 and that of Candidate of Sciences to 3,333 candidates the title of Professor and Assistant Professor was awarded to 450 and 1,896 scientists and specialists, respectively.

Today science in Belarus has a number of problems. After the breakup of the Soviet Union and disruption of economic and scientific relations some branches of Belarusian industry have been left without any scientific basis. A lack of funds has affected the state of some branches of science. There was also a tendency of brain drain from the science sector which emerged in the 1990s. However, the country's scientific and technical basis hasn't been destroyed.

Several branches of the scientific and technical sphere can be brought to the level of competitiveness in the world market. This mainly holds true for laser and plasma technologies, chemical synthesis of substances, biotechnologies and information processes – the areas with a high scientific and technical potential. The outstanding scientists in these fields of science are Fyodor Korshunov, Gennady Yablonski, Sergei Gaponenko, Ivan Bodnar, Igor Troyanchuk, Victor Borisenko, Vyacheslav Yarmolik, Rauf Sadykhov, Sergei Ablameyko, Nikolai Kazak and others.

Achievements of scientific schools in the sphere of mathematics, theoretical physics, spectroscopy and luminescence, electronics, automation, thermophysics, material science, machine building, geology, bioorganic chemistry, physiology, genetics, selection, soil science, cardiology, surgery, linguistics, etc. are known worldwide and have been highly appraised in Belarus and enjoyed the international recognition. Findings of some researchers have the highest rank of significance and are registered as scientific discoveries.

The NASB Central Scientific Library, Republican Scientific and Technical Library of Belarus, Republican Scientific Medical, Pedagogical and Agricultural libraries, University libraries and others provide Belarusian researchers and

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specialists with the needed scientific literature. Scientific papers, periodicals, collections, popular-scientific and reference literature relating to an extensive range of science and engineering sectors are published by the specialized NASB Publishing House "Belaruskaya Navuka", publishing centers of scientific institutes and institutions of higher education. A number of scientific journals, including international, are published in Belarus. Among them, "Computational Methods in Applied Mathematics", "Doklady of the National Academy of Sciences of Belarus", "Proceedings of the National Academy of Sciences of Belarus" (7 thematic series), "Journal of Applied Spectroscopy", "Journal of Engineering Physics and Thermodynamics", etc. Part of them is published in English or is translated, reissued and distributed all over the world by prestigious scientific publishers "Kluwer Academic/Plenum Publishers" and "Allerton Press".

1. *What do you know about the history of science in Belarus?*
2. *What are the latest achievements of Belarusian science?*
3. *Enumerate the problems our science is facing at present.*
4. *Do Belarusian and Russian sciences have much in common in their development?*
5. *What are the ways to overcome these problems?*
6. *How many researchers work in Belarus now?*
7. *What is the number of Doctors and Candidates of Sciences in our country?*
8. *What departments does the Academy of Sciences consist of?*
9. *What kind of scientific literature is available in the republic?*

Thinking and discussing

Exercise 1. Share your opinion with a partner about the List of Priority Scientific and Technological Activities of our republic:

- The development of the statehood of Belarus
- Healthcare
- Consequences of Chernobyl disaster. Environmental protection
- Producing, processing and storing agricultural produce
- Power engineering and transport
- Informatization, telecommunication and communication
- Resource-saving technologies. New materials and technologies

Raising competitiveness of machine-building and radioelectronics manufacturing.

Exercise 2. Discuss in small groups all pros and cons of:

a. Cloning
b. Genetically modified food

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c. Building atomic power stations
d. Using Sun's wind in space flights
e. Was the problem of 'The year 2000' a real problem or mystification
f. Suggest your own scientific problems for discussion.

Exercise 3. Our University majors in information technology and communications – the fields that are supposed to develop swiftly in the near future. Complete the list of specialities of our University:

- Informatics
- Computer systems and networks
- Design and manufacture of radioelectronic devices
- …

Discuss the list with your groupmates and explain which specialities and qualifications you consider most promising and why.

Exercise 4. What do you know about R&D (research and development) carried out at your department (University)? Speak on the achievements of our scientists, engineers, post-graduate students – you may find a lot of interesting material in the University museum.

The words you need

research and development	to be involved	swift, rapid
scientific and engineering	to be in charge of	extensive
potential	to carry out	prestigious
personnel	to conduct, to develop	chemical
fundamental and applied research	to comprise, to consist of	biological
	to enjoy (recognition)	humanitarian
an acute (urgent, important) problem	to deal with	currently
	to be concerned with	

PROJECT

Make a short report about one of the famous scientists and his invention. Choose a topic. Here are some possible ideas.

a) Choose a famous scientist. Find out as much as possible about him / her.
- Write his / her biography. Describe his / her early life.
- Tell a story from his / her life.
- Describe and comment on the results of his / her work.
- Explain why his / her work is important.

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b) Choose any discovery / invention. Find as much information about it as you can about it.

- Describe what problems existed before the discovery / invention was made.
- Give some information about the difficulties the scientist encountered during his work.
- Describe and comment on the results of the discovery / invention.

SCIENTIFIC COOPERATION OF BELARUS WITH OTHER COUNTRIES

It is hard to imagine peaceful coexistence of nations without all-round scientific and engineering cooperation among the states. Besides, there are fields which cannot be developed effectively only on a national scale, such for instance, as environmental protection, space exploration, development of nuclear and solar energy, rational use of the ocean's resources, etc.

The policy of our state with regard to scientific and technological cooperation with other countries rests on respect for sovereignty, equality and mutual advantage. International contacts in science and technology are regarded as a means of speeding up socio-economic progress of all the countries.

An integral part of the national scientific and technical policy of the Republic of Belarus is the international scientific cooperation within the framework of which Belarusian scientists and specialists conduct research and development jointly with foreign counterparts, and establish strong relations with international academic organizations. The international intergovernmental treaties and agreements serve as a legal basis for such cooperation. The Republic of Belarus concluded and executes over 30 bilateral and more than 10 multilateral (within the CIS) agreements on scientific and engineering cooperation. The collaboration is being intensified with the International Association for Promotion of Cooperation with Scientists from the New Independent States of the Former Soviet Union (INTAS), International Science and Technology Center (ISTC), International Center for Scientific and Technical Information (ICSTI), Joint Institute of Nuclear Research (JINR), European Center for Nuclear Research (CERN), NATO Science Committee, etc. The Belarusian scientists participated in implementation of over 300 research projects through annually held INTAS open contests. The UNESCO, IAEA, INCO-Copernicus, CRDF and other organizations' projects are also being implemented. The scientific and engineering cooperation with CIS countries and Russian Federation within the framework of the Belarus-Russia union state is prioritized.

Bilateral scientific and technical cooperation of Belarus with the Ukraine, Kazakhstan, Armenia, Azerbaijan, Georgia, Moldova is growing. Belarus seeks cooperation with many countries, which is indicative of its multi-vector foreign policy.

Belarus signed the long-term agreements on cooperation in science and engineering with Bulgaria, Great Britain and Nothern Ireland, Hungary, Germany,

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Egypt, India, Iran, Cyprus, China, Poland, Rumania, Slovakia, the USA, Turkey, Japan, The United Arab Emirates.

Belarus is a host as well as a participant of a great number of international conferences and symposia such as 'Tibo', 'Prospective Technologies and Systems', 'Alternative sources of energy', 'Prevention of Natural Disasters', to name only some of them.

Answer the questions

1. What are the aims and principles of international scientific cooperation of Belarus?
2. How can Belarus contribute to the solution of the problems of environmental protection; medical service and public health; development of supercomputers; industrial automation; creating new kinds of materials, etc.? Give the examples of Belarus's contribution into these areas.
3. Which of our neighbour states can be regarded as best partners in scientific cooperation? Give your reasons.

The words you need

a trend	to regard	national
an exchange	to solve (to face) the problem	mutual
an agreement	to render assistance	bilateral
in the frames of	to establish	multilateral
a means	to maintain	fruitful
activity	to achieve	effectively
cooperation	to contribute	annually
sovereignty	to sponsor	
implementation	to speed up	
basis	to increase	
	to collaborate	

Now let's turn to the ways of organizing science in some other countries. Read and decide what are the advantages and disadvantages of science organization in Russia, Britain and America.

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Focus on the vocabulary

Read the text and say what difficulties Russian science encounters

THE CURRENT PROBLEMS OF RUSSIAN SCIENCE

By Sergey Korotaev D.Sc. (phys./math.)

In pre-Revolutionary Russia fundamental science was supported by the state mainly through the self-governed Academy of Sciences.

During the Soviet era, the principal motive of the ruling authorities was to create a war machine that could stand up to the rest of the opposing world. That required a cutting-edge military science. The country's Communist leaders understood that the results they needed could only be reached by a high level of fundamental science. As a result, by the 1980s, Soviet science ranked second in the world.

In the 90s the scientific sector became a serious problem. As a result, many talented people emigrated, the most enterprising went into business, while the most passive became lumpenized. The inflow of fresh blood – young scientists – stopped completely. Some university graduates went abroad, others started working as programmers at banks and other commercial institutions, while the rest took whatever jobs were available as long as they were not in science since it is the lowest paid profession.

Putin's move was to set the level of funding for scientific research programs at 4 per sent of the national budget – a level that was never actually achieved but that was, at least, something to fight for. The latest initiative by the Putin administration, however, is a reduction in the number of scientific research institutes because of the low effectiveness of scientific organizations. Paradoxically, bad as the present situation may be, this effectiveness is, as a matter of fact, extremely high – its source is the unflagging energy and fanaticism of Russian scientists. True, the number of patents is not a problem of fundamental (or even applied) science, but the problem of industry's primitive orientation toward the raw materials sectors which does not generate demand for inventions and innovations.

There are serious internal problems in the organization of Russian science. Its administrative-managerial apparatus – from the Presidium of the Russian Academy of Sciences to almost every scientific research institute – is self-centered, acting on self-interest. Competitive bidding on the allocation of funds within the Academy and the ministry, which is required by law, is seldom implemented. It is a purely bureaucratic procedure – a private divvying – up within a narrow circle of directors and government officials.

An internal reorganization of scientific sector may only come second – after the state has drastically revised its science policy, in particular boosting budget spending on scientific research programs.

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Answer the questions to the text

1. Why was it possible to achieve a high level of the fundamental science during the Soviet era?
2. What changes took place in the scientific sector in 90s?
3. Why did the number of young scientists decrease in that period?
4. Do you consider reasonable to set the level of funding scientific research at 4 per cent of national budget?
5. How can you account for high effectiveness of Russian science at present?
6. What is understood by the phrase ‘a private divvying’?

HOW BRITISH SCIENCE IS ORGANIZED

John B.S.Haldane

The British Association for the Advancement of Science was founded in 1831, and at that time almost every serious scientist in Britain belonged to it. There were so few of them that most of the year’s work in a given branch of science could be discussed in a few days. In fast it merited the title of “Parliament of Science” which is still bestowed on it by some newspapers.

Since then the situation has completely changed. At present there are a number of societies, for example the Royal Astronomical Society, the Chemical Society, the Genetical Society, the Geological Society and the Physiological Society which are composed of scientists only. Finally there is the Royal Society of London for Improving Natural Knowledge. This has 384 scientific fellows, 49 foreign members, and 15 British fellows. When it was founded nearly 300 years ago, it included every scientist in England, who were interested in science. But now it only includes a small fraction of scientists, and its discussions are less lively than those of the societies concerned with individual sciences. On the other hand, the British Association is concerned with matters other than science. It has sections devoted to psychology, education and economics.

But except for the Royal Society, the scientific societies have no money to subsidize research. This is done by universities, the government, industrial firms, and endowed bodies. There is no organisation of research on a national scale. Some of the government and industrial research is secret, and therefore of no value to science. For science means knowledge.

The British Association is able to spare a few hundred pounds yearly for grants in aid of research. But its main function now is discussion. New results are generally announced at meetings of smaller societies, and the public hears very little of them. Both in Russia and in Scandinavia the press has far better scientific news than in Britain.

If science is to advance in this country as it should, we need more democracy in the laboratories, and also more democratic control of expenditure on research. This

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will only be possible if the people are educated in science, and they are at present deliberately kept in the dark. For a knowledge of science leads to a realization of the huge amount of knowledge which could be applied to the public benefit in industry, agriculture and transport were organised for use and not for profit.

HOW AMERICAN SCIENCE IS ORGANIZED

American scientific establishments are a series of pragmatic responses to society's specific needs. The Federal government sponsors the major part of the country's research through contract systems. The government supports about 75 per cent of all scientific research carried on in universities. It also maintains a large system of its own government laboratories run by government workers and national laboratories run by outsiders. Many of them depend on universities as a source of permanent research personnel, and on government policy for guidance of their research programs. Such government and national laboratories as Oak Ridge National Laboratory[1], the National Research Laboratory[2] and others are concerned with basic research.

The important thing is that at present the giant Rand D spenders are the Pentagon and NASA[3] which is a government agency. At present it is common for individual firms to sponsor research done through a contract system in universities. Usually an industrial sponsor finds research of interest to a university and then the sponsor and the university pool their resources of scientific talent and equipment, with the work usually taking place on the university campus. This cooperative university-industry research is beneficial for both partners, and it is an ideal vehicle for fostering technology transfer from basic research to the market place.

This, the first major player in American science today is the Federal government which supports a lob of basic and applied research. Then comes private industry which has a large share in basic research but plays a dominant role in funding applied research and development. The third major player is the university. And then come the so-called non-profit institutions[4].

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[1] Oak Ridge National Laboratory – Oak Ridge, Tennessee – independent non-profit, widely diversified research and development organization owned by the US Government Principal fields of research: nuclear energy development, biochemical and environmental problems, basic energy sciences, studies on properties of materials, etc.

[2] National Research Laboratory – Cincinnati, Ohio, Field of R and D: microbiology, basic and product – oriented research in immunohematology.

[3] NASA ['n-es-] – National Aeronautics and Space Administration, a government agency.

[4] Non-profit institution – organization not intending or intended to earn profits.

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Answer the questions

1. What part is played by the government in subsidizing science in America?
2. What institutions are concerned with basic research?
3. How is research done in universities?
4. What fosters technology transfer from basic research to the market place?
5. Which country – in your opinion – has the most advanced way of organizing science and why? Discuss it with your partners.
6. So, as you see, a great part of research and development is carried out by Academies and Universities in many countries. Choose any National Academy or University in Europe. Using reference material make a table comprising the following information:

Name	Moscow University	
Date of Foundation (the Founder)	1755. M. Lomonosov	
Source of Funding (if mentioned)	-	
Major Fields of Research	Initially philosophy law medicine	At present mathematics, physics, mechanics, geography, geology, economics, phychology
Outstanding Researchers	Stoletov, Sechenov, Timiryazev, Vernadsky, Vavilov	Writers: Griboedov, Lermontov, Goncharov, Turgenev, Chekhov
Important Achievements		
Current Trends in Research		

Compare your table with that of your neighbour. Make a short report about the Academy or University chosen.

Read the text and discuss its contents with your partners.

What do you think it will be about?

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THE FUTURE OF ENGINEERING

By Robert W. Lucky

What will engineering be like in the future? Every now and then I think about how much it has changed over the course of my own career. If changes of a similar magnitude happen in the coming decades, what will the profession be like for today's college students?

Today we soar on the wings of computers and networking to heights where the minutiae of engineering lie indistinguishable on the ground far below. Sometimes I think of Archimedes' lever: "Give the a place to stand on, and I can move the earth" We've been given the lever and the place to stand upon, and feel that the earth is ours to move.

That feeling of empowerment is exhilarating. My worry is the price that we have paid for soaring so far above the landscape. In our profession there is a growing distancing from reality. It is like the profound feeling of disconnection I have when I stare out the window of an airplane. Those aren't real houses down there, I think, and I'm not really sitting in an aluminum tube high in the sky with no visible means of support. Why does the pilot tell me that the outside temperature is-50^0C? This has no meaning to me, because the outside world is merely a diorama painted on my window. But as soon as these troubling thoughts intrude, the flight attendant's voice supervenes, telling me to lower my window shade so that I can better see the movie, substituting one form of unreality for another.

Engineering today feels like that window seat on the airplane. Those can't be real transistors and wires down there, can they? Watching the simulations on my computer monitor is like watching the movie on the airplane – an unreality wrapped in another unreality. I feel that I have lost touch with Edison's world of electricity – a world of black Bakelite meters, whirring motors, acrid chemical smells, and heated conductors. I miss Heathkits and the smell of molten solder and burning insulation – the sensual aspects of engineering that have been replaced for many of us by antiseptic, ubiquitous, and impersonal CRTs.

I have a deeper worry that math itself is slipping away into the wispy clouds of software that surround us. I walk down the aisles of laboratories, and I see engineers staring vacantly into monitors, their desks piled high with anachronistic paper detritus. Is anyone doing math by hand any longer, I wonder? Do they miss the cerebral nourishment of solving equations? Perhaps math in the future will be the exclusive province of a cult of priests that embeds its capability in shrink-wrapped, encrypted software.

I can't believe that 20 years from now engineers will still stare into displays, run CAD tools, and archive their results in Power Point. But what will they do? My deepest fear is that the reality gap becomes so great that the best-selling software will be called Engineer-in-a-Box.

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Answer the questions:

1. Can you foresee the development of engineering in the near future? What will it be like?
2. How has your idea of engineering (your speciality) changed since you were a first year student?

THE HISTORY AND FUTURE OF THE INTERNET

The Internet technology was created by Vinton Cerf in early 1973 as part of a project headed by Robert Kahn and conducted by the Advanced Research Projects Agency, part of the United States Departament of Defence. Later Cerf made many efforts to build and standardise the Internet. In 1984 the technology and the network were turned over to the private sector and to government scientific agencies for further development. The growth has continued exponentially. Service-provider companies that make "gateways" to the Internet available to home and business users enter the market in ever increasing numbers. By early 1995, access was available in 180 countries and more than 30 million users used the Internet. The Internet and its technology continue to have a profound effect in promoting the exchange of information, making possible rapid transactions among businesses, and supporting global collaboration among individuals and organizations. More than 100 million computers are connected via the global Internet in 2000, and even more are attached to enterprise internets. The development of the World Wide Web leads to the rapid introduction of new business tools and activities that may lead to annual business transactions on the Internet worth hundreds of billions of dollars.

Write a short essay about the history (or future) of the computers, robotics, automation in industry, communication and control, artificial intelligence, etc. See the example.

Role-playing

Situation:
You are taking part in a TV talk-show ("Choice"). Different people are invited to the studio to participate in the discussion "How should science develop in the near future?"

Roles:
1. **A producer** outlining the major achievements and problems of science in the world.
2. **A Belarusian scientist** engaged in fundamental research (physics, mathematics, chemistry, botany, etc.)
3. **A British scientist** collaborating with Belarusian collegues in the area of inorganic chemistry, microelectronics, etc.

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4. **A post-graduate student** participating in building a robot-manipulator, an electronic library, etc.

5. **A state official** in charge of allocating the money for scientific research in our country.

6. **A Russsian** scientist carrying out research in the field of laser physics, automatic control, etc.

7. **An analyst** from a scientific journal making examination of the views expressed and presenting the judgement of the discussion results.

RESEARCH WORK

Problem presentation

Recent developments in the fields of communications and information technology are indeed revolutionary in nature. Information and knowledge are expanding in quantity and accessibility. In many fields future decision-makers will be presented with unprecedented new tools for development. In such fields as agriculture, health, education, human resources and environmental management, or transport and business development, the consequences really could be revolutionary. Communications and information technology have enormous potential, especially for developing countries, and in furthering sustainable development.

There is a consensus that the transition to the 21st century will witness a quantum leap in the development and exploitation of information technologies, with corresponding ramifications for social and economic organization, the environment, culture and the development of a global information infrastructure. The key issues of concern to policy-makers and international organizations are the extent to which this major transformation has benefited all aspects of society and the ways and means of achieving a truly global information infrastructure.

The words you need:

chair	do research	predict
thesis	enable	anticipate
obtained data	prove	simulate
scientific degree	take part	discover
close cooperation	deal with	complete
computer science	make contribution	collaborate
innovations	be engaged in	result in
arrangement	have an opportunity	participate
confusion	pay attention to	perform

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Focusing on the vocabulary:

Read the letter. What do you think Alex is busy with?

Dear Robert.

Thank you very much for you letter . I'm sorry for not having written for so long. I'm very busy at the moment.

As you know I'm a system analyst at one of the departments of the Belarusian State University of Informatics and Radioelectronics. My special subject is hardware design of the digital system for static image compression. I combine my practical work with scientific research. I'm a post-graduate student now.

I'm doing research in the field of image processing . This branch of science has been rapidly developing for the last decade and the obtained results have already found wide application in most varied spheres of science, technology and national economy.

I'm particularly interested in image compression algorithms because hardware realization of different algorithms is much faster than their software realization. I have been working on the problem for a year. I got interested in it when a student. I work in close cooperation with my colleagues. We also closely cooperate with several institutions and enterprises of our republic and other countries.

There are several research teams at our department. The team I work in is headed by Doctor of Technical Sciences Professor Petrov. He is my scientific adviser. I always consult him when I encounter difficulties in my research. We often discuss the data obtained.

I have not completed the experimental part of my thesis (dissertation) yet but I'm through with the theoretical part. For the moment I have 5 scientific papers. Some of them were published when I was a student. Two papers were published in the journals of Germany and Russia.

I take part in various scientific conferences where I make reports on my subject. I willingly participate in scientific discussions and debates.

I'm planning to finish writing the dissertation by the end of the next year and prove it in the Scientific Council of the University. I hope to get the scientific degree of a Candidate of Technical Sciences.

Looking forward to hearing from you soon.

Sincerely yours.
Alex.

1. What field of science is Alex doing his research in? Is this field of science very promising nowadays?

2. What are the duties of a scientific adviser?

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Exercise 1. Look at these anagrams. What areas of scientific study or technology are there in the list?

SIPHYSC
TORCISOB
YOCELOG
MYNASORTO
COLETRENSIC

Which one has to do with?

a) stars and planets ?
b) computers, TV, etc.?
c) velocity, gravity, etc.?
d) the environment ?
e) machines that do the work of people?

Of course you have heard about these sciences. Which would you like to study most? Are they supposed to contribute to human progress?

Exercise 2. Say which inventions each of the following words relates to?

CD
Scanner
Software
Receiver
Internet
Hardware
Bit
Robots

Exercise 3. Each of the following extracts describes a certain specialty which you can get at one of the departments of our University. Can you work out what it is?

- they design, build and install electrical devices, especially microelectronics ones and operate electricity generating stations and transmission networks;
- they oversee the repair and maintenance of computer systems and electronic equipment;
- they integrate various hardware components or networks of computers and design multipurpose software to run on those computers;
- they work primarily at computer manufacture integrating hardware components with software.

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Exercise 4. Why should one be involved into research work? Which of these are good reasons for doing research work? Give your reasons.

I think I'd be able to make more money if I proved my scientific degree.

There are a lot of fields of science where I can do my best to discover something new.

It's great to feel you can say how things are done. It makes you feel important.

My dream is to get the Nobel prize.

When you are engaged in research work you have a real opportunity to be successful in your carrier.

Thinking and discussing

Text 1. Read the text. Do you know what Babbage is famous for? What discovery did he make?

CHARLES BABBAGE'S DIFFERENCE ENGINE

The first device that might be considered to be a computer in the modern sense of the word was conceived in 1822 by the eccentric British mathematician and inventor Charles Babbage.

In Babbage's time, mathematical tables, such as logarithmic and trigonometric functions, were generated by teams of mathematicians working day and night on primitive calculators. Due to the fact that these people performed computations they were referred to as "computers." In fact the term "computer" was used as a job description (rather than referring to the machines themselves) well into the 1940s, but over the course of time this term became associated with machines that could perform computations on their own.

In 1822, Babbage proposed building a machine called the Difference Engine to automatically calculate these tables. The Difference Engine was only partially completed when Babbage conceived the idea of another, more sophisticated machine called an Analytical Engine.

Interestingly enough, more than one hundred and fifty years after its conception, one of Babbage's earlier Difference Engines was eventually constructed from original drawings by a team at London's Science Museum. The final machine, which was constructed from cast iron, bronze and steel, consisted of 4,000 components, weighed three tons, and was 10 feet wide and 6 feet tall. The device performed its first sequence of calculations in the early 1990's and returned results to 31 digits of accuracy, which is far more accurate than the standard pocket calculator. However, each calculation requires the user to turn a crank hundreds, sometimes thousands of times, so anyone employing it for anything more than the most rudimentary calculations is destined to become one of the fittest computer operators on the face of the planet!

The Analytical Engine was intended to use loops of Jacquard's punched cards to

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control an automatic calculator, which could make decisions based on the results of previous computations. This machine was also intended to employ several features used in modern computers, including sequential control, branching, and looping.

ADA LOVELACE

Working with Babbage was Augusta Ada Lovelace, the daughter of the English poet Lord Byron. Ada, who was a splendid mathematician and one of the few people who fully understood Babbage's vision, created a program for the Analytical Engine.

Had the Analytical Engine ever actually worked, Ada's program would have been able to compute a mathematical sequence known as Bernoulli numbers. Based on this work, Ada is now credited as being the first computer programmer and, in 1979, a modern programming language was named ADA in her honor.

What do you know about the history of the science you are engaged in? Who are the most prominent scientists in this field of knowledge?

1. *What did mathematicians use for calculations in Babbage's time?*
2. *What was the Analytical Engine intended to?*
3. *Who created a program for the Analytical Engine?*

Text 2. Why do computer engineers have a ready market for jobs? What are the main duties of computer engineers?

COMPUTER ENGINEER

Computer engineering stands midway between the hardware orientation of the electrical/electronics engineer and the software orientation of the computer scientist or programmer, The computer engineer addresses the basic questions of hardware design and decides how best to adapt software programs to the procedures written into hardware.

It is truly amazing how many competing computer designs are fighting for market share today. Some future historian may look back on the 1990s as a golden age for computer designers.

To begin with, there is the traditional delineation among mainframe, minicomputer, and microcomputer units. In the late 1970s the supercomputer became" commercially accepted and has since become a billion-dollar industry in its own right. Then, as computer power went up and hardware costs went down, there arose superminicomputers, supermicro computers, and engineering workstations. Now, each of these categories is being further blurred by the advent of parallel processing machines and reduced instruction set computer (RISC) technology. In each case, the fundamental components of a computer — the central processing unit, data storage, and data input/output — get rearranged. This makes work — and plenty

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of it — for the computer engineer.

Computer engineering evolved as engineering departments across the country grappled with the issues of designing computer systems. In the early days, hardware defined how software was to work; one simply had to take what was available and adjust programs to run on those machines. But, because the cost of developing software was so high and because alterations in hardware could make programs run more quickly, soon software began defining how hardware should be assembled.

Because the technology for computer designing changes so dramatically from year to year, it would seem to be essential that computer engineers keep up-to-date. Computer engineers are not required to work in the computer industry, but they tend to concentrate there. Once the thorny issues of how a computer architecture is designed are resolved and the design reduced to hardware, the applications work shifts to computer programmers and analysts. The most robust section of computer manufacturing today is engineering workstations, which tend to fall midway between personal computers and minicomputers in power

Since overall growth of the computer industry has been so robust, computer engineers have a ready market for jobs. Meanwhile, guess what? The computer industry is researching a host of new design technologies, including the use of quantum-effect devices, gallium arsenide computer chips, and fiber optics. The race goes on.

1. *Which of these defines a computer design more: software or hardware?*
2. *Why must computer engineers keep up-to-date?*
3. *What is the computer industry researching now?*

Text 3. Do you think duties of computer engineers differ from the duties of computer programmers? What are the differences?

COMPUTER PROGRAMMER

"Computer programming" has become a vague term, one comparable in some respects to "business management." Both phrases have meaning, but nearly everyone defines that meaning differently.

With regard to programming, the confusion stems from the still-evolving nature of the computer and information processing businesses. Years ago, when computers were few and far between, it was important for organizations owning computers to maintain staffs that could perform routine setups and run specialized programs; thus, the computer programmer. In the intervening years, computer software development has become concentrated in consulting or services organizations that provide programs of varying size for databases, transaction processing, statistical functions, and financial management. Many computer users in this arrangement employ data processing or ‘information’ staffs that input data and periodically upgrade the system. The computer programming work done by the software-developing businesses is often similar to that done by the software-using businesses, though the job titles

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differ. Software programs can have a cumulative value (in terms of hours invested in their installation and operation) that equals or exceeds the cost of the hardware that runs the programs.

The microcomputer, or personal computer (PC), has further scrambled an already fragmented field. There are probably more computer programmers working in a PC environment than with minicomputers or mainframes. (There are definitely more microcomputers than other types; the dollar value of PC software and hardware is fast approaching that of the larger computers.)

Here are some of the hot job prospects in computer programming currently.

Computer-aided engineering (CAE) programming. The market for engineering workstations—computers midway between a powerful microcomputer and a minicomputer—is booming, with sales growth projected at 30 percent a year. Engineers use these; programs to run design or analytical

operations for projects that used to be done with pencil and paper. The control program called UNIX dominates.

Computer-aided software engineering (CASE) programming. Programmers are automating everything else—why not their own work as well? '

Although it would seem to be a process of working oneself out of a job, CASE ,

is becoming an essential tool for programmers. In large part this is because the time it takes to write a new program is often so long that the business '

reasons driving its development may have changed in the meantime, altering its specifications, or a client organization may cancel the project because of a loss of revenue while awaiting its completion. The main point here is to shorten the program's development time so that organizations can take advantage of it more quickly. Automation of programming techniques can help accomplish this. Microcomputer software companies, for example, are notorious for failing to meet delivery schedules for new programs.

Transaction processing programming. Transaction processing involves making multiple, simultaneous entries to a database or file of records very rapidly. Transaction processing is what enables automatic teller machines to perform many functions, and it keeps Wall Street stock traders on top of a 100-million-share trading day. The banking and financial services industries have big plans for expanding their automatic services.

Microcomputer software development. Microcomputer software, according to industry observers, now resembles the music industry in this regard: sales of software (recorded music) no longer depend on sales of hardware (record players). This development is a significant factor in the growth of the software industry. Now, with tens of millions of microcomputers in use—in homes and businesses—software developers can count on a base of users who will buy any program, as long as its usefulness is demonstrated. In the past, a new application couldn't be successfully marketed until the potential users of that program also purchased a microcomputer. Job seekers are well advised to know the relatively new computer language C, which is often used in the microcomputer realm.

Artificial intelligence (AI) programming. AI has a bad rap; it has been expected

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to "turn the corner" from laboratory curiosity to commercial product for almost twenty years now. Although many people still don't accept its legitimacy (many believe that what is termed "computer intelligence" is simply better programming), AI has indeed entered the commercial realm. Near-term market growth is projected at 50 percent per year.

Finally, it is worth noting that contract work remains a common job classification for programmers. "Contract programming" is simply an agreement between employers and independent workers that a certain amount of work will be done during a set period of time. Contract programming, by its very definition, is unstable — there is no guarantee that a new contract will be forthcoming when an existing one ends — but it does represent a way to gain programming experience in diverse computing environments in fairly short order.

1. *What are the hot job prospects in computer programming currently?*
2. *Why is it necessary to shorten the program's development time?*
3. *What do transaction processing programmers do?*
4. *Why does microcomputer software resemble the music industry now?*
5. *What is "contract programming"?*

Text 4. Do you think AI is a promising field of science? What is the subject of research in AI?

ARTIFICIAL INTELLIGENCE

Artificial intelligence (Al) is not defined in the same way by all who use the term because of disagreement over what intelligent behavior is. One faction within the Al community defines intelligence as the ability to cope with change and to incorporate new information in order to improve performance. Existing technologies don't appear capable of this. The broader view, however, is that artificial intelligence is that which mimics human reasoning or sensing. We already see examples of this capability in expert systems, industrial robots, machine vision, parallel processing, and neural networks.

Because Al is hard to define, it is hard to state who works in it and to describe their occupations. Workers include researchers with advanced degrees and software designers who have a bachelor's degree in computer science with an emphasis on Al. Currently, relatively few people are engaged in developing Al products, no more than 8,000 according to knowledgeable sources. Rapid growth in demand for workers to develop this software is expected, but the number of new jobs in this area will still be relatively small.

The most commercially successful Al application is the expert system. An expert, or knowledge-based, system is a computer program that acts as a consultant to decisionmakers. The program contains information on a particular subject, known as the knowledge base, that is most frequently represented as a series of "if-then" rules,

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although in some systems the knowledge is represented as frames, objects, or semantic networks. When applied to a problem, the system searches for solutions in the same logical patterns that human experts would use, The largest and most complex expert systems have over a thousand rules and may take 2 years or more to create. Development takes so long because, for the system to be usable, the expertise to be captured must be clearly defined, and all the steps a human expert would take to draw a conclusion must be spelled out beforehand. This is the job of the knowledge engineer, who is the link between the software developer and the end user.

Expert systems are only one of a cluster of Al technologies with commercial significance. Others involve creating equipment with a human-like ability to move, see, and communicate. The problems encountered so far have driven home to scientists just how complex we humans are and how difficult it is to simulate even our most basic reasoning processes Getting a robot to do something that a baby does naturally requires hundreds, perhaps thousands, of detailed instructions.

Most researchers now concede that it could be a long time before the necessary breakthroughs occur that will lead to the production of machines that think or reason in any fully human sense of the word, or that act autonomously, or that speak and understand human speech in ah its complexity. Nevertheless, researchers keep making advances in these areas.

Demand for computer professionals with Al skills will continue to rise. Even if further advances in basic technology aren't made—and this is highly unlikely--the development, integration, implementation, and maintenance of products based on existing technologies will require many additional skilled workers. Demand for workers will also increase as more organizations use Al products.

Growth will occur in software houses and hardware developers producing Al products and in large corporations who are developing their own Al capabilities. In these organizations, demand will be strongest for programmers who can program in LISP or other Al languages. Demand is also growing for knowledge engineers, who can work closely between the programmer and the user to design expert systems.

Artificial intelligence is clearly merging with the field in which most computer professionals are employed, the development and maintenance of management information systems (MIS). In this environment, the strongest demand will be for programmers and systems analysts with experience in regular systems and a good working knowledge of Al.

1. What spheres of industry, business, technologies can the specialists in the field of AI work in?

2. How can you define the term "AI"?

3. What is the most commercially successful application of AI?

4. Why is the demand for workers in the field of AI increasing nowadays?

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Text 5. You are doing your research work. This text will help you in defining the main steps in it.

The Research Question

Your research question is the most critical part of your research proposal—it defines the proposal, it guides your arguments and inquiry, and it provokes the interests of the reviewer. If your question does not work well, the proposal is unlikely to be successful. Because of this, it is common to spend more time on the researching, conceptualizing and forming of each individual word of the research question than on any other part of the proposal.

To write a strong research question **you will need time**. Step away from your computer; consider what drew you to your topic. What about it animates and matters to you? Listen to yourself and start formulating your question by following your own interests. Remember, you will spend a lot of time researching and writing about the proposed project: if it does not interest you in the beginning, it will certainly become very difficult to write about in the end.

Next, **extensively research your** topic. What have people said about it? How have they framed their research? What gaps, contradictions, or concerns arise for you as you read, talk to people, and visit places?

After you have done this you can go back to your computer or note pad and start crafting the question itself. When you do, consider that a **strong research question should be evocative, relevant, clear, and researchable.**

The research question should be evocative

Evocative questions are ones that catch the interest of the reviewer and draw her/him into the proposal. Equally important, they easily adhere in the reviewers' memory after reading the proposal. Questions tend to be evocative because of the ways they engage with challenging topics: they pose innovative approaches to the exploration of problems, and because of this the answers found are far from obvious. There is no single way to form a conceptually innovative question. However, some of the following qualities are common to successful proposals.

Make it timely. Evocative questions are often distilled from very contemporary social or theoretical concerns. For example, questions regarding the energy crisis, international tribunals, nationalism, or the rise of anti-globalization protests are likely to peak the interests of others because they are questions whose relevance will be clearly discernable for reviewer.

Frame it as a paradox. Frame your question around a provocative paradox. For example, why have indigenous organizations in Bolivia markedly declined while the number and quantity of funding sources has increased? Or why have violent conflicts

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over forest resources increased in the last ten years while the very people involved in these conflicts have become less and less dependent on forest resources for their livelihoods? There are many potential answers to these questions, and your research may ultimately challenge your own expected explanation—but this in itself is a relevant discovery. These types of paradoxes pull the reader into the proposal and set up a situation whereby the research will fill in a provocative piece of the puzzle and make clear a much-needed broader understanding.

Take a distinctive approach. Finally, a question that approaches an old problem in a refreshingly new way, or proposes a surprising angle of analysis on a difficult dilemma, is likely to prove evocative for reviewers. This could involve a new methodology, a new conceptual approach, or the linking of two previously disparate fields of knowledge. These innovative approaches both develop confidence in the intellect of the researcher and hold promise for new understandings and insights to old and difficult questions.

The research question should be relevant

Questions that clearly demonstrate their relevance to society, a social group, or scholarly literature and debates are likely to be given more weight by reviewers. Of course the relevance of a research question, not to mention the question of who finds it relevant, will vary widely according to the funding source. As a general rule, research is more likely to be funded if it is seen as part of a larger intellectual project or line of inquiry, not just a way for the researcher to get a degree. Below are two common ways to demonstrate this in your proposal.

Fill in the missing piece. If your proposal can lay out a given field or dilemma and then point to a specific portion that is missing in that field or dilemma—a gap which will be filled by the answer to your research question--your research is likely to garner a great deal of support. Reviewers will note its importance and recognize its relevance to a larger community of researchers.

Make connections. Even if you are working on a narrow topic or in a specific place, ask questions that help relate the research to broader trends, patterns, and contexts. Doing this will help show how funding a seemingly distinct research project helps fuel larger debates. For example, show how someone working in a small town in Outer Mongolia will help understand the broader process of post-Soviet economic transformations.

The research question should be clear

Clear questions tend to be short, conceptually straightforward, and jargon-free. This does not mean they have to be overly simplistic; but save your theoretical gymnastics and abstract disciplinary language for the analysis. Work to keep your questions as lucid and simple as possible. This may be easier in some cases than in others, but some of the strongest and most theoretically sophisticated proposals we

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reviewed were framed by some of the simplest, most straightforward research questions. In contrast, the most complicated questions tended to appear in proposals where the researcher seemed more interested in demonstrating his/her theoretical knowledge than in engaging the research itself. Below are simple ways to keep your question clear.

Ground the questions. Keep your questions close to the topic or place you are researching. Questions that are too abstract or obtuse make it difficult for the reader to determine your question's relevance and intent. You must still link your question to a larger context, but ground that connection in temporal and spatial specifics.

Limit variables. If a question is burdened with too many variables or too many clauses it becomes both difficult to read and difficult to research. Here are two contrasting examples from the SSRC web site: a question like "Was the decline of population growth in Brazil the result of government policies?" is much easier to understand than "Was the decline in population growth in Brazil related more to sex education, the distribution of birth control, or resource depletion?" You may talk about all these factors in your proposal, but the first question allows the reader to focus on the central aspect of your research rather than the variables surrounding it.

The research question should be researchable

Research questions need to be clearly "doable." One of the most common rationales for rejecting proposals is that the question is simply too expansive (or expensive) to be carried out by the applicant. There are many questions that you will need to ask yourself to avoid this pitfall. Above all else, consider your limitations. Many very practical questions need to be considered when choosing your research question. First among them is: How long will the research take to carry out? Next, do you have the appropriate background to carry out the research? Are there ethical constraints? Is the project likely to be approved by your advisor and your university's committee for the protection of human subjects? Can you obtain the cooperation from all the necessary individuals, communities and institutions you need to answer the question you have asked? Are the costs of conducting the research more than you will be likely to raise? If I can't complete this project well, can I break it down and address the most important component? Remember that writing a research question is an iterative process and such concerns need to be carefully considered in your research design and budget.

Talking it over

1. *The world is changing. It's really true. There are some outstanding people who have already changed it and are changing now. Who surprised you with new discoveries and inventions during last decades?*
2. *Could you predict new discoveries in the field of AI, computer science of the 21-st century? Compare your predictions with your groupmates ones.*

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3. Are you optimistic or pessimistic about the future discoveries of the world?

4. Will the results of your research work be of any practical use? Where can they be used?

Role-playing

Situation:

You are hosting a TV talk-show programme. Different people are invited to the studio to participate in the discussion " Scientific Work. Discoveries and Inventions".

Role assignments:

A_1 *You are a prominent scientist. You are in favor of all scientific discoveries changing the world. You are sure people will benefit from them.*

A_2 *You look pessimistic at all inventions in the field of robotics. You feel scared of them.*

A_3 *You are a post-graduate student doing your research work. Speak about the difficulties in your work and the reasons of them.*

A_4 *You are a representative of the Ministry of Education. You speak about the innovations in the sphere of post-graduate system of education.*

A_5 *You are a young scientist and you are concerned with financial support of science in our republic.*

Writing

1. Write 4 or 5 quiz questions of your own on science and technology. You should know the answers to your questions.

2. Suppose you are to write a paper on your research work. Give reasoning of your work and a brief review of the latest developments in this field.

3. Give some facts from the history of your science. Mention should be made of the most prominent scientists in this area and their major contributions to it.

4. Give some details about experiments you perform in your laboratory or at your workplace. Mind the following: methods applied, devices used, calculations made.

5. a) Think of a famous scientist you would really like to meet. Write him a letter which explains who you are and what you are engaged in. Ask him some questions you really want to get the answers to.

b) Pass your letter to someone else in the group who should pretend to be the person to whom the letter is addressed. Write your reply.

6. You want to find a job in some foreign company. Write a letter of motivation.

7. You want your scientific paper to be published in the scientific magazine. Write an abstract of your article.

8. You want to get a grant for your scientific research. Please, write an application for it.

9. Suppose you are going to enter the Cambridge University. You need to send your CV (curriculum vitae there).

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Св. план 2005, поз. 125

Учебное издание

ПРАКТИКУМ

по совершенствованию навыков устной речи на английском языке
для аспирантов, магистрантов и студентов,
занимающихся научной работой

Составители:
Тарасова Елена Петровна,
Образцова Регина Константиновна,
Рогачевская Анна Ивановна

Библиотека БГУИР

Корректор Е.Н. Батурчик

Подписано в печать 8.08.2005.	Формат 60x84 1/16.	Бумага офсетная.
Гарнитура «Таймс».	Печать ризографическая.	Усл. печ. л. 4,18.
Уч.-изд. л. 3,8.	Тираж 250 экз.	Заказ 229.

Издатель и полиграфическое исполнение: Учреждение образования
«Белорусский государственный университет информатики и радиоэлектроники»
Лицензия на осуществление издательской деятельности №02330/0056964 от 01.04.2004.
Лицензия на осуществление полиграфической деятельности №02330/0131518 от 30.04.2004.
220013, Минск, П. Бровки, 6