

# New Materials

Carmen Mateo & Raquel del Pozo

UAB tutor: Cristina Escobar  
School mentor: Jill Simon

**UAB**



TED Master's Degree, 2011

**Teacher's  
book**

### Acknowledgements

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We would like to thank our UAB teacher and tutor Cristina Escobar for her warm encouragement and explicit faith on us. Her words have been the push we needed.

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Finally, we would like to thank our families for their unconditional support.

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### Planning Template

**UNIT TITLE: NEW MATERIALS**

**AUTHORS: Carmen Mateo and Raquel del Pozo**

**CLASS/AGE: 1<sup>st</sup> Batxillerat/17 years old**

**SUBJECTS, LANGUAGES and/or TEACHERS INVOLVED: SCIENCE AND SOCIETY (Jill Simon)**

**NUMBER OF LESSONS: 7**

**COE LEVEL: A2/B1**

#### INTRODUCTION TO THE TASK (the unit)

We live in an artificial world. You will be able to look at an object and identify some types of materials it is made of. You will be able to explain the origin of some of these materials, some of their properties, some uses, and the social and environmental repercussions of using some of these materials.

#### OBJECTIVES / GOALS

By the end of the unit, the students will be able to:

- Identify the different types of materials, some of their properties and applications.
- Give their opinion about using some materials (advantages and disadvantages).
- Discuss about the social and environmental repercussions derived from the extraction of some materials.
- Extract information from a graph, analyze data and draw some conclusions on waste management per countries.
- Identify the different ways of managing waste.

#### DOMAIN or TOPIC RELATED CONTENTS

##### MAIN TARGET KNOWLEDGE

- Relevance of humanity's use of materials over time.
- Dependency of society on technology as a result of the creation of new necessities.
- Different types of materials, properties and uses.
- Social and environmental repercussions derived from the use of some materials.
- Different ways of waste management.

#### DOMAIN or TOPIC-RELATED CONTENTS

##### MAIN TARGET SKILLS

- Be able to explain the evolution of materials over time.
- Be able to explain some applications of new materials in Medicine and Construction.
- Present a topic orally in public describing an object (materials, properties, applications and social and environmental repercussions).
- Develop a critical approach on the use of some materials and their environmental impacts.





### CONTENT OBLIGATORY / CONTENT COMPATIBLE LANGUAGE

#### TERMINOLOGY (words and phrases)

##### DOMAIN or TOPIC SPECIFIC

Flint, metals, alloy, iron, steel, copper, bronze, aluminium, ceramics, polymers, fibres, semiconductors, silicon, composites, ductility, conductivity, brittleness, elasticity, plasticity, thermoplastics (PVC, PET, PP, PC), thermosets, elastomers, biodegradable, raw material, exploitation of oil, blood diamonds, waste accumulation, landfill, recycling, composting, incineration, waste management

##### GENERAL ACADEMIC

- I would use... to ...
- Something is made of...
- It is the ability to ...
- Noun/adjective: ductility/ductile
- A material that ... is ...
- To begin with, ...
- Apart from this/that, ...
- Furthermore, ...
- Researchers point out that...
- In my opinion, ...
- As far as I am concerned, ...
- In conclusion, ...
- To sum up, ...

#### DISCOURSE GENRE or TEXT TYPE

##### TO UNDERSTAND

- Understand explanatory texts (oral and written).
- Understand instructions.

##### TO GENERATE

- Giving their opinion and justify it.
- Organizing/summarizing the key ideas from an oral or written text.
- Producing an explanation.

##### TO NEGOTIATE

- Interacting and exchanging information.

#### PRAGMATIC STRATEGIES (face saving, politeness, etc.)

- Ss will be given a printout with tips on how to speak in front of an audience.

#### SOCIAL & CULTURAL VALUES; PERSONAL & EMOTIONAL DEVELOPMENT

- Emphasizing the importance of cooperative learning among peers.
- Collaborative learning through the use of ICT.
- The importance of consumerism in our society and its socioeconomic repercussions.
- The relevance of environmental impacts derived from the production, use and waste treatment of certain materials.

### SUMMATIVE ASSESSMENT

(with formative value)

#### TASK:

- Different quizzes on content.
- Completing a chart on different materials over time.
- Matching names of materials and definitions.
- Matching columns to create sentences (defining materials according to their properties).
- Writing a brief essay on advantages/disadvantages of using a material.
- Collaborative mind map about the classification of materials and properties
- Understanding the papermaking process through watching a video.
- Describing the papermaking process.
- Designing a PPT and explaining it.
- Final written exam.

### SUMMATIVE ASSESSMENT

(with formative value)

#### ASSESSMENT CRITERIA and/or ASSESSMENT INSTRUMENTS:

- Ss can identify the use of different materials over time (gradebook + written exam).
- Ss can describe the use of some new materials in Medicine and construction (gradebook + written exam).
- Ss can explain critically the disadvantages of using some material (gradebook).
- Ss can talk about an object (materials, properties, applications and social and environmental repercussions (PPT presentation + gradebook).
- Ss can assess their peers' presentations based on 4 criteria: preparedness, clear speech, vocabulary, and content (Peer evaluation rubric).

### MATERIALS and RESOURCES

- Computer, blackboard, overhead projector and Internet connection, PPT presentations
- Student's book, Teacher's book and cards
- ICT tools: Microsoft Office PowerPoint, Microsoft Office Word, webspirationclassroom.com, Youtube, Wordle, ScienceDaily and Moodle

### REFERENCES

- Images from Creative Commons ([www.creativecommons.org](http://www.creativecommons.org)), Flickr ([www.flickr.com](http://www.flickr.com)), Google Images, among other sources.
- Videos hosted in Youtube (<http://www.youtube.com>): -accessed on March 2011-
- Rubrics ([www.rubistar.4teachers.org](http://www.rubistar.4teachers.org))

### COMMENTS

- This document was created by the authors of "New Materials" unit and it is meant for teacher's education purposes only. It was designed and piloted during the academic year 2010-2011 within the UAB TED Master's Degree.
- This document has been created with images available on the Internet under the Creative Commons license.
- It is essential to present and contextualize the unit goals and the main activities that will be carried out on the first session.
- This is a CLIL unit implemented in the Science and Society class.
- All the assessment material is meant to be shared with students, so they identify what and how is being evaluated. Peer assessment is also taken into account in the final mark.


























### KEY COMPETENCES

1. **Communication in the mother tongue**  
Producing oral and written communication of content.
  - Interacting and swapping information.
  
2. **Communication in foreign languages**  
Comprehension and interpretation of the written, oral and visual information.
  - Interacting and swapping information.
  - Producing explanations.
  - Giving an opinion and justifying it.  
Oral and/or written communication with or without digital support.
  - Interacting and swapping information.
  - Producing explanations.
  - Present a topic in public in an oral presentation.
  - Giving an opinion and justifying it.
  
3. **Mathematical competences and basic competences in science and technology**  
Identification and conceptualization of socioeconomic repercussions of the use of materials.
  - Interpreting data, variables, agents and facts.
  - Interpreting results and/or conclusions.  
Responsible usage of natural resources and acquiring habits of responsible consumption.
  - Developing a critical point of view.
  
4. **Digital competence**  
Obtaining, organizing and selecting information in different environments.
  - Texts.
  - Surfing on the Internet in order to find relevant information.
  - Using Webspirationclassroom website.  
Treating information in order to communicate it through tools and digital environments.
  - Electronic texts.
  - Using Moodle.
  - Using Microsoft PowerPoint.
  - Using Webspirationclassroom website.
  
5. **Learning to learn**  
Revision and evaluation by using peer assessment rubrics.
  - Cooperative work.
  
6. **Social and civic competences**  
Participation and engagement with the democratic society
  - Collaborative work.
  - Differentiating between formal and informal registers and use them properly.
  
7. **Sense of initiative and entrepreneurship**  
Developing interpersonal abilities in order to get along with others.  
Transforming ideas or suggestions into action.
  
8. **Cultural awareness and expression**

**Session-by-session overview**

Session	Activities	Timing	Interaction	Skills	ICT	Assessed	Comments
<b>1</b> <i>History of materials</i>	Task 1: Word search and possible ways of surviving	10'	S-S				
	Task 2: Reading Comprehension	20'	Ss-Ss				
	Task 3: Quiz	10'	S			✓	Ss take quiz on content. Teacher jots down results in gradebook.
	HW - Task 1: Completing a chart		S			✓	Ss hand in homework and teacher checks that all students have done their homework and corrects their answers.
	HW - Task 2: Matching names and definitions		S			✓	Ss hand in homework and teacher checks that all students have done their homework and corrects their answers.
<b>2</b> <i>Necessities and ambitions of the Modern World</i>	Task 1: Video to present materials around us	10'	T-Ss				
	Task 2: Warmer for PPT (materials around us)	5'	Ss-Ss				
	PPT presentation of content	10'	T-Ss				
	Task 3. Jigsaw Task	20'	Ss-Ss				
	Task 4. Quiz	10'	S			✓	Ss take quiz on content. Teacher jots down results in gradebook.
<b>3</b> <i>Properties of materials</i>	Task 1: Listening activity	20'	Ss-Ss				
	Card game (physical and Chemical properties)	15'	Ss-Ss				
	Task 2: Matching properties, antonyms and definitions	10'	Ss-Ss				
	Task 3: Define properties	10'	Ss-Ss				
	HW - Task 1: Matching columns to create sentences		S			✓	Ss hand in homework and teacher checks that all students have done their homework and corrects their answers.
<b>4</b>	PPT Presentation	20'	T-Ss				
	Task 1: match lists	15'	S-S				

## New materials

<b>Classification of materials</b>	on the different type of materials						
	Task 2. Writing about metals	7'	S-S				
	Task 3: Mind map of metals	7'	S-S				
	HW - Task 1: Writing on the disadvantages of using plastic		S	 		✓	Ss write an essay about the disadvantages of using plastic.
	HW - Task 2: Collaborative Mind map on materials & properties		Ss-Ss		✓	✓	Ss create a mind map of materials using <a href="http://www.webspirationclassroom.com">http://www.webspirationclassroom.com</a>
<b>5 Earth's limited resources</b>	PPT Earth's limited resources	10'	T-Ss				
	Task 1: Report on the video	10'	S-S	 			
	Task 2: Report on the video	20'	S-S	 			
	Task 3: Quiz	10'	S			✓	Teacher corrects report.
	HW - Task 1: Watching a video on paper production		S	 		✓	Ss hand in homework and teacher checks that all students have done their homework and corrects their answers.
<b>6 Environmental impacts</b>	PPT presentation on Environmental Impacts	10'	T-Ss	 			
	Task 1: Paper production	15'	S-S	 			
	Task 2: Waste Management	20'	S-S	  		✓	Ss hand in written report and teacher jots down the results in the gradebook .
<b>7 Final project + Unit test</b>	PPT oral presentations	30'	Ss-Ss	 		✓	Peer assessment with rubric + teacher assessment with rubric + peer assessment of collaborative work within the group
	Unit test	30'	S			✓	Teacher checks student's mastery of the unit and jots down the results in the gradebook.



### Session-by-session detailed instructions for implementation

#### Session 1: History of materials

##### Aim

Students will see the historical development of materials and will understand that human evolution has been the result of controlling the materials surrounding them. First, it was the basic need and now it is consumerism and the new needs created by this consumer society.

##### Resources

Computer, blackboard, digital board, Power Point (Imagine.ppt), Student's book (pages 7-16), cards of different colours, video "Lost 1x1"

##### Assessment

- While they are working in pairs the teacher will evaluate their work walking around the class.
- Participating actively in class and peripheral participation.
- When results are checked with the plenary the teacher will see how they have been working.
- At the end of the lesson the teacher will think about what worked well and what didn't.

##### Pre-evaluation task

5

T-Ss

Teacher distributes the pre-evaluation task. Ss are asked to hand it in during the following session.

##### PPT

10

T--Ss

Power Point presentation "imagine.ppt" with shocking questions.

Introduce the topic of materials by watching the video "Lost 1x1"

Elicit some answers from students to engage them in the unit.

##### T 1: Word search and possible ways of surviving

10

Ss--Ss

Students open their student's book on page 8 and teacher introduces the task of the word search. Students must do the task in pairs. Teachers must tell them that they have 2 minutes.

After completing the word search, students must write the materials they would use to survive.

## New materials

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### T 2: Reading Comprehension

20

Ss--Ss

1. The teacher has posted on the walls two copies of Paleolithic+Neolithic reading and Industrial Revolution+Modern World reading.
2. Teachers distribute students in groups of 4. In each group there will be 2 experts on the Paleolithic+Neolithic reading and the other 2 students will be experts on the Industrial Revolution+Modern World reading.
3. Each couple will have a questionnaire to fill in with 10 questions regarding the two readings. At the same time, each couple will also have 5 of the 10 questions written on cards that they will have to find in their reading. Students will only be allowed to write 5 words in each card regarding each question.
4. Once they have the information about all 5 questions, they will have to write down the answers in the questionnaire. Each couple will be able to answer only 5 questions.
5. Then they will have to share their knowledge with the other couple so they can answer all 10 questions.

### T 3: Quiz

10

Ss--Ss

Students will have to fill in a quiz on the history of materials and check the answers.

### Homework

1. Students will have to complete the chart in page 15 to make a chronological line. Then, they have to fill in the motivation column with the words given.
2. Students match the name of the material with its definition.

### Session 2: Necessities and ambitions of the Modern World

#### Aim

Students will realize we are surrounded by materials. Students will get familiar with a first classification of materials around us (mainly visual). They will understand that we are in a consumer society. Students will learn that today man designs materials "a la carte" in the lab and how dependent human beings are on technology. They will learn the applications of these new materials in fields such as Medicine and Construction.

#### Resources

Computer, blackboard, digital board, Power Point presentation (Necessities and Ambitions of the Modern World.ppt), Student's Book pages 17-22, video "Friends"

#### Assessment

- While they are working in pairs the teacher will evaluate their work walking around the class.
- Participating actively in class and peripheral participation.
- When results are checked with the plenary the teacher will see how they have been working.
- At the end of the lesson the teacher will collect homework from session 1 and will jot down results in gradebook. The teacher will think about what worked well and what didn't.

**T1: Video (Friends) to introduce materials around us** 10 T--Ss

The teacher shows a short clip about an ordinary morning: one of the characters in Friends wakes up. She is surrounded by materials. Elicit some answers from students to engage them in the unit.

Students tick the materials they have used during the morning.

**T2: Pre-task as a warmer for PPT** 5 Ss--Ss

In pairs students will have to think of the different types of materials and fill in the chart with two examples of objects made of different types of materials.

**PPT Necessities and Ambitions of the Modern World** 10 T--Ss

The teacher explains content.

**T3: Jigsaw task** 20 Ss-Ss

Student A and student B read text 1 (Medicine). Student C and student D read text 2 (Construction). They memorize the text (10'). Student A and student B explain their text to Student C and Student D and vice-versa (10'). They are not allowed to look at the texts.



## New materials

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T4: Quiz on jigsaw task

10

S

The last 10 minutes are devoted to complete a quiz on the information from the texts. The winners get a prize!

### Homework

1. Go to Moodle and in Session 2 you will find the following link: "Homework due on March 22<sup>nd</sup>". You'll find some information about the properties of materials that will be really useful for session 3. Read the whole document.

## New materials

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### Session 3: Properties of materials

#### Aim

The aim of the lesson is to introduce the different physical and chemical properties through a card game and familiarize learners with them. Before this, students will watch and listen to a video as a way to connect where left off in previous class (regarding applications of new materials).

#### Resources

Computer, blackboard, digital board, Student's Book (pages 23-26), cards of different properties, Video from Science Daily "Fog-free glass".

#### Assessment

- While they are working in pairs the teacher will evaluate their work walking around the class.
- Participating actively in class and peripheral participation.
- When results are checked with the plenary the teacher will see how they have been working.
- At the end of the lesson the teacher will collect the student's book from session 2 and will jot down results of quiz in gradebook. The teacher will think about what worked well and what didn't.

#### T 1: Listening activity

20

Ss--Ss

Students will work in pairs. They will do a fill-in gaps activity as a pre-task to get familiar with the new vocabulary.

Students will listen to the video ([http://www.sciencedaily.com/videos/2006/01/12-fogfree\\_glass.htm](http://www.sciencedaily.com/videos/2006/01/12-fogfree_glass.htm)) twice and will have to choose between two possible summaries of the video.

#### Card game (Physical and Chemical properties)

15

Ss--Ss

Students will work in pairs. Each pair will receive a group of properties, images and definitions. They will have to match each property with each definition and picture.

#### T2: Match properties, antonyms and definitions

10

Ss--Ss

In pairs, students will have to fill in a chart by matching a few properties with their antonyms and the definitions of the antonyms. Afterwards, they have to write down the Catalan translation of each property and antonym.

#### T3: Define properties

10

Ss--Ss

In pairs, students will have to define the properties of the previous task that were not defined. They can use as examples the definitions of the antonyms of the previous task.

## New materials

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### Homework

Students will have to create sentences by matching the 4 columns in page 26.

### Session 4: Classification of materials

#### Aim

The students will learn that materials are classified into different types: metals, ceramics & glass, polymers, fibres, semiconductors and composites. At the end of the session they will be able to talk about the origin, some properties and some applications of these types of materials.

#### Resources

Computer, blackboard, digital board, Power Point presentation (Classification of Materials.ppt), Student's Book (27-36)

#### Assessment

- While they are working in pairs the teacher will evaluate their work walking around the class.
- Participating actively in class and peripheral participation.
- When results are checked with the plenary the teacher will see how they have been working.
- At the end of the lesson the teacher will collect the student's book from session 3 and will jot down the homework results in gradebook. The teacher will think about what worked well and what didn't.

PPT

20

T--Ss

Power Point presentation: Classification of Materials.ppt

The teacher explains the different types of materials. To keep the attention of the students, they will have a printout of the PPT with some gaps to fill in.

T1: Match lists on the different types of materials

15

S--S

After listening to the PPT, students should be able to know a few things on the different types of materials. In pairs, students will have to match two lists (Heads and Tails). They have the printout of the PPT so that they can check for information, if they need to.

T 2: Writing about metals

7

S--S

After watching the PPT students (in pairs) should be able to write 4 properties about metals

T 3: Mind map of metals

7

S--S

Students (in pairs) should be able to fill in the mind map on metals using the information about properties, appearance and state of metals learnt in the previous task.

## New materials

### Homework

**1. Writing** about the disadvantages of plastics. Students read the model text on advantages of using plastic. For reading comprehension, they answer True/False on the 4 statements below. Individually, they will have to write a brief composition on the disadvantages of using plastic. They can use the Phrase Bank and the Writing Plan as help.

	TRUE	FALSE
Plastics can only have a very limited set of properties.		✓
Plastic is a cheap material as it can be massively produced.	✓	
Plastic is environment friendly, as it helps saving resources.	✓	
Plastic waste cannot be recycled.		✓

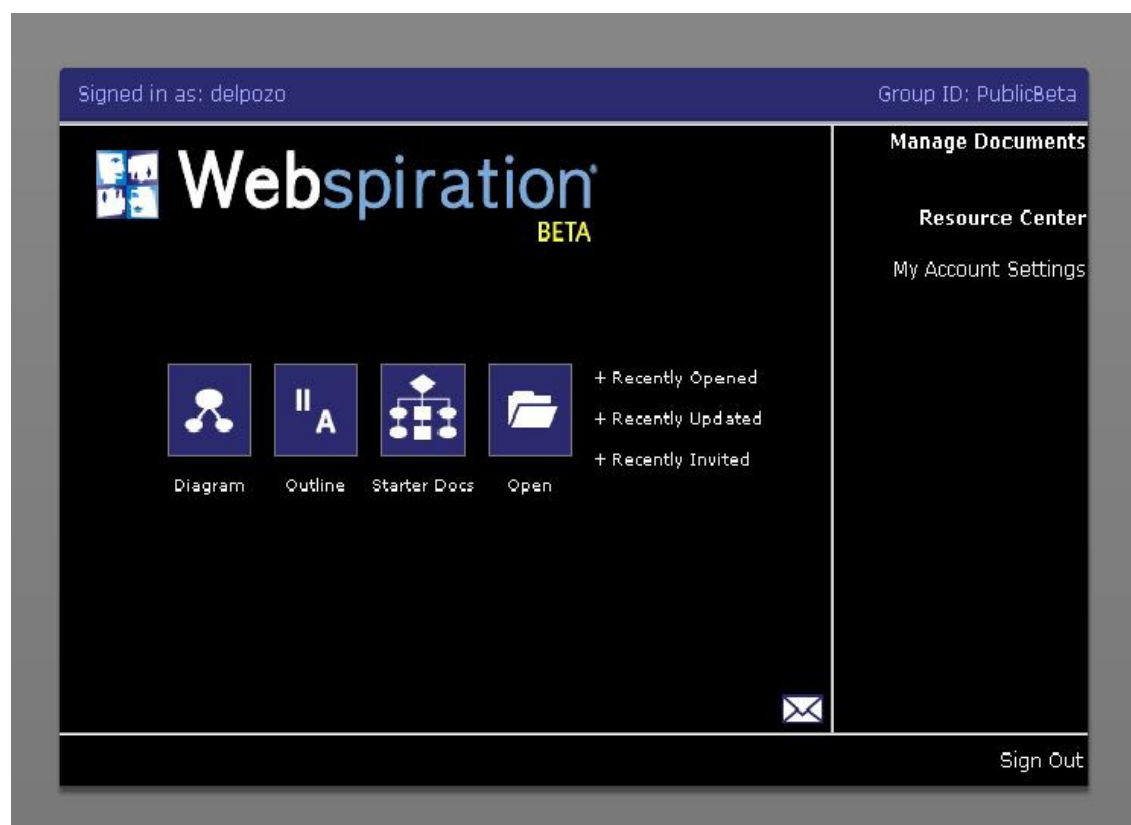
**2. Collaborative mind map** on the properties of the types of materials

1. You will receive an invitation to join the following webpage:

<http://www.webspirationclassroom.com>

2. Fill in the information to sign up.

3. You should get to the following screen:

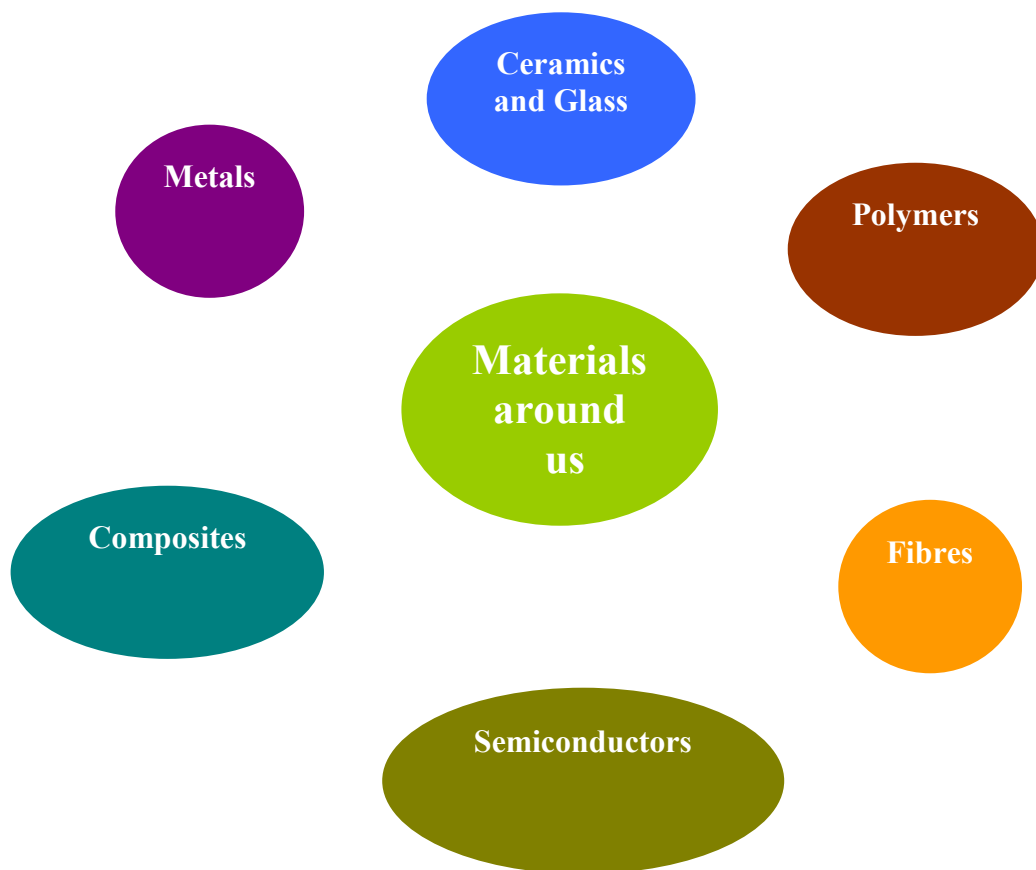


4. Click on "+ Recently invited" to open the link. You should see a document titled "Materials". Click on "Materials" to open the document.

## New materials

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5. You should see a mind map about "Materials around us" with the following structure:



6. We have added some words (see our names in brackets) to the mind map. Now it is your turn to collaborate in this mind map. Write 2 properties of materials we have seen today or add 2 examples of types of materials. Don't forget to write your name next to your 2 contributions.

7. By next class, all of you will have contributed to the mind map. Remember that we have seen physical and chemical properties of materials!

**3.** In the next session we will be dealing with **world conflicts** related to the extraction of some raw materials. Watch the following 2 videos to have an opinion:

Congo and Coltan (4':37)

<http://www.youtube.com/watch?v=3OWj1ZGn4uM>

Sierra Leone Diamond Mines (3')

<http://www.youtube.com/watch?v=IYPMm6qxFZQ>



## New materials

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### Session 5: Earth's limited resources

#### Aim

The aim of the lesson is to realize that the Earth's resources are limited and, for this reason, there are many socioeconomic repercussions. Students will realize that there are many conflicts in the world in order to control such resources. It is also important that students practice the vocabulary and structures related to the topic and start giving their own opinion.

#### Resources

Computer, blackboard, digital board, Power Point (Earth's limited resources.ppt), Student's book (pages 37-41) and Videos: "Nigeria and the oil", "Sierra Leone and diamonds", "Congo and Coltan"

#### Assessment

- While they are working in pairs the teacher will evaluate their work walking around the class.
- Participating actively in class and peripheral participation.
- When results are checked with the plenary the teacher will see how they have been working.
- At the end of the lesson the teacher will collect the student's book from session 4 and will jot down the homework results in gradebook. The teacher will think about what worked well and what didn't.

PPT 10 T--Ss

Power Point presentation Earth's limited resources.ppt

T1: Report on the video 10 S--S

In pairs, students will have to fill in the report on the video "Nigeria and the oil". Then the whole class will correct it.

T 2: Report on the video 20 S--S

In pairs, students will have to watch one of the following videos: "Sierra Leone and diamonds" or "Congo and Coltan". They will have to fill in a report on the video because they will have to explain it to another couple who has watched the other video.

T3: Quiz 10 S

Students will have to do a quiz on the two videos.

#### Homework

1. Watch a video on paper production. It will help you follow the class!!  
<http://www.youtube.com/watch?v=4x9HIzPZLyM>



### Session 6: Environmental impacts

#### Aim

The aim of the lesson is to make students aware of the environmental impact of manufacturing materials. As an example of a very polluting industry, they will see the production of paper.

They will also learn the different ways of managing waste, and their advantages and disadvantages.

They will be able to interpret a chart related to waste management and to draw conclusions.

#### Resources

Computer, blackboard, digital board, Power Point (6 Environmental Impacts.ppt), Student's Book pages 42-46

#### Assessment

- While they are working in pairs the teacher will evaluate their work walking around the class.
- Participating actively in class and peripheral participation.
- When results are checked with the plenary the teacher will see how they have been working.
- At the end of the lesson the teacher will collect the student's book from session 5 and will jot down the results from the quiz and from their homework in gradebook. The teacher will think about what worked well and what didn't.

#### PPT Environmental Impacts

10

T--Ss

Teacher explains the environmental impacts of industries focusing on the paper production. The idea is to elicit information from students.

Teacher explains the types of waste management: advantages and disadvantages.

#### T 1: Process of paper production

15

S--S

In pairs, students will have to order and describe the images of the production of paper (they have cards with the images, and keywords as help). After the PPT presentation, they will be able to say what type of environmental impacts this industry may have.

#### T 2: Waste Management

20

S--S

In pairs, students will have to match definitions of different types of waste management: *landfill*, *recycled/composted*, and *incineration*.

## New materials

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In pairs, students look at a graph on waste management by countries and interpret data by finishing sentences.

In pairs, students draw conclusions by answering some questions related to the graph.

Preparation for PPT presentations

5

T-Ss

Teacher distributes the topic for each of the groups and also the document with "Tips on how to speak in front of an audience".

**Assessment Chart**

Session	Activities	Timing	Tool	Criteria	Comments
<b>1</b> <i>History of materials</i>	Task 1: Word search and possible ways of surviving	10'			
	Task 2: Reading Comprehension	20'			
	Task 3: Quiz	10'	Gradebook	3 (Science) 13 (Language) Ss can identify the use of different materials over time.	Ss take quiz on content. Teacher jots down results in gradebook.
	HW: Task 1: Completing a chart		Gradebook	3 (Science) 13 (Language) Ss can explain the evolution of material over time through the completion of a chart.	Ss hand in homework and teacher checks that all students have done their homework and corrects their answers.
	HW: Task 2: Matching names and definitions		Gradebook	7 (Science) 13 (Language) Ss can use some basic vocabulary on materials.	Ss hand in homework and teacher checks that all students have done their homework and corrects their answers.
<b>2</b> <i>Necessities and ambitions of the Modern World</i>	Task 1: Video to present materials around us	10'			
	Task 2: Warmer for PPT (materials around us)	5'			
	PPT presentation of content	10'			
	Task 3. Jigsaw Task	20'			
	Task 4: Quiz	10	Gradebook	7 (Science) Ss can describe the use of some new materials in Medicine and construction.	Ss take quiz on content. Teacher jots down results in gradebook.
<b>3</b> <i>Properties of materials</i>	Task 1: Listening activity	20'			
	Card game (physical and Chemical properties)	15'			
	Task 2: Matching properties, antonyms and definitions	10'			
	Task 3: Define properties	10'			

## New materials

	HW: Task 1: Matching columns to create sentences		Gradebook	13 (Language) Ss can define materials according to their properties.	Ss hand in homework and teacher checks that all students have done their homework and corrects their answers.
4 Classification of materials	PPT Presentation	20'			
	Task 1: match lists on the different type of materials	15'			
	Task 2. Writing about metals	7'			
	Task 3: Mind map of metals	7'			
	HW: Task 1: Writing on the disadvantages of using plastic		Written essay	6 (Science) 16(Language) Ss can describe the disadvantages of using plastic.	Teacher corrects written essay by looking at usage of connectors, explanation of ideas and grammar correction.
	HW: Task 2: Collaborative Mind map on materials and properties		Teacher observation in <a href="http://www.webspiratio nclassroom.com">http://www.webspiratio nclassroom.com</a>	7 (Science) Ss can collaborate to create a mind map of types of materials and properties.	
5 Earth's limited resources	PPT Earth's limited resources	10'			
	Task 1: Report on the video	10'			
	Task 2: Report on the video	20'			
	Task 3: Quiz	10'	Gradebook	6 (Science) 16 (Language) Ss can write a report on the causes and consequences of some world conflicts related to the consumption of materials.	Ss take quiz on content. Teacher jots down results in gradebook.
	HW: Task 1: Watching a video on paper production		Gradebook	6 (Science) 14 (Language) Ss can understand a video on paper production and can describe the process using precise terminology.	Ss hand in homework and teacher checks that all students have done their homework and corrects their answers.
6 Environmental impacts	PPT presentation on Environmental Impacts	10'			
	Task 1: Paper production	15'			
	Task 2: Waste Management	20'	Written report	6 (Science) Ss can extract information from a graph and draw some	Ss hand in task and teacher corrects their

## New materials

				conclusions about the different ways of waste management per countries.	answers.
<b>7</b> <b>Final Project</b> <b>+</b> <b>Unit test</b>	PPT oral presentations	30'	Peer assessment with rubric	<p>6 (Science), 7 (Science)            17 (Language) Ss can assess their peers' presentations based on 4 criteria (preparedness, clear speech, vocabulary, and content).            Ss can work collaboratively when designing the PPT presentation.            Ss can talk about an object (materials, properties, applications and social and environmental repercussions)</p>	Peer assessment with rubric + teacher assessment with rubric + peer assessment of collaborative work within the group
	Unit test	30'	Questioning	<p>6 (Science), 7 (Science)            16 (Language) Ss can describe the use of different materials over time. Ss can identify the different types of materials and their properties.            Ss can relate the consumption of materials with some world conflicts.            Ss can describe different types of waste management.</p>	Teacher checks student's mastery of the unit and jots down the results in the gradebook.



### Type of tasks

Symbols we use in order to help students know what type of activity they will do.

- 1** Individual
- 2** Pair- work
- 4** Group- work
- L** Listening
- W** Writing
- R** Reading
- V** Video
- ICT** Using ICT

## New materials

Student name: \_\_\_\_\_

### Pre-evaluation task

These questions will let you know what type of information we are going to study in this unit. Mark the box with an "X" which is the most appropriate for each answer.

	I know this answer and I could explain it.	I know this answer, but I couldn't explain it.	I'm not sure if I know this answer, but I have heard the concept before.	I don't know the answer at all.
Can you think of any materials that were used in the Paleolithic and Neolithic?				
What materials were massively produced during the Industrial Revolution?				
What materials were extensively used during the 20th century?				
What is the difference between traditional and synthetic materials?				
Can you think of any properties of metals?				
What's the opposite of brittleness?				
What is plasticity?				
What is an alloy?				
What is a polymer?				
What type of materials PVC, PET, polycarbonates are?				
What is a composite?				
What is a semiconductor?				
What material is extensively used to create most semiconductors?				
What is a thermoplastic polymer?				
What is landfill waste?				

## New materials

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1. Can you think of one example of how consumption can be related to conflicts around the world?
2. What do you know about coltan?
3. Which is the most polluting industry?



# History of materials



### W 2 Task 1

Look for the materials you could find in the island:

a	d	w	o	o	d	f	g	h	e
e	r	d	s	e	o	f	i	o	d
s	i	i	l	h	n	l	p	q	d
g	r	c	t	r	u	b	b	e	r
l	e	a	t	h	e	r	w	v	g
w	s	t	o	n	e	v	n	c	e
v	f	r	d	s	w	x	t	y	u
a	z	d	l	a	t	e	x	e	u
f	g	t	y	h	b	v	n	k	i
f	i	b	r	e	s	a	f	j	m

1. *wood*
2. *rubber*
3. *leather*
4. *stone*
5. *latex*
6. *fibres*

### W 2

Now that you know the name of the materials in the island, imagine you are in the situation shown in the video, what materials would you do to survive?

1. *I would use wood to build up my house*
2. *I would use leather for my clothes*
3. *I would use stones for my tools and weapons*
4. *I would use the fibre from plants to create rope*

### R 2 Task 2: Paleolithic (250.000 - 10.000 BC)

Anthropologists define the civilization in relation to the materials that different cultures used. The records they left are used by anthropologists to see the human development.



Image 1: Flint

As a result of being more intelligent, the volume of the brain increased and humans were capable of creating better tools.

150.000 years ago, Homo Sapiens started using pigments to represent hunting scenes in cave painting. This fact shows the high level of cultural sophistication and the knowledge of the environment.

Two million years ago, Homo Habilis started using tools, objects that multiply the intensity and efficiency of human strength. The usage of these tools made out of **flint**, a type of stone, evidenced the intelligent use of the brain.

Anthropologists suggest that the manipulation of weapons and *bipedy* contributed to develop their brain.

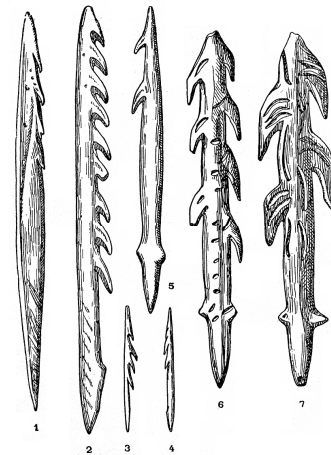


Image 2: Tools

### Neolithic (8.000- 2.000 BC)



Image 3: Copper

This period is very important because humans started using **bronze** to create weapons and tools. Bronze is obtained through the extraction of **copper** and **tin**. Once you have the two metals, you have to melt them and then you have bronze.

The production of bronze required moving big quantities of *soil* and cutting down trees to obtain **charcoal** to melt the copper and the tin.



## New materials

Another important discovery was the use of **ceramics**. It allowed the storage of food, the construction of houses and big buildings and the possibility of boiling legumes.

Besides, producing *pottery* was very difficult and a long process, for this reason, humans created the *pottery wheel*; a wheel that made the process of creating pottery easier and faster.

Another relevant discovery was **iron**, a metal that was more resistant than bronze and that allowed the production of *arrows*, *swords*, *ploughs*, etc. All this progress contributed to the growth of the population and the creation of bigger cities and empires.



Image 4: Pottery

## Glossary

*Flint: Sílex*

*Bipedy: bipedisme*

*Cave painting: Pintures rupestres*

*Weapons: Armes*

*Charcoal: carbó vegetal*

*Pottery: Terrissa*

*Copper: Coure*

*Tin: Estany*

*Soil: Terra, sorra*

*Pottery wheel: Torn*

*Iron: Ferro*

*Arrow: Fletxa*

*Sword: Espasa*

*Phough: Arada*

R

2

### Task 2: Industrial Revolution (AD 1750 – 1900)

In Britain a series of technical and scientific discoveries changed forever traditional trades and customs. This period is known as the Industrial Revolution.

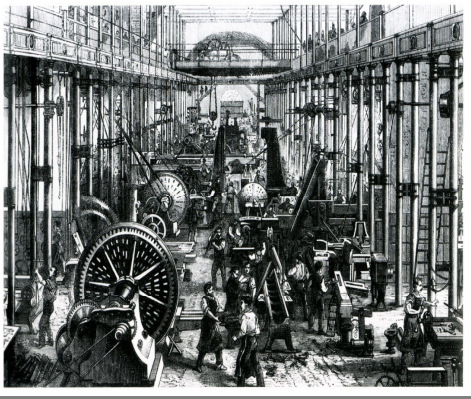


Image 5: Industrial warehouse

It was a transition from manual labour to the use of machines. Machines were now powered by *steam* instead of water, so factories could be placed anywhere, not just next to a river. Soon country people went to work in the cities. The new cities were full of people who needed to buy everything. This meant new housing, new clothing, new furniture and new transportation.

The major change in the metal industries during the era of the Industrial Revolution was the replacement of organic fuels based on **wood** with fossil *fuel* based on **coal**. The use of **coke** as fuel was key in the production of **steel** and **iron**.

New materials favoured the development of communications. The introduction of canals and railways and the improvement of roads expanded trade. The large scale production of chemicals was an important development during this period.

It was the beginning of the industrial and commercial world we know today.



Image 6: Workers going to the factory

### The Modern World (AD 1900 - today)

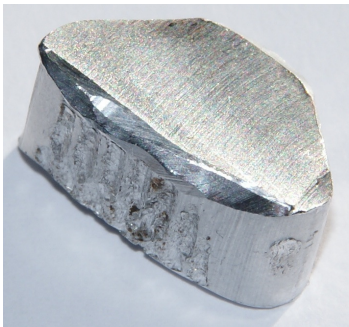


Image 7 Aluminium

During the 20<sup>th</sup> century the economical growth and the technical and scientific discoveries resulted in new needs.

**Aluminium** is the most abundant metal in the Earth's crust. Its use was made extensive during the 20<sup>th</sup>

## New materials

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century. It is *light*, and malleable, which makes a material ideal to work with. After steel, aluminium has become the most used metal. It is vital to the aerospace industry and very important in other areas of transportation and building.

The invention of **plastic** in the 19<sup>th</sup> century and its extensive use after the Second World War has forever changed the way we live. Thousands of scientists and



Image 8: Plastic objects

engineers worked for over a century trying to substitute old materials and meet new needs. Today the raw materials needed to make most plastics come from petroleum. This is an important *drawback* as plastics depend on petrol availability.

Nanotechnology is the manipulation of *matter* at an atomic scale. Using nanotechnology we can control atoms and create materials with unique properties. With nanotechnology we can arrange atoms in a way that they do not normally occur in nature. We can have materials 'a la carte'.

## Glossary

*Coal: Carbó*  
*Coke: Carbó de coque*  
*Iron: Ferro*  
*Fuel: Combustible*  
*Steam: Vapor*  
*Steel: Acer*

*Trade: Comerç*  
*Drawback: Inconvenient*  
*Light: Lleuger*  
*Matter: Matèria*

### Task 2: What can you say about the history of materials?

Answer the following questions with the help of your classmates:

1. What did the use of tools contribute to?  
*It contributed to the development of the human brain.*
2. What did they use to represent hunting scenes?  
*They used pigments*
3. What is flint?  
*A type of stone used to create tools and weapons.*
4. Why was the discovery of ceramics that important?  
*Because ceramics allowed the storage of food.*
5. Which was the material that contributed to the growth of the population?  
*The material was iron.*
6. What type of material was mainly used as fuel during the Industrial Revolution?  
*Coke (a type of coal) was mainly used as fuel during the Industrial Revolution.*
7. What types of metal were massively produced during the Industrial Revolution?  
*Iron and steel were massively produced during the Industrial Revolution.*
8. Why is aluminium such an ideal material to work with?  
*Because it is light and malleable.*
9. What is the raw material of plastic?  
*Plastics are derived from petrol.*
10. What can you do with nanotechnology?  
*With nanotechnology you can arrange atoms in a way that they not occur in nature and, therefore, create materials with improved properties.*

**W 1** Task 3 Quiz on the history of materials

History of materials	TRUE	FALSE
1. Food contributed to the development of the brain.		√
2. Pigments were use to represent hunting scenes.	√	
3. Flint is a type of stone used to create tools.	√	
4. Ceramics were only used for decoration.		√
5. Iron allowed the creation of bigger cities.	√	
6. During the Industrial Revolution, coal was replaced with wood.		√
7. Steel has become the most used metal.	√	
8. Aluminium, the most abundant metal in the Earth's crust, is a heavy metal.		√
9. Plastics were extensively used before the Second World War.		√
10. Using nanotechnology we can manipulate atoms and create materials that do not normally occur in nature.	√	

### Homework

Fill in the chart to make a chronological line. Fill in the motivation column with the words you will find below (you don't have to use all of them):

Coincidence  
 Basic  
 Consumerism  
 Boredom  
 Mistake  
 needs  
 Fun

Motivation for the discovery of new materials	Age/Historical Moment	Relevant materials	Applications
<i>Basic needs</i>	<i>Paleolithic</i>	<i>Flint and pigments</i>	<i>Tools and cave painting</i>
<i>Basic needs</i>	<i>Neolithic</i>	<i>Bronze, copper, tin, charcoal, ceramics and iron</i>	<i>Weapons, tools, storage of food,</i>
<i>Basic needs</i>	<i>Industrial revolution</i>	<i>Coke, steel, iron, concrete</i>	<i>Canals, railways, roads and chemicals</i>
<i>Consumerism</i>	<i>Modern world</i>	<i>Aluminium and plastic</i>	<i>Aerospace industry, transportation, buildings, films, materials 'a la carte'</i>

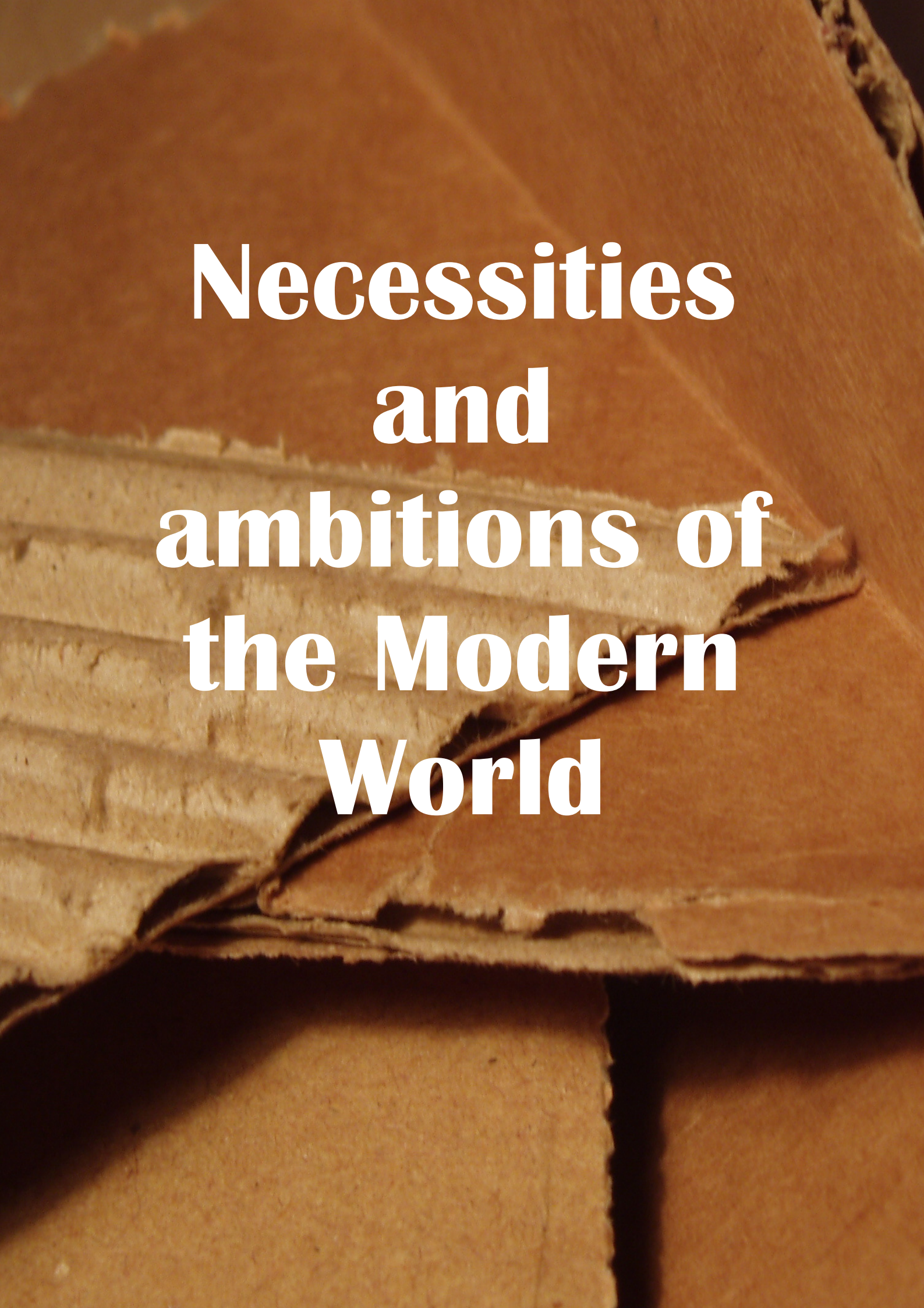


### Homework

Match the definitions with its material:

A	Wood
B	Flint
C	Copper
D	Iron
E	Concrete
F	Steel
G	Bronze
H	Aluminium

<i>E</i>	A hard strong building material made by mixing a cementing material, sand and water
<i>D</i>	A silver-white malleable, magnetic, heavy and metallic element that easily rusts in moist air
<i>A</i>	The hard fibrous substance that constitutes the greater part of the stems, branches, and roots of trees
<i>B</i>	A massive hard dark quartz that produces a spark when struck by steel
<i>G</i>	A metal alloy consisting primarily of copper and tin.
<i>H</i>	A silvery white chemical element found combined in many different minerals, mainly in the bauxite ore. It is very resistant to corrosion.
<i>C</i>	A common reddish metallic element that is ductile and malleable and is one of the best conductors of heat and electricity
<i>F</i>	An alloy that consists mostly of iron and has carbon content. With increased carbon content, it can be made harder and stronger than iron, but less ductile.



**Necessities  
and  
ambitions of  
the Modern  
World**



## New materials

**V** Watch the following video:

<http://www.youtube.com/watch?v=QBndaE56Rao>

### **W** **2** Task 1

Now that you have watched the video, let's go back and see if you begin the day in a similar way... Did you use all those objects this morning?



Image 9: Friends

Rachel was peacefully sleeping in her bed made of **wood**, with a **foam** mattress under the **cotton** sheets and the **duvet** made of **synthetic feathers**. Then a man starts singing while he is tying his **tie** made of **silk**. Does your dad have any of those ties? Rachel, who is wearing a **polyester** pyjama, opens the window made of **glass** and then leaves the room and starts shouting at two friends. They are having breakfast in their **ceramic** mugs by using a **stainless steel** spoon and reading the newspaper that is made of **paper**.

## Glossary

**Mattress:** You sleep on it

**Sheets:** You use them to cover you when you are sleeping

**Duvet:** Thick blanket made of feathers

**Tie:** Men wear it around the neck when they wear smart clothes.

**Mugs:** What you use to drink a coffee.

Tick the materials you have used in the morning and add any other material you have used:

wood	<input type="checkbox"/>	ceramic	<input type="checkbox"/>
foam	<input type="checkbox"/>	stainless steel	<input type="checkbox"/>
cotton	<input type="checkbox"/>	paper	<input type="checkbox"/>
synthetic feathers	<input type="checkbox"/>		<input type="checkbox"/>
silk	<input type="checkbox"/>		<input type="checkbox"/>
polyester	<input type="checkbox"/>		<input type="checkbox"/>
glass	<input type="checkbox"/>		<input type="checkbox"/>

**W** **2** Task 2

In pairs, think of 2 objects made of the following types of materials and write them down. Each box is a type of material. Can you think of the name? An example is given for you.

<b>Metals</b>	aluminium <i>Cans</i> <i>Bikes</i> copper <i>Cables</i> <i>pipes</i>  stainless steel <i>cutlery</i> <i>Jack knife</i>	porcelain <i>Cups</i> <i>Tiles</i>  clay <i>Pottery</i>  <i>Bricks</i>  concrete <i>Walls</i>  <i>Pavement</i>	<b>Ceramics</b>
	<b>Fibres</b>	Cotton <i>T-shirt</i>  <i>Sheets</i>  Nylon <i>Tights</i>  <i>Fishing line</i>	
		PET (polyethylene terephthalate) <i>Bottle of water</i>  <i>Frozen dinner tray</i>  Polycarbonate (PC) <i>Eyeglasses</i>  CD	

**R** **2** Task 3: JIGSAW TASK

Read and remember as much information as possible because you will have to explain everything to your team:

Medicine

Nowadays, cardiac surgery uses new techniques capable of repairing different problems of the heart.

“Arteriosclerosis” is an illness in which arteries *harden* and cholesterol gets deposited inside them.

The arteries become inelastic and *narrow*, and for this reason, the stress on the heart increases as it tries to *pump* more blood.

In the hospital, doctors introduce a *folded net* called “stent” made of **nickel** and **titanium**. This net has the property of shape memory; consequently, once the stent is introduced into the coronary artery, a balloon inflates it and then, it retakes its original form and makes the diameter of the artery bigger.

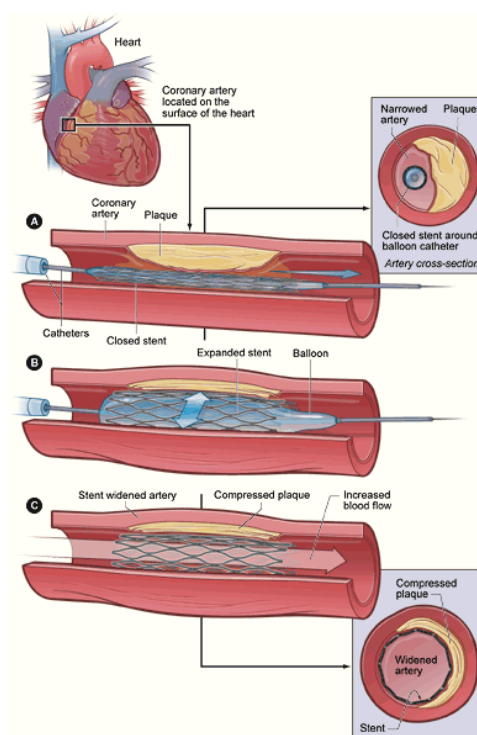


Image 10

Glossary

Surgery: *cirurgia*  
Harden: *endurir-se*  
Narrow: *estret*

Pump: *bombejar*  
Folded: *dobleгат*  
Net: *xarxa*

### R 2 Task 3: JIGSAW TASK

Read and remember as much information as possible because you will have to explain everything to your team:

#### Construction

The construction of buildings has changed a lot during the last decades.

The materials used in the construction of houses and infrastructures are basically **reinforced concrete** and **steel**. Both materials have been improved and now are more resistant and *last* longer.

Moreover, nowadays, new materials are being used because they respond to different needs and also because they are not heavy. These new materials are **carbon fibre**, organic **polymers** and **glass**.

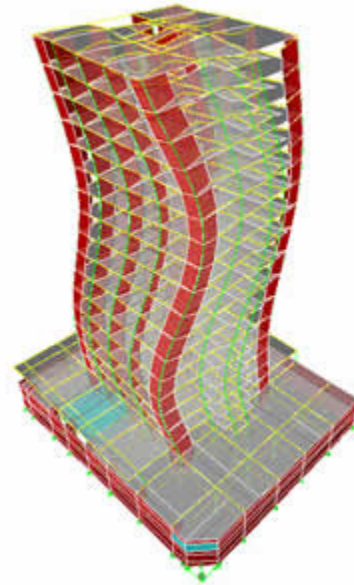


Image 11

The use of these new materials allows architects and engineers to design buildings that are able to resist earthquakes. They are frequently used in Japan because it is located in one of the most earthquake- *prone* regions in the world.

#### Glossary

**Reinforced concrete:** *formigó armat*

**Steel:** *acer*

**Last:** *dura*

**Carbon fibre:** *fibra de carboni*

**Prone:** *propens*

**W 1** Task 4: Quiz on the uses of new materials

Tick TRUE or FALSE according to what you have learnt. If you know the correct answer, write it down:

Uses of new materials	TRUE	FALSE
1. The use of new materials allows overcoming illnesses such as "Arteriosclerosis".	√	
2. The materials used in the construction of houses are mostly reinforced concrete and steel.	√	
3. Medicine does not use materials with shape memory.		√
4. New materials used in construction allow buildings to resist earthquakes.	√	
5. "Stents" are made of aluminium.		√
6. Shape memory is a property of some materials.	√	
7. Carbon fibre is a very heavy material.		√
8. New materials used in construction are more resistant.	√	



A close-up photograph of a piece of brown cardboard that has been torn. The tear is jagged and runs diagonally across the frame. The cardboard has a distinct fluted or corrugated internal structure, which is visible where the material is broken. The color is a warm, brownish-tan. Overlaid on the center of the image is the text "Properties of materials" in a bold, white, sans-serif font.

# Properties of materials

L 2 Task 1

Before listening to the following video (1:32) on **fog-free glass** ([http://www.sciencedaily.com/videos/2006/0112-fogfree\\_glass.htm](http://www.sciencedaily.com/videos/2006/0112-fogfree_glass.htm)), fill in the missing words to get familiar with the vocabulary you will hear:

**Droplet:** A tiny drop

**Coating:** A thin layer that covers something

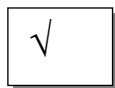
**Scatter:** To disperse

**Moisture:** Condensed liquid that makes something wet

**Nanopores:** Tiny pores

1. It can happen anywhere where *moisture* condenses on a cool surface.
2. When they condense they are just the right size to *scatter* light.
3. Materials chemist, Michael Rubner, created a polymer *coating*, made from different materials that transform the opaque *droplet* of water into a transparent sheet.
4. We're forming what we call *nanopores*. The pores are so small that you can't see them with your eyes.

Next, tick the box that best summarizes the information from the video you just heard:



Fog is caused when moisture condenses on a cool surface and then forms miniscule water droplets. A new polymer coating attracts droplets into nanopores and transforms them into a transparent sheet, improving vision. This solution can have many applications in everyday life but it is also interesting in the military field.



Foggy windows and lenses are a nuisance, and in the case of aircrafts windows, can pose a driving hazard. Now, a group of scientists at the Massachusetts Institute of Technology (MIT) may have found a permanent solution to the problem. The team has developed a unique polymer coating — made of silica nanoparticles — that they say can create surfaces that never fog.



**W** **2** Task 2

Match the properties with their antonyms, definition and translation:

Properties	Antonym	Definition of the antonym	Translation
Hardness	Softness	<i>It is the opposite of hardness. Easily deformed as a result of thermal stresses. Ex. Polymers, wood.</i>	<i>Duresa/ tou</i>
Brittleness	<i>Toughness</i>	<i>It is the ability of a material to withstand blows without breaking. Ex.: wood</i>	Fragilitat/ Tenacitat
Elasticity	<i>Plasticity</i>	<i>The ability of a material to change its shape (permanent deformation) without breaking after the stress is removed.</i>	<i>Elasticitat/ plasticitat</i>
Solubility	<i>Insolubility</i>	<i>It is the ability of being impossible to be dissolved</i>	<i>Solubilitat/ insolubilitat</i>

**Antonym**

Softness  
Plasticity  
Insolubility  
Toughness

**Definition of the antonym**

The ability of a material to change its shape (permanent deformation) without breaking after the stress is removed.

It is the ability of a material to withstand blows without breaking. Ex.: wood

~~It is the ability of being impossible to be dissolved~~

It is the opposite of hardness. Easily deformed as a result of thermal stresses. Ex. Polymers, wood.

### Task 3

Now that you have seen how to define the properties of materials, define the following concepts in relation to what you have seen in the power point presentation

1. Hardness

*It is the opposite of softness. Difficult to deform.*

2. Brittleness

*It is the ability of a material to break easily.*

3. Elasticity

*The ability of a material to change its shape under pressure. Once the pressure disappears, the material regains its original shape.*

4. Solubility

*The ability of being able to dissolve in another substance.*

### Homework

Connect the 4 columns and create sentences:

A material that	conducts electricity	is	a thermal conductor
	recovers its original size after deformation		dense
	degrades as a consequence of a chemical reaction with the environment		an electrical conductor
	has a great amount of mass per unit of volume		recyclable
	conducts heat		soluble
	burns easily		elastic
	dissolves in a given substance		corrosive
	is attracted by a magnet		ferromagnetic
	breaks easily		flammable
	can be reprocessed		brittle

1. A material that conducts electricity is an electrical conductor
2. A material that recovers its original size after deformation is elastic
3. A material that degrades as a consequence of a chemical reaction with the environment is corrosive
4. A material that has a great amount of mass per unit of volume is dense
5. A material that conducts heat is a thermal conductor
6. A material that burns easily is flammable
7. A material that dissolves in a given substance is soluble
8. A material that is attracted by a magnet is ferromagnetic
9. A material that breaks easily is brittle
10. A material that can be reprocessed is recyclable



A close-up photograph of a piece of brown cardboard that has been torn. The cardboard is layered, showing the internal fluted structure. The text "Classification of materials" is overlaid in a bold, white, sans-serif font. The background is a warm, brownish-orange color, matching the cardboard.

# **Classification of materials**

### W 2 Task 1

After the PPT presentation on the Classification of Materials, you should be able to say a few things on the different types of materials. In pairs, match the following lists. Number 1 is done for you:

1	The main properties of metals are	2	are those composed by the combination of simple materials.
2	Composite materials	4	brittle and hard.
3	Metals are mixed	5	amber, natural rubber, cellulose, etc.
4	Ceramics materials are	1	ductility, high electrical and thermal conductivity.
5	Natural polymers include	3	to form alloys in order to make another metal with particular properties (steel, for example).
6	Synthetic polymers include	6	neoprene, PVC, polyethylene, silicone, etc.
7	Thermoplastics polymers	9	are those based on synthetic polymers. The four main types are nylon, polyester, acrylic and polyamide.
8	Thermoset polymers	10	is used to create most semiconductors. Its use in computer chips meant a revolutionary advance in the high-tech industry.
9	Synthetic fibres	7	can be heated and shaped many times.
10	Silicon	8	can only be heated and shaped once.



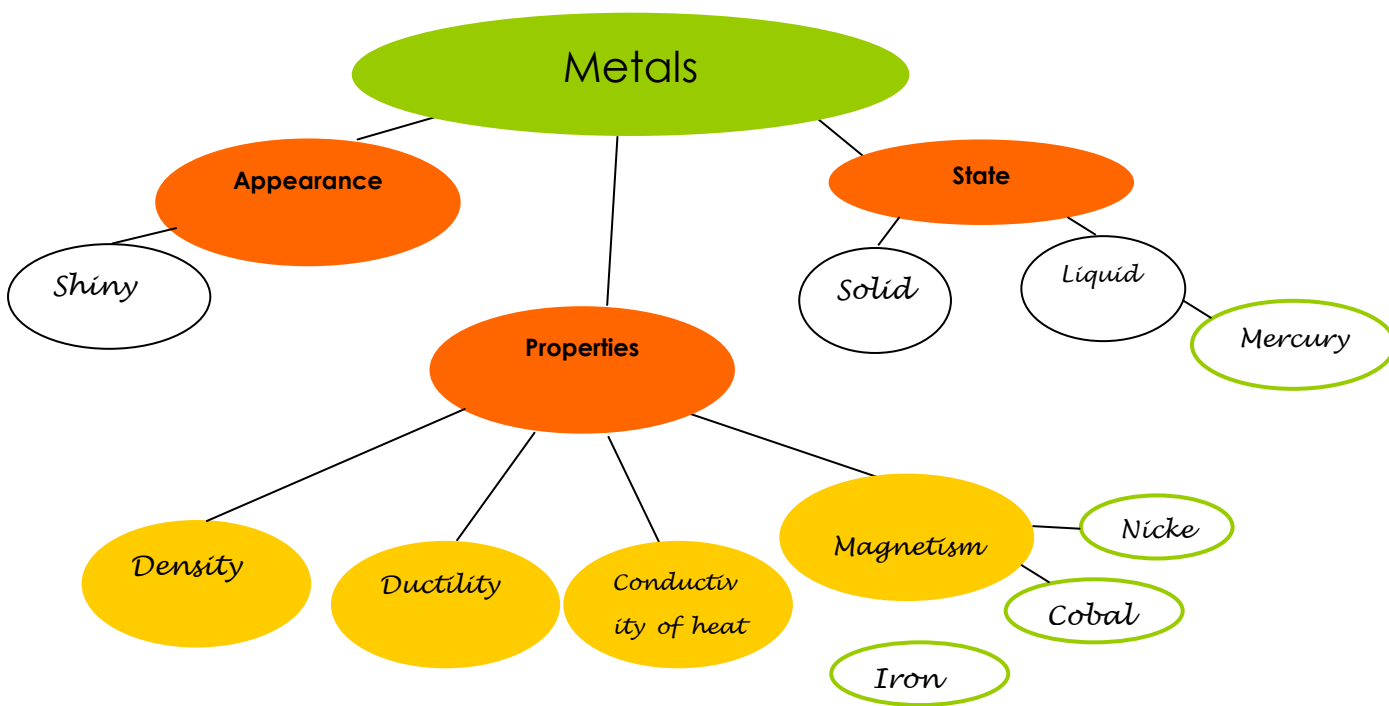
**W 2** Task 2

After listening to the PPT presentation on properties and metals, what can you say about metals? Think of 4 properties at least.

Metals are good conductors of electricity and heat. They are ductile, dense and some types of metals are magnetic.

**W 2** Task 3

Complete the following mind map with the information given:



- |  |         |
|--|---------|
| Magnetism                                    | Mercury |
| Density (heavy for their size)               | Iron    |
| Shiny or lustrous                            | Nickel  |
| Solid  | Cobalt  |
| Ductility (easily deformed without fracture) | Liquid  |
| Conductivity of heat and electricity         |         |

## Homework

Carol is a 16 year-old student studying the use of plastics in modern manufacturing. After having researched the topic, she has written the following essay on the advantages of using conventional plastics derived from oil. Read her essay and answer the comprehension questions below.

### Plastics are forever!

The many different types of plastics offer a broad range of properties. It is all about choosing the right type of plastic for a particular product based on requirements concerning hardness, rigidity, impact-resistance, insulating capacity with regard to electricity or cold/heat, weight, etc. **For this reason, we can state that** plastic can meet any requirement.

**Moreover**, plastic is an economical material as it well suited to mass production, e.g. through injection-molding, extrusion or blow-molding.

**Researchers point out** that the amount of energy consumed during the manufacture of plastic is low **compared with** many other materials. **In other words**, plastic saves resources - replacing heavy materials in cars, trains, ships and aircraft with lighter plastic components saves fuel. Much plastic waste is collected and recycled for use in new plastic products. Plastic which is not recycled can be incinerated, without any environmental problems for most plastics. Therefore, we can state that plastic has environmental advantages.

**In my opinion**, plastic is a very versatile material, often chosen in preference to other materials. For instance, in the car industry, plastic components are increasingly being used to replace metal.

Say whether the following statements are true or false according to Carol's essay:

	TRUE	FALSE
Plastics can only have a very limited set of properties.		✓
Plastic is a cheap material as it can be massively produced.	✓	
Plastic is environment friendly, as it helps saving resources.	✓	
Plastic waste cannot be recycled.		✓

Now, using the following phrase bank to connect sentences, answer Carol's essay with the **disadvantages** of using plastic (you can use Carol's essay as a model). Finish your essay with an opinion about our dependence on plastics. (120 words approx.)

Phrase Bank	
<p><b>Beginning a composition</b></p> <p>To begin with,</p> <p>Firstly,</p> <p><b>Adding information</b></p> <p>Apart from this/that,</p> <p>Furthermore,</p> <p>Besides,</p> <p>Moreover,</p> <p>In addition to ...,</p> <p><b>Rephrasing</b></p> <p>In other words,</p> <p>That is to say,</p> <p><b>Stating facts</b></p> <p>Researchers point out that ...</p> <p>Some studies have highlighted that ...</p> <p>We can state that ...</p>	<p><b>Contrasting facts</b></p> <p>While xxx, it...</p> <p>Compared with...</p> <p><b>Stating your opinion</b></p> <p>In my opinion,</p> <p>I think that,</p> <p>As far as I am concerned,</p> <p>I believe that...</p> <p>It seems reasonable that...</p> <p>Personally,</p> <p><b>Ending a composition</b></p> <p>In conclusion,</p> <p>To sum up,</p>

You can use the following writing plan to guide your thoughts. Do not forget to write a catchy title!

### Writing Plan

**Paragraph 1:** Plastic packaging, environmental and health costs. Some advantages, but accumulation of wasted plastic

**Paragraph 2:** durable materials, do not degrade, stay forever in landfills, not easy to be recycled.

**Paragraph 3:** manufacture of plastics involves chemicals, toxic impact on humans, migration of toxic substances into food, not enough tested, potential risk to health, some type of PVC is banned in Europe, not in America.

**Paragraph 4:** In my opinion,...

Title:

## Homework: Collaborative mind map "Properties of the types of materials"

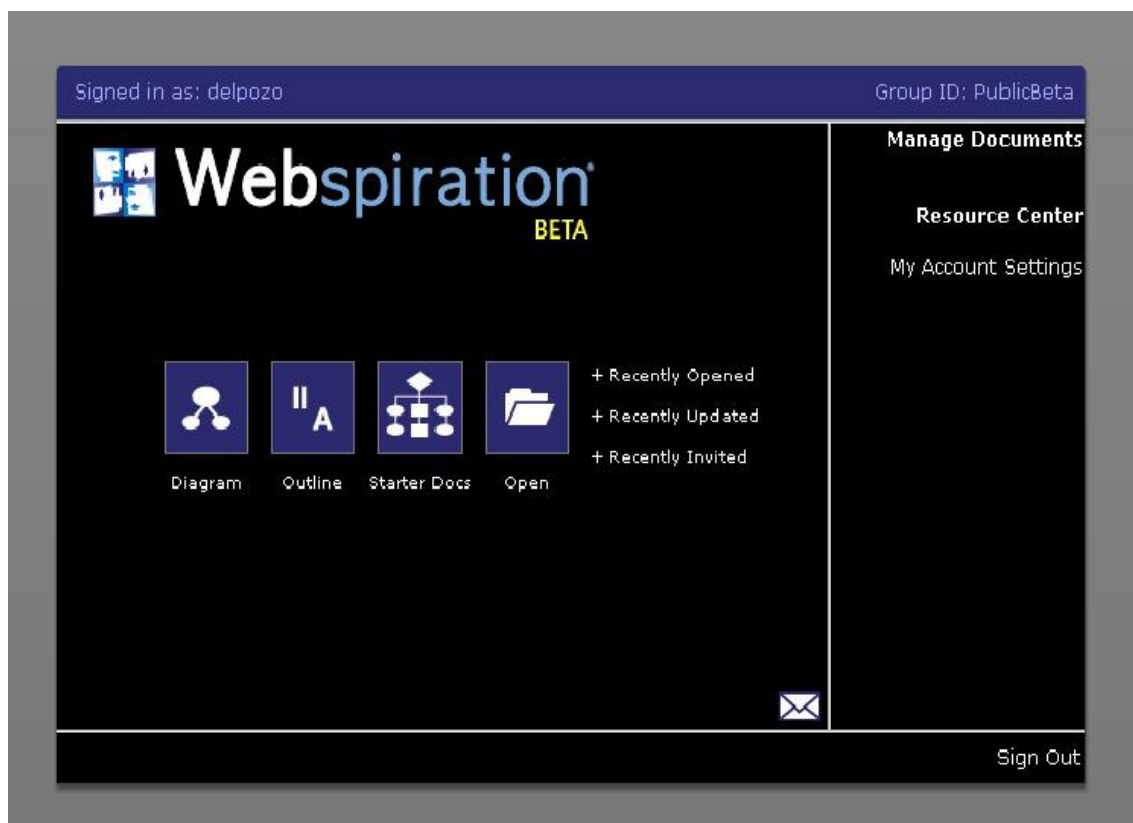
### How are you going to do this task?

1. You will receive an invitation to join the following webpage:

<http://www.webspirationclassroom.com>

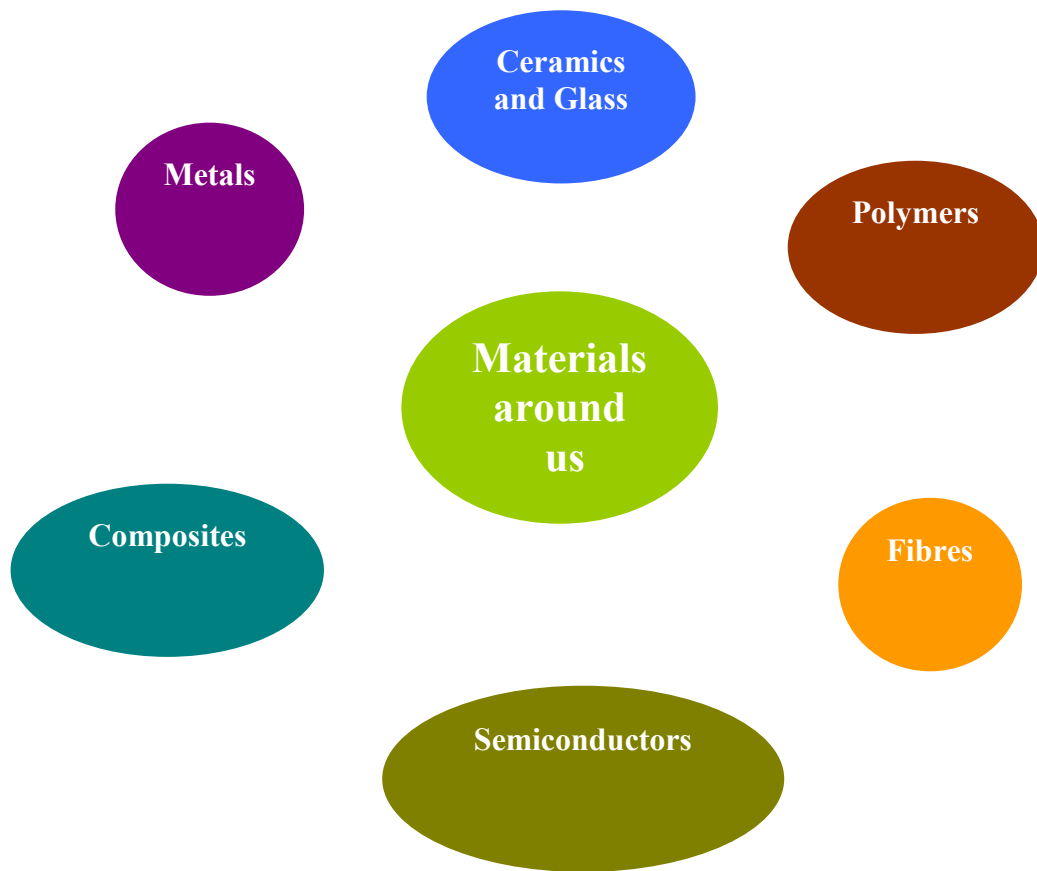
2. Fill in the information to sign up.

3. You should get to the following screen:



4. Click on "+ Recently invited" to open the link. You should see a document titled "Materials". Click on "Materials" to open the document.

5. You should see a mind map about “Materials around us” with the following structure:



6. We have added some words (see our names in brackets) to the mind map. Now it's your turn to collaborate in this mind map. Write 2 properties of materials we have seen today or add 2 examples of types of materials. Don't forget to write your name next to your 2 contributions.

7. By next class, all of you will have contributed to the mind map. Remember that we have seen physical and chemical properties of materials!

## Homework

In the next session we will be dealing with world conflicts related to the extraction of some raw materials. Watch the following 2 videos to have an opinion:

Congo and Coltan (4':37)

<http://www.youtube.com/watch?v=3OWj1ZGn4uM>

Sierra Leone Diamond Mines (3')

<http://www.youtube.com/watch?v=IYPMm6qxFZQ>





**Earth's  
limited  
resources**



Watch the following video:  
"Nigeria and the oil"



### Task 1

Fill in the report with the relevant information obtained in the video

## Report on the video

**Resource:** *oil*

**Where is it exploited?** *Nigeria*

**Describe in rough lines the conflict:**

*The conflict is about the exploitation of oil in Nigeria. Their environment has been destroyed and as many countries try to control the material. There are many mafias that are contributing to the worsening of the situation.*

**Who are the ones that suffer the negative effects of this exploitation?**

*The ones affected by this exploitation are people living in the area as they have to suffer wars for controlling the material and because their environment has been destroyed as a result of its exploitation.*

**What is your opinion?**

.....  
.....  
.....  
.....

**L V 2** Task 2

Now you will have to watch one of the following videos and fill in the report as you did before with the rest of the class:

“Sierra Leone and diamonds” or “Congo and coltan”

### Report on the video

**Resource:** Coltan/ Diamonds

**Where is it exploited?** Congo/ Sierra Leone

**Describe in rough lines the conflict:**

The conflict is about *the exploitation of Coltan/ Diamonds in Congo/ Sierra Leone. By doing so, Workers suffer really bad working conditions while many countries try to control the material. Moreover, there are many mafias that are contributing to the worsening of the situation.*

**Who are the ones that suffer the negative effects of this exploitation?**

The ones affected by this exploitation are *people living in the area as they have to suffer wars for controlling the material and because their environment has been destroyed as a result of its exploitation.*

**What is your opinion?**

In my opinion .....

.....

.....

.....



**W** **1** Task 3

Answer the following quiz

Quiz on the videos

Video name: .....

Where are blood diamonds located?

*Sierra Leone*

Where is the oil exploited?

*Nigeria*

Who is suffering the bad consequences of the exploitation of oil?

*People from the area*

Who is suffering the bad consequences of the exploitation of blood diamonds?

*People from the area*

Who takes profit of the blood diamonds?

*Rich countries.*

Who takes profit of the oil?

*Rich countries.*

Which is the conflict that shocked you the most? Why?

.....  
.....

## Homework

Before watching the following video (3:14) on papermaking process

<http://www.youtube.com/watch?v=4x9HlzPZLyM>, fill in the missing words:

**squeeze:** to firmly press from opposite or all sides.

**woodchips:** smaller pieces logs are cut into.

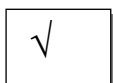
**logs:** a part of the trunk of a tree that has been cut off.

**pulp:** a soft wet mass of fibres derived from wood in making paper.

**bark:** the tough protective outer skin of the trunk.

1. To begin the papermaking process, the harvested *logs* arrive at the mill.
2. After the *bark* is removed, the logs run through machines that cut the wood into chips.
3. The *woodchips* and the recycled fibre are then pressure cooked with a mixture of water and chemicals in a digester in order to make the pulp.
4. The *pulp* created from the harvested logs and recycled fibre is washed, refined, cleaned and then turned to slush or watery mud in another machine.
5. The resulting crude paper sheet is *squeezed* between large rollers to remove most of the remaining water and ensure smoothness and uniform thickness.

Watch the video, and tick the box which best describes the procedure for paper making according to the video:



1. After the harvested logs arrive at the mill, they are debarked and reduced to woodchips.
2. The woodchips and the recycled fibre are mixed with water and chemicals in a digester to make a pudding.
3. Chemicals are used to clean the pulp.
4. Paper sheet is squeezed between rollers to remove water, and then through dryer rollers to remove the extra water.
5. The paper sheet is tested for uniformity of colour and surface, and water resistency.
6. The finished paper is wound into large rolls.



1. After the harvested logs arrive at the mill, the bark is removed and logs are reduced to woodchips.
2. The woodchips are mixed with water and chemicals in a digester to make a pudding.
3. Chemicals are used to clean the pulp.
4. Paper sheet is squeezed between rollers to remove water.
5. The paper sheet is run through a series of dryer rollers to remove the remaining water.
6. The finished paper is wound into large rolls.



A close-up photograph of brown cardboard, showing its layered structure and some frayed edges. The text "Environmental impacts" is overlaid in the center in a white, bold, sans-serif font.

# **Environmental impacts**

**W** **2** Task 1

Describe the process of paper production in pairs. Once you are done, choose between the words below in order to complete the "environmental impacts" box:

First,.....  
.....  
.....  
.....  
.....  
.....

Then,.....  
.....  
.....  
.....  
.....  
.....

Afterwards,.....  
.....  
.....  
.....  
.....  
.....

Finally,.....  
.....  
.....  
.....  
.....  
.....

**Air Pollution**  
**Energy Consumption**  
**Noise**  
**Water Pollution**  
**Deforestation**

We think that the **environmental impacts** may be .....  
.....  
.....  
.....  
.....  
.....



**W** **2** Task 2

Match the following ways of treating waste with the correct definition:

<b>A</b>	Landfill	<b>B</b>	To process materials in order to be used again by humans/ Organic matter used as fertilizing.
<b>B</b>	Recycled/composted	<b>C</b>	To burn organic substances contained in waste materials.
<b>C</b>	Incineration	<b>A</b>	To eliminate waste material by burying it under layers of earth.

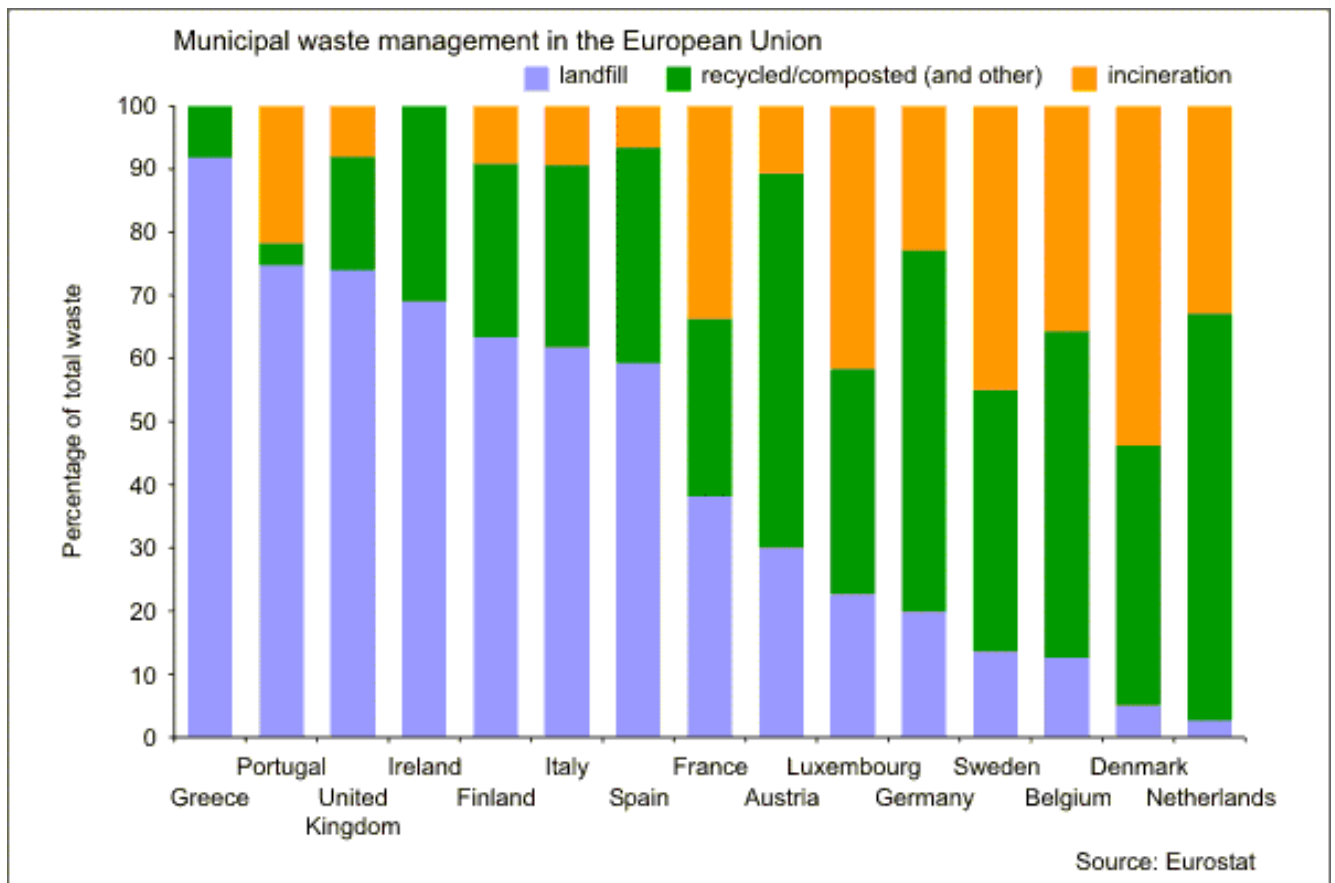


Image 12

## Interpreting data

Look at the amount of waste that goes into landfill per countries and extract some information. Number 1 is done for you. Use help from the boxes below.

1. Greece **landfills** over 90% of its waste.
2. Portugal and the United Kingdom *landfill  $\frac{3}{4}$  of waste*
3. The Netherlands and Denmark *landfill almost no waste*
4. Belgium, Sweden, Germany and Luxembourg *landfill less than a quarter*
5. Italy, Spain and Finland *landfill less than  $\frac{3}{4}$  of waste*

$\frac{3}{4}$  of waste

less than a quarter

almost no waste

~~90% of its waste~~

less than  $\frac{3}{4}$  of waste

## Drawing conclusions

1. Which is the country that recycles the most? And the country that recycles the least?

*The Netherlands is the country that recycles the most. Portugal is the country that recycles the least.*

2. Most countries belonging to the north of Europe recycle more than the ones closer to the Mediterranean Sea. Why do you think it happens? Is it related to any particular policy?

*Because they have very strong policies regarding waste management.*

3. Compare Spain with The Netherlands

*Spain has bigger amounts of landfill waste (60%) and less use of recycling (30%) and incineration, (10%), whereas The Netherlands has almost no landfill waste (5%) and they recycle/compost 65 per cent and incinerate 30 per cent of their waste*

## Final Project: PPT Oral Presentations

ICT

### Group 1: Car

#### *How are you going to do this final project?*

1. You will have to work in groups of 4 and identify the following materials of a car by using the following websites:

- **Steel**
- **Carbon fibre**
- **Rubber**
  
- <http://www.whatcar.com/car-news/what-car-tv-how-a-car-is-made/228187>
- [Nissan factory on Windows Media](#) (video showing a car factory)
- [http://www.ehow.com/facts\\_4897896\\_what-materials-used-car.html](http://www.ehow.com/facts_4897896_what-materials-used-car.html)
- [http://www.bbc.co.uk/schools/gcsebitesize/science/ocr\\_gateway/rocks\\_metals/5\\_cars\\_for\\_scrap2.shtml](http://www.bbc.co.uk/schools/gcsebitesize/science/ocr_gateway/rocks_metals/5_cars_for_scrap2.shtml)
- <http://www.carsdesignonline.com/production/materials/carbon-fiber.php>
- <http://ezinearticles.com/?What-Metals-and-Other-Materials-Make-Up-Cars?&id=2421163>
- [www.wikipedia.org](http://www.wikipedia.org)

2. You will have to create a power point presentation with 6 slides. You have a model (*What's your mobile phone made of?*) up in the Moodle.

3. The content of the presentation must include the following information about the materials used in the car:

- Slide 1: cover and title. Ex. "What's a car made of?"
- Slide 2: 3 materials used in a car
- Slide 3: Origin of the materials
- Slide 4: Applications of the materials
- Slide 5: Properties of the materials
- Slide 6: Social and environmental repercussions of using these materials

4. Oral presentations:

- a. Each group must bring their PPT on a **pen drive** (PPT format).
- b. **Every** student in the group must explain **1 slide** (each student should speak the same amount of time). Slides 3, 4, 5 and 6 are the main slides and each one of them should be explained by a different member of the group. Total time of the **oral presentation is 6 minutes**.

- c. While one group is explaining their topic, another group fills in a rubric evaluating the presentation based on 4 categories (preparedness, clear speech, vocabulary, and content).

5. The PPT oral presentations and the written exam will take place on **8<sup>th</sup> April** at **sixth** hour. Tutoria will be at first hour. At sixth hour, the first 30 minutes of class will be devoted to your PPT oral presentations. Groups 1, 2, 3 and 4 will stay in the CMC classroom. Groups 5, 6, 7, 8 will go to a different class. The last 30 minutes of class will be devoted to the written exam.

## ICT Group 2: Running shoe

### **How are you going to do this final project?**

1. You will have to work in groups of 4 and identify the following materials of a running shoe by using the following websites:

- **Synthetic leather**
- **Polymers: EVA (ethylene vinyl acetate)**
- **Carbon rubber**
  
- <http://www.madehow.com/Volume-1/Running-Shoe.html>
- <http://en.wikipedia.org/wiki/Insole#Insole>
- <http://www.epodiatry.com/running-shoes.htm>
- <https://www.roadrunnersports.com/trs/content/content.jsp?contentId=content1106>
- <http://www.sneakerhead.com/nike-brand-technology.html>

2. You will have to create a power point presentation with 6 slides. You have a model (*What's your mobile phone made of?*) up in the Moodle.

3. The content of the presentation must include the following information about the materials used in the running shoe:

- Slide 1: cover and title. Ex. "What's a running shoe made of?"
- Slide 2: 3 materials used in a running shoe
- Slide 3: Origin of the materials
- Slide 4: Applications of the materials
- Slide 5: Properties of the materials
- Slide 6: Social and environmental repercussions of using these materials

4. Oral presentations:

- a. Each group must bring their PPT on a **pen drive** (PPT format).
- b. **Every** student in the group must explain **1 slide** (each student should speak the same amount of time). Slides 3, 4, 5 and 6 are the main slides and each one of them should be explained by a different member of the group. Total time of the **oral presentation is 6 minutes**.
- c. While one group is explaining their topic, another group fills in a rubric evaluating the presentation based on 4 categories (preparedness, clear speech, vocabulary, and content).



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**How are you going to do this final project?**

1. You will have to work in groups of 4 and identify the following materials of a computer by using the following websites:

- **Silicon (semiconductor) -> silicon wafer**
- **Liquid crystal (for the screen)**
- **Polymer for the keyboard: Acrylonitrile butadiene styrene (ABS)**
  
- <http://www.youtube.com/watch?v=aWVywhzuHnQ>
- [http://www.ehow.co.uk/facts\\_4911761\\_what-material-computer-screen-made.html](http://www.ehow.co.uk/facts_4911761_what-material-computer-screen-made.html)
- <http://www.howstuffworks.com/lcd.htm>
- [http://en.wikipedia.org/wiki/Acrylonitrile\\_butadiene\\_styrene](http://en.wikipedia.org/wiki/Acrylonitrile_butadiene_styrene)
- <http://www.rutlandplastics.co.uk/abs.shtml>

2. You will have to create a power point presentation with 6 slides. You have a model (*What's your mobile phone made of?*) up in the Moodle.

3. The content of the presentation must include the following information about the materials used in the computer:

- Slide 1: cover and title. Ex. "What's a computer made of?"
- Slide 2: 3 materials used in a computer.
- Slide 3: Origin of the materials
- Slide 4: Applications of the materials
- Slide 5: Properties of the materials
- Slide 6: Social and environmental repercussions of using these materials

4. Oral presentations:

- a. Each group must bring their PPT on a **pen drive** (PPT format).
- b. **Every** student in the group must explain **1 slide** (each student should speak the same amount of time). Slides 3, 4, 5 and 6 are the main slides and each one of them should be explained by a different member of the group. Total time of the **oral presentation is 6 minutes**.
- c. While one group is explaining their topic, another group fills in a rubric evaluating the presentation based on 4 categories (preparedness, clear

speech, vocabulary, and content).

5. The PPT oral presentations and the written exam will take place on **8<sup>th</sup> April** at **sixth** hour. Tutoria will be at first hour. At sixth hour, the first 30 minutes of class will be devoted to your PPT oral presentations. Groups 1, 2, 3 and 4 will stay in the CMC classroom. Groups 5, 6, 7, 8 will go to a different class. The last 30 minutes of class will be devoted to the written exam.

**How are you going to do this final project?**

1. You will have to work in groups of 4 and identify the following materials of a backpack by using the following websites:

- **Nylon (polymer-based fibre)**
- **Steel for the zipper (the slider is made of steel)**
- **Closed cell foam (polymer) for padded straps**
  
- <http://ezinearticles.com/?Why-a-Nylon-Backpack-is-Useful&id=2376485>
- <http://www.helium.com/items/1914789-best-material-for-a-backpack>
- [http://www.whitemountain.com.au/backpack\\_construction/material\\_fags.html](http://www.whitemountain.com.au/backpack_construction/material_fags.html)
- <http://www.enotes.com/how-products-encyclopedia/zipper>
- [http://zenbackpacking.net/BackpackFabrics.htm#Closed\\_Cell\\_Foam](http://zenbackpacking.net/BackpackFabrics.htm#Closed_Cell_Foam)

2. You will have to create a power point presentation with 6 slides. You have a model (*What's your mobile phone made of?*) up in the Moodle.

3. The content of the presentation must include the following information about the materials used in the backpack:

- Slide 1: cover and title. Ex. "What's your backpack made of?"
- Slide 2: 3 materials used in a backpack.
- Slide 3: Origin of the materials
- Slide 4: Applications of the materials
- Slide 5: Properties of the materials
- Slide 6: Social and environmental repercussions of using these materials

4. Oral presentations:

- a. Each group must bring their PPT on a **pen drive** (PPT format).
- b. **Every** student in the group must explain **1 slide** (each student should speak the same amount of time). Slides 3, 4, 5 and 6 are the main slides and each one of them should be explained by a different member of the group. Total time of the **oral presentation is 6 minutes**.
- c. While one group is explaining their topic, another group fills in a rubric evaluating the presentation based on 4 categories (preparedness, clear speech, vocabulary, and content).

5. The PPT oral presentations and the written exam will take place on **8<sup>th</sup> April** at **sixth** hour. Tutoria will be at first hour. At sixth hour, the first 30 minutes of class will be devoted to your PPT oral presentations. Groups 1, 2, 3 and 4 will stay in the CMC classroom. Groups 5, 6, 7, 8 will go to a different class. The last 30 minutes of class will be devoted to the written exam.

## ICT Group 5: Tennis Racket

### **How are you going to do this final project?**

1. You will have to work in groups of 4 and identify the following materials of a tennis racket by using the following websites:

- **Strings (Synthetic polymer: Kevlar)**
- **Chassis (Carbon fibre)**
- **Filler (Polyurethane)**
  
- <http://tennis101.com/anatomyofthetennisracquet.htm>
- <http://www.madehow.com/Volume-3/Tennis-Racket.html>
- <http://en.wikipedia.org/wiki/Kevlar>
- [http://en.wikipedia.org/wiki/Carbon\\_fibre](http://en.wikipedia.org/wiki/Carbon_fibre)
- <http://www.ifftennis.com/technical/equipment/rackets/history.asp>
- <http://www.pslc.ws/macrog/kidsmac/polyure.htm>

2. You will have to create a power point presentation with 6 slides. You have a model (*What's your mobile phone made of?*) up in the Moodle.

3. The content of the presentation must include the following information about the materials used in the tennis racket:

- Slide 1: cover and title. Ex. "What's a tennis racket made of?"
- Slide 2: 3 materials used in a tennis racket.
- Slide 3: Origin of the materials
- Slide 4: Applications of the materials
- Slide 5: Properties of the materials
- Slide 6: Social and environmental repercussions of using these materials

4. Oral presentations:

- a. Each group must bring their PPT on a **pen drive** (PPT format).
- b. **Every** student in the group must explain **1 slide** (each student should speak the same amount of time). Slides 3, 4, 5 and 6 are the main slides and each one of them should be explained by a different member of the group. Total time of the **oral presentation is 6 minutes**.
- c. While one group is explaining their topic, another group fills in a rubric evaluating the presentation based on 4 categories (preparedness, clear



speech, vocabulary, and content).

5. The PPT oral presentations and the written exam will take place on **8<sup>th</sup> April** at **sixth** hour. Tutoria will be at first hour. At sixth hour, the first 30 minutes of class will be devoted to your PPT oral presentations. Groups 1, 2, 3 and 4 will stay in the CMC classroom. Groups 5, 6, 7, 8 will go to a different class. The last 30 minutes of class will be devoted to the written exam.

**How are you going to do this final project?**

1. You will have to work in groups of 4 and identify the following materials of a diving suit by using the following websites:

- **Diving suit (Neoprene)**
- **Diving cylinder (aluminium)**
- **Diver fins (rubber)**
  
- <http://www.pslc.ws/macrog/kidsmac/rubber.htm#isoprene>
- <http://www.ali-tek.com/>
- <http://seavenger.com/sea-diver-classic-rubber-swimming-scuba-diving-fins-p-179.html>

2. You will have to create a power point presentation with 6 slides. You have a model (*What's your mobile phone made of?*) up in the Moodle.

3. The content of the presentation must include the following information about the materials used in the diving suit:

- Slide 1: cover and title. Ex. "What's a diving suit made of?"
- Slide 2: 3 materials used in a diving suit.
- Slide 3: Origin of the materials
- Slide 4: Applications of the materials
- Slide 5: Properties of the materials
- Slide 6: Social and environmental repercussions of using these materials

4. Oral presentations:

- a. Each group must bring their PPT on a **pen drive** (PPT format).
- b. **Every** student in the group must explain **1 slide** (each student should speak the same amount of time). Slides 3, 4, 5 and 6 are the main slides and each one of them should be explained by a different member of the group. Total time of the **oral presentation is 6 minutes**.
- c. While one group is explaining their topic, another group fills in a rubric evaluating the presentation based on 4 categories (preparedness, clear speech, vocabulary, and content).

5. The PPT oral presentations and the written exam will take place on **8<sup>th</sup> April** at **sixth** hour. Tutoria will be at first hour. At sixth hour, the first 30 minutes of class will be devoted to your PPT oral presentations. Groups 1, 2, 3 and 4 will stay in the CMC classroom. Groups 5, 6, 7, 8 will go to a different class. The last 30 minutes of class will be devoted to the written exam.

**How are you going to do this final project?**

1. You will have to work in groups of 4 and identify the following materials of a fire fighter suit by using the following websites:

- **Coat and trousers (nomex, a synthetic fibre)**
- **HELMET (polyurethane)**
- **Boots (goretex)**
  - <http://en.wikipedia.org/wiki/Nomex>
  - <http://www.pslc.ws/macrog/kidsmac/polyure.htm>
  - <http://www.msa-europe.com/int/products/head-protection/fire-helmets/f1-sf-approved-to-en4432008/> (**Go to: "Download additional info"**)
  - <http://www.haix.com/international/fire-fighting-boots/haix-florian-europe>

2. You will have to create a power point presentation with 6 slides. You have a model (*What's your mobile phone made of?*) up in the Moodle.

3. The content of the presentation must include the following information about the materials used in the fire fighter suit:

- Slide 1: cover and title. Ex. "What's a fire fighter suit made of?"
- Slide 2: 3 materials used in a fire fighter suit.
- Slide 3: Origin of the materials
- Slide 4: Applications of the materials
- Slide 5: Properties of the materials
- Slide 6: Social and environmental repercussions of using these materials

4. Oral presentations:

- a. Each group must bring their PPT on a **pen drive** (PPT format).
- b. **Every** student in the group must explain **1 slide** (each student should speak the same amount of time). Slides 3, 4, 5 and 6 are the main slides and each one of them should be explained by a different member of the group. Total time of the **oral presentation is 6 minutes**.
- c. While one group is explaining their topic, another group fills in a rubric evaluating the presentation based on 4 categories (preparedness, clear speech, vocabulary, and content).

5. The PPT oral presentations and the written exam will take place on **8<sup>th</sup> April** at **sixth** hour. Tutoria will be at first hour. At sixth hour, the first 30 minutes of class will be devoted to your PPT oral presentations. Groups 1, 2, 3 and 4 will stay in the CMC classroom. Groups 5, 6, 7, 8 will go to a different class. The last 30 minutes of class will be devoted to the written exam.

**How are you going to do this final project?**

1. You will have to work in groups of 4 and identify the following materials of a bike by using the following websites:

- **Bike frame (aluminium)**
  - **Bicycle seat/saddle (carbon fibres)**
  - **Tyres (rubber)**
- 
- <http://en.wikipedia.org/wiki/Aluminium>
  - [http://en.wikipedia.org/wiki/Carbon\\_fiber-reinforced\\_polymer](http://en.wikipedia.org/wiki/Carbon_fiber-reinforced_polymer)
  - [http://en.wikipedia.org/wiki/Natural\\_rubber](http://en.wikipedia.org/wiki/Natural_rubber)
  - <http://www.madehow.com/Volume-7/Bicycle-Seat.html>

2. You will have to create a power point presentation with 6 slides. You have a model (*What's your mobile phone made of?*) up in the Moodle.

3. The content of the presentation must include the following information about the materials used in the bike:

- Slide 1: cover and title. Ex. "What's your *bike* made of?"
- Slide 2: 3 materials used in a bike
- Slide 3: Origin of the materials
- Slide 4: Applications of the materials
- Slide 5: Properties of the materials
- Slide 6: Social and environmental repercussions of using these materials

4. Oral presentations:

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## Tips on how to speak in front of an audience

1. Introduce yourself and your team. Establish who is going to talk about what.
2. Know your topic well. This will ease your nervousness and fear.
3. Try to speak clearly so your audience can follow you easily.
4. Use precise vocabulary we have seen in class related to materials, properties, etc.
5. To finish your PPT, say "Thanks for your attention".

## Assessment: Oral Presentations on New Materials rubric

Oral Presentation Title: \_\_\_\_\_

Assessed by: \_\_\_\_\_

Name of the student assessed: \_\_\_\_\_

CATEGORY	4 points	3 points	2 points	1 point
<b>Preparedness</b>	Very good preparation	Good preparation.	Little preparation.	No preparation
<b>Speaks Clearly</b>	Very clear speaking.	Clear speaking.	Not very clear speaking.	Unclear speaking.
<b>Vocabulary</b>	Very precise vocabulary.	Precise vocabulary.	Not very precise vocabulary.	No precise vocabulary.
<b>Content</b>	Shows full understanding.	Shows good understanding.	Shows not very good understanding.	Shows no understanding.

Name of the student assessed: \_\_\_\_\_

CATEGORY	4 points	3 points	2 points	1 point
<b>Preparedness</b>	Very good preparation	Good preparation.	Little preparation.	No preparation
<b>Speaks Clearly</b>	Very clear speaking.	Clear speaking.	Not very clear speaking.	Unclear speaking.
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<b>Content</b>	Shows full understanding.	Shows good understanding.	Shows not very good understanding.	Shows no understanding.

## Assessment: Collaborative work rubric

Assessed by: \_\_\_\_\_

Student name: \_\_\_\_\_

CATEGORY	4 points	3 points	2 points	1 point
<b>Quality of Work</b>	Provides work of the highest quality.	Provides high quality work.	Provides work that occasionally needs to be checked to ensure quality.	Provides work that usually needs to be checked/redone by others to ensure quality.
<b>Problem-solving</b>	Actively looks for and suggests solutions to problems.	Refines solutions suggested by others.	Does not suggest solutions, but is willing to try out solutions suggested by others.	Does not try to solve problems or help others solve problems. Lets others do the work.
<b>Attitude</b>	Never is publicly critical of the project or the work of others. Always has a positive attitude about the task(s).	Rarely is publicly critical of the project or the work of others. Often has a positive attitude about the task(s).	Occasionally is critical of the project or the work of other members of the group. Usually has a positive attitude about the task(s).	Often is publicly critical of the project or the work of other members of the group. Often has a negative attitude about the task(s).
<b>Working with Others</b>	Almost always listens to, shares with, and supports the efforts of others. Tries to keep people working well together.	Usually listens to, shares with, and supports the efforts of others. Does not cause "waves" in the group.	Often listens to, shares with, and supports the efforts of others, but sometimes is not a good team member.	Rarely listens to, shares with, and supports the efforts of others. Often is not a good team player.

Student name: \_\_\_\_\_

CATEGORY	4 points	3 points	2 points	1 point
<b>Quality of Work</b>	Provides work of the highest quality.	Provides high quality work.	Provides work that occasionally needs to be checked to ensure quality.	Provides work that usually needs to be checked/redone by others to ensure quality.
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## Assessment: Main idea learnt in the oral presentations on New Materials

Student name: \_\_\_\_\_

1. Oral Presentation title: \_\_\_\_\_

What did you learn?

---

2. Oral Presentation title: \_\_\_\_\_

What did you learn?

---

3. Oral Presentation title: \_\_\_\_\_

What did you learn?

---

## EXAM ON NEW MATERIALS

Student name: \_\_\_\_\_

**1. Name all four periods in history seen in class and relate them with the materials used. ( /12)**

Period of history	Materials used
Paleolithic	
	Aluminium and plastic

**2. Name two fields where new materials are used and describe the new application of new materials in both fields. We saw them in class. ( /10)**

A. \_\_\_\_\_:

B. \_\_\_\_\_:

**3. Read the following 5 definitions of properties and choose among the 10 names of properties. You just have to use 5 names of properties. ( /10)**

	<b>Definitions of properties</b>
<b>A</b>	The ability of a material to change its shape (permanent deformation) without breaking after the stress is removed.
<b>B</b>	It is the measure of how resistant a material is to being scratched.
<b>C</b>	It is the ability to be deformed under stress without fracture.
<b>D</b>	It is the ability to be deformed under stress and once the stress is removed, the material regains the original shape.
<b>E</b>	It is the ability of a material to break easily.

	<b>Names of properties</b>
	Hardness
	Brittleness
	Elasticity
	Ductility
	Plasticity
	Thermal conductivity
	Inflammability
	Solubility
	Ferromagnetism
	Density

**4. The main properties of metals are:**

( /3)

- a) Brittleness and elasticity
- b) High electrical conductivity, brittleness and elasticity
- c) Ductility, high electrical and thermal conductivity

**5. Circle the true statement.**

( /5)

- a) Thermoplastic polymers can only be heated and shaped once.  
Example: PET and PVC
- b) Thermoset polymers are difficult to recycle. Example: polyurethane (PU).
- c) Elastomer polymers are not very elastic. Example: polybutadiene.

**6. Circle the true statement.**

( /5)

- b) Silicon is a semiconductor material used in the manufacturing of radios, computer microchips and many other electronic devices.
- c) Composites is a type of material composed by a combination of metal and another material.
- d) Synthetic fibres are based on natural polymers and are mainly used to make plastic containers.

7. Give at least one example of how consumption can be related to conflicts around the world. Include the socioeconomic and environmental impacts. ( /20)

8. Write down three ways of treating waste and describe them. ( /15)

A. \_\_\_\_\_:

B. \_\_\_\_\_:

C. \_\_\_\_\_:

## New Materials: Feedback

This document is anonymous and its only aim is to help us improve and become better teachers in the future. You don't need to answer in English. This survey **does not include** the **nanotechnology** session.

Thanks for collaborating!!!

Which part did you like the best? Why?

Which part was the most interesting for you?

And the most boring?

Which is the part do you remember the most?

Is there something you would have liked to know more about?

Rate the unit from 1 to 10



# **Annex with materials used in class**

## **Annex: Table of contents**

<b>Session 1: Task 2 The use of materials through history</b>	<b>97</b>
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## Session 1: Task 2 The use of materials through history

1. Find out whether you are student A, B, C or D. Students A and B are in charge of Reading 1 (Paleolithic and Neolithic). Students B and C are in charge of Reading 2 (The Industrial Revolution and The Modern World).
2. Spot where your Readings are. They should be somewhere posted on the wall.
3. Read the questions on the cards. Then, stand up and go to your Reading. Take a few minutes to read the 2 texts. You are allowed to write 5 words in each card regarding each question.
4. Go back to your seat. You have to answer 5 questions. Students A and B are in charge of questions 1 to 5. Students C and D are in charge of questions 6 to 10.
5. Student A and B tell C and D about the information they have read, and viceversa. Then, answer the rest of the questions.
6. Quiz Time! Let's see which group knows all the information!

What did the use of tools contribute to?

- 
- 
- 
- 
- 

What did they use to represent hunting scenes?

- 
- 
- 
- 
- 

What is flint?

- 
- 
- 
- 
- 

Why was the discovery of ceramics that important?

- 
- 
- 
- 
- 

Which was the material that contributed to the growth of the population?

- 
- 
- 
- 
-

## Session 1: Task 2 The use of materials through history

1. Find out whether you are student A, B, C or D. Students A and B are in charge of Reading 1 (Paleolithic and Neolithic). Students B and C are in charge of Reading 2 (The Industrial Revolution and The Modern World).
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5. Student A and B tell C and D about the information they have read, and viceversa. Then, answer the rest of the questions.
6. Quiz Time! Let's see which group knows all the information!

What type of material was mainly used as fuel during the Industrial Revolution?

- 
- 
- 
- 
- 

What types of metal were massively produced during the Industrial Revolution?

- 
- 
- 
- 
- 

Why is aluminium such an ideal material to work with?

- 
- 
- 
- 
- 

What is the raw material of plastic?

- 
- 
- 
- 
- 

What can you do with nanotechnology?

- 
- 
- 
- 
-

## Session 3:

### Card Game

Ferromagnetism

Luminescence

Solubility

Corrosion

It is the low-temperature emission of light.

It is the ability of dissolving in a given amount of another substance.

Image 1



Image 2

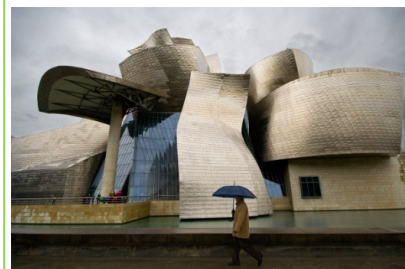


Image 3



Image 4



It is the phenomenon by which materials exert an attractive or repulsive force on other materials. Ferromagnetic materials are attracted by magnets.

It is the degradation of materials as a result of a chemical reaction with the environment.

## Session 3:

Brittleness

Hardness

Plasticity

Elasticity

It is the measure of how resistant a material is to being scratched

It is the ability of materials to recover their size and shape after deformation.

Image 5



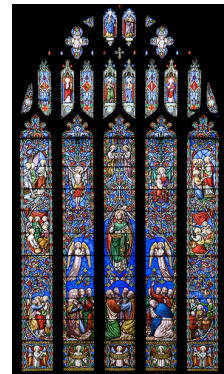
Image 6



Image 7



Image 8



It is the ability of a material to retain a shape through pressure and deformation.

A material is brittle if it is susceptible to fracture when a sudden force is exerted on it.

## Session 3:

Density

Refraction index

Absorption

Reflection

It is the mass of a substance per unit volume. The less dense, the lighter they are.

It measures the speed of light in matter.

Image 9



Image 10



Image 11



Image 12



It is the ability of a material to absorb some electromagnetic radiations.

It is the ability of a material to reflect the incident light.



### Session 3:

Inflammability

PH

Recyclable

It is the ability of materials to burn easily.

Image 13



Image 14



Image 15



It measures the activity of Hydrogen ions in a solution; thus, it measures the acidity and alkalinity of a solution.

It is the ability of materials to be reprocessed after being used.

## Session 6: Cards and descriptions

Image 1



Image 2



Image 3



Image 4



**Deforestation:** Cutting down many trees.

**Transportation:** To collect the already cut down logs and to carry them to the paper mill.

**Cutting up into pieces:** After bark is removed, logs are cut into smaller pieces (wood chips).

**Chemical pulping process:** Wood chips broken down by chemicals into a pudding of cellulose fibres. Chemicals are used to clean pulp



## PPTs used in class to explain content

The teachers designed 5 PowerPoint presentations, one for each session in New Materials (except for session 3), to explain content to students.

### **PPTs per session:**

- 1 Imagine.ppt
- 2 Necessities and ambitions of the Modern World.ppt
- 4 Classification of Materials.ppt
- 5 Earth's limited resources.ppt
- 6 Environmental Impacts.ppt

# 1. Imagine



Image 1

Imagine this  
happens to  
you...

**Let's watch a video...**

**You are here, in the  
middle of nowhere**



Image 2

**What do you do?  
There's no electricity...**



Image 3

**There isn't food or  
drinking water...**

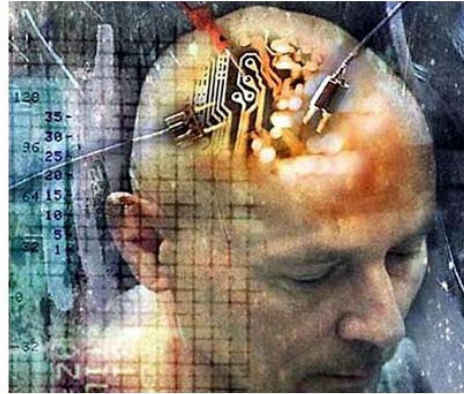


Image 4

**What materials would you  
use to survive?**

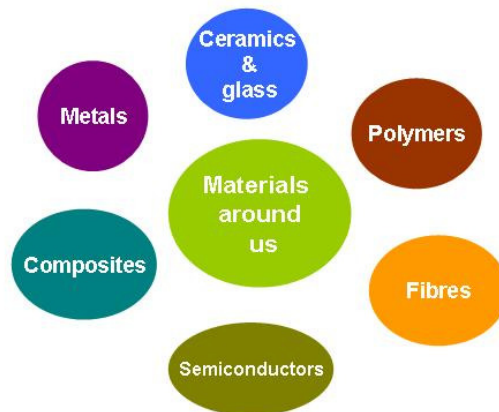
# 2. Necessities and ambitions of the Modern World

# Necessities and ambitions of the Modern World



## Materials around us

- Materials around us are mostly artificial:
  - fabrics, glass, metals, plastic, paper, ceramic, etc.
- Some of these materials have been known for a long time.
- Others, like plastic or semiconductors, have been recently created
  - scientific and technological development.





# Metals



Stainless steel



Copper



Aluminium



Aluminium

# Ceramics & glass



Porcelain



Clay



Concrete



Glass

# Polymers



Polycarbonate  
CD



Rubber  
boots



PET  
bottles



Synthetic  
rubber

# Fibres



Cotton



Wool



Nylon  
sport  
jacket



Polyester  
dress

# Semiconductors



Microchip



Solar cell  
made with  
silicon

# Composites



Carbon fibre  
composite



Carbon fibre  
composite



Cermetal  
panel  
potentiometer

# Necessities

➤ Materials have helped to meet many necessities throughout history.



Stone



Bronze



Iron



Skyscraper + steel structures

- **Stone** was replaced by **bronze** because bronze was easier to work with.
- **Iron** replaced bronze because it was cheaper.
- Skyscrapers were possible thanks to **steel**.
- The solution to dental caries was possible thanks to the use of **composite materials**.
- Tennis rackets kept breaking until carbon fibre was used.
- Nylon stockings did not appear until plastics were widely used.

# Ambitions of the Modern World

What are today's challenges?



Electric car



Plastic accumulation



Aircraft industry



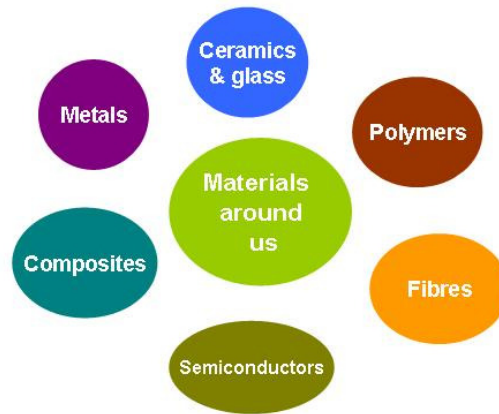
Brain implants

- Longer-running electric car batteries: **Silicon-nanotube** electrodes enable to store 10 times more charge than the conventional graphite electrodes used in lithium-ion batteries
- Plastic accumulation. A **plastic-eating bacteria** has been discovered. It is able to degrade 15% of plastics in 2 months.
- Aircraft industry. New airplanes are made out of **carbon fibre composites**. They are lighter than aluminium and consume less fuel on air.
- Medicine. New brain implants made of **carbon-nanotubes** can record signals from neurons more clearly than the conventional metal electrodes. Applications: neurological disorders (Parkinson and paralysis).



# What should we know?

- ✓ Materials around us: a first quick classification.
- ✓ Necessities
  - ✦ Materials have helped to meet many necessities throughout history.
- ✓ Ambitions of the Modern World:
  - ✦ Design of new materials in the lab → new necessities → complex society, dependent on new technology.
  - ✦ Today's challenges. Applications of new materials in different fields (Medicine, Construction, etc.).

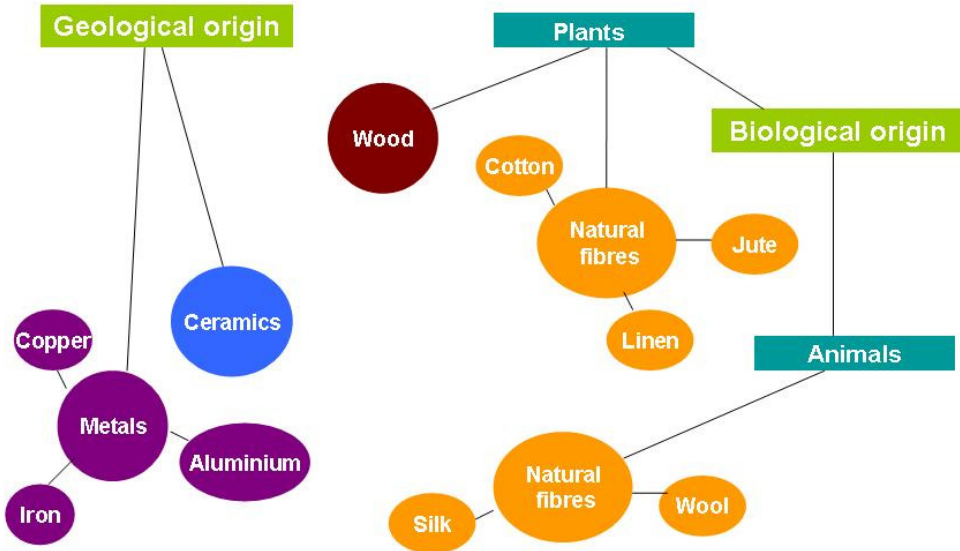


# 4. Classification of Materials

# Classification of Materials

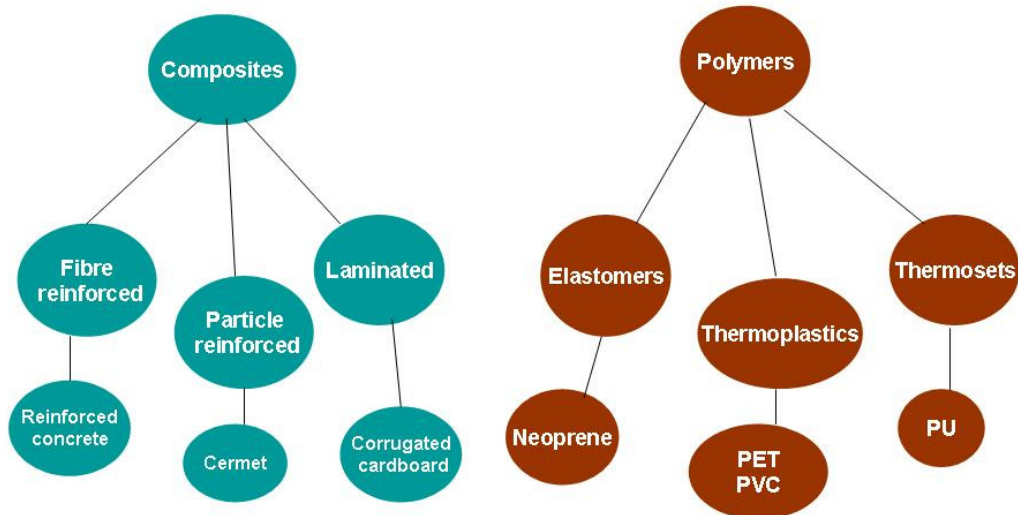


# Traditional materials





# Synthetic materials



# Metals

- Main properties
  - high electrical conductivity
  - thermal conductivity
  - density
  - ability to be deformed under stress without fracture (**ductility**)
  - magnetism (iron, cobalt, nickel)

- Main uses
  - packaging
  - buildings
  - machinery and tools
  - vehicles
  - appliances

- Metals are shiny or lustrous.
- Solid at room temperature, except **mercury** (liquid).
- **Iron** is the most important metal of industrialized countries. Other metallic materials are **copper** and **aluminium**.
- Extracted by **mining** (ores) and transformed into metals



City Hall, London (steel structure)

# Metals

- Metals are mixed to form **alloys**.
  - Modify the properties of pure metals to produce desirable characteristics.
  - Aim: less brittle, harder, resistant to corrosion, or with better color or luster.
  - Alloys of iron (iron + carbon = **steel**; iron + carbon + chromium = **stainless steel**, etc.) are the most common.
  - Copper + tin = **bronze**
  - Copper + zinc = **brass**



Iron

+



Coke

+



Chromium

=



Stainless steel

# Ceramics & glass

- Main properties
  - brittleness
  - hardness
  - good as electric and thermal insulator

- Main uses
  - daily containers
  - industrial applications

➤ Made from several non-metallic materials (geological origin), ground to a fine powder, mixed together and fired at high temperatures.

➤ **Clays**, bricks, cement and glass are the most important ones.



Bricks



Clay



**Concrete**: cement powder  
+ water + aggregates



Glass

# Polymers

➤ A polymer is a large molecule composed of repeating small molecules (monomer).

➤ Main types

- **Synthetic polymers** ..... or **plastics** are mainly made out of crude oil.
  - ✓ Synthetic rubber, bakelite, neoprene, PVC, polystyrene, silicone, etc.
    - Polyethylene. Flexible: plastic bags.
    - Polycarbonates. Rigid: CDs and DVDs.
  - ✓ Polluting. Need recycling.
- **Natural polymers**: amber, natural rubber, cellulose (base of wood), etc.
  - ✓ They have been used for centuries.

➤ Main uses

- Industrial
- Domestic
- Sanitary
- Construction
- Clothing
- Electronics
- Etc.



Polycarbonate CD



Plastic bag (PE)



Synthetic rubber

# Synthetic Polymers

- **Thermoplastics**: heated and shaped many times. Ex.: PET (polyethylene terephthalate), PVC (Polyvinyl chloride), PP (Polypropylene), PC (Polycarbonate), etc.
- **Thermosets**: heated and shaped only once. Difficult to recycle. Ex.: PU (polyurethane, used in foam mattresses, tires, adhesives), bakelite (electrical insulators and plasticware), etc.
- **Elastomers**: a lot of elasticity. Ex.: Polybutadiene (pneumatic tire), polychloroprene (neoprene to make waterproof boots, neoprene drysuit...)



PET bottles



PU sponge



Neoprene case

# Fibres

- Continuous filaments.
- Mainly used to make fabrics, also to support other materials, fibreglass or carbon fibres.

## Natural fibres

- produced by plants, animals, geological processes.
- biodegradable
- **silk, cotton, spider silk, wool**, etc.

## Man-made fibres

- extracted from natural products and modified through chemical processes.
- not biodegradable
- **paper** < cellulose (type of fibre found in wood). **Rayon** < cellulose. Rayon has replaced silk.
- **Synthetic fibres:**
  - ✓ based on synthetic polymers.
  - ✓ Four main types: **nylon, polyester, acrylic** and **polyamide**.



Paper



Cotton



Polyester jacket



Fibreglass car



Acrylic nails



Nylon sport jacket

# Semiconductors

- Main properties
  - electrical conductor or insulator depending on certain factors (pressure, temperature)

- Main uses
  - radio, computers, telephones and many other electronic devices.



Microchip

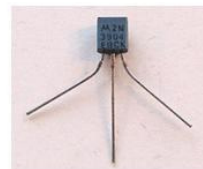


Solar cell made with silicon

- **Silicon** . . . Most commercial semiconductors.
  - Chemical element, rarely found as a pure element in nature.
- **Transistor**. Device made of semiconductor materials.
  - Manufactured with semiconductor materials in **1947**. Has become key in modern electronics.
  - Considered one of the greatest inventions of the 20th century.
    - ✓ Importance: It can be **mass produced** using a highly automated process that is **not expensive**.



Silicon



Transistor



# Composites

- Composed by the combination of simple materials in order to obtain a new material with improved properties.
  - **Fibre reinforced:** ~~.....fibres.....~~ as the basis to give more resistance to new material. E.g. Reinforced concrete, polymers reinforced with carbon fibre (in aerospace, automotive fields, etc.), fibreglass
  - **Particle reinforced:** ~~.particles..~~ as the basis of material to give more resistance to new material. E.g. Cermet (ceramic and metal).
  - **Laminated:** Materials are created by sticking sheets of the same material. E.g. Corrugated cardboard.



Tail of helicopter, CFRP



Cermet panel potentiometer



Corrugated cardboard

## What should we know? (I)

### Metals

- ✓ **Origin:** extracted by mining (ores) and transformed into metals.
- ✓ **Appearance:** shiny
- ✓ **State:** solid (except **mercury**, which is liquid)
- ✓ **Properties:** high electrical/thermal conductivity, ductility, high density, magnetism (**iron, cobalt, nickel**)
- ✓ Metals are mixed to form alloys (**steel, brass**, etc.)
- ✓ **Applications:** packaging, buildings, machinery, tools, vehicles, appliances...
- ✓ More **examples:** **copper, aluminium**, etc.



### Ceramics

- ✓ **Origin:** several inorganic non-metallic substances, ground to a fine powder, mixed together and fired at high temperatures
- ✓ **Properties:** brittleness, good electrical/thermal insulator, hard
- ✓ **Applications:** daily containers and also industrial applications
- ✓ **Examples:** **clay, porcelain, concrete**, etc.



## What should we know? (II)

### Polymers

- ✓ **Natural polymers:** produced by living organisms (**amber, natural rubber, cellulose**, etc.)
- ✓ **Synthetic polymers**
  - ✦ **Origin:** extracted from crude oil.
  - ✦ **Properties:** hardness, impact-resistance, insulating capacity, etc.
  - ✦ **Applications:** industrial, domestic (plastic bottles), sanitary, construction, etc.
  - ✦ **Types of synthetic polymers:** thermoplastics (**PET, PVC, PP, PC**, etc.), thermosets and elastomers



### Fibres

- ✓ **Natural fibres:** produced by plants, animals geological processes (**silk, cotton, wool**, etc.)
- ✓ **Man-made fibres:** extracted from natural products and modified (**paper, rayon**, etc.)
  - ✦ **Synthetic fibres:** based on synthetic polymers: **nylon, polyester, acrylic** and **polyamide**.



## What should we know? (III)

### Semiconductors

- ✓ **Origin:** extracted from **silicon** mainly and transformed.
- ✓ **Properties:** electrical conductivity or insulator
- ✓ **Applications:** radio, computers, telephones, other electronic devices



### Composites

- ✓ **Origin:** composed by the combination of simple materials
- ✓ **Properties:** improved properties based on simple materials
- ✓ **Applications:** aerospace, automotive fields, medicine, etc.
- ✓ **Types:**
  - ✦ Fibre reinforced: **reinforced concrete, polymers+carbon fibre**
  - ✦ Particle reinforced: **Cermet** (ceramics + metals)
  - ✦ Laminated: **corrugated cardboard**



# 5. Earth's limited resources





Image 1

Earth's  
limited  
capacity

There are many conflicts  
in the world to obtain  
different materials

These are some of the most appreciated limited resources



Coltan Image 2



Gold Image 3



Diamonds Image 4



Oil Image 5



Coal Image 6

It is called the Resource Curse

### Obtaining materials includes

- ✓ Localization of materials
- ✓ Extraction of materials
- ✓ Control to the access of materials
- ✓ Transformation and transportation of materials

# Localization of materials

Resources are mostly exploited in areas away from Europe.

The exploitation of certain resources depends on their low cost and easy access.



Image 7

# Extraction of materials

Many times, the exploitation of materials obliges population to move out from their houses.

During the extraction process, there are many mortal accidents because workers are not well protected.



Image 8

## Control to the access of materials

Many countries are interested in obtaining certain resources. For this reason, there are many wars in order to control its price and exploitation.



Image 9

## Transformation and transportation of materials

They both contribute to the contamination of the planet and most of the times, they are not taken into account when we buy certain products.



Image 10

# 6. Environmental Impacts



# Waste: what to do about it



## Environmental Impacts

Which are the most polluting industries?

- ① chemical industry
- ② oil and coal products industry
- ③ metal industry
- ④ paper industry

# Paper production

## Environmental impacts

- Deforestation
- Great amount of landfill waste
- High energy consumption
- Use of high amounts of water
- Water pollution

## Alternative

### Use of recycled paper

- No deforestation
- Low amount of landfill waste
- Low energy consumption
- Less wastewater

# Waste Management

## ➤ Why waste management?

- Reduce, reuse and recycle- It's not enough!!

## ➤ How to manage waste?

- **Landfill**
- **Composting**
- **Incineration**
- **Recycling**



Bales of paper to recycle



Landfill



Composting facility



# Waste Management

	<u>DISADVANTAGES</u>	<u>ADVANTAGES</u>
Landfill	<ul style="list-style-type: none"><li>• Gas emissions</li><li>• Soil contamination</li><li>• Environmental noise</li></ul>	<ul style="list-style-type: none"><li>• Located in a small area</li></ul>
Composting	<ul style="list-style-type: none"><li>• Time consuming. It is limited to certain materials.</li></ul>	<ul style="list-style-type: none"><li>• No gas emissions</li></ul>
Incineration	<ul style="list-style-type: none"><li>• Methane gas emissions that contribute to the greenhouse effect.</li></ul>	<ul style="list-style-type: none"><li>• Good for the disposal of clinical waste.</li><li>• Reduced volume</li></ul>
Recycling	<ul style="list-style-type: none"><li>• Complex products are difficult to recycle.</li></ul>	<ul style="list-style-type: none"><li>• No use of natural resources</li></ul>

## What should we know?

- ✓ Most polluting industries
- ✓ An example: Paper manufacturing
  - ✦ Environmental impacts
  - ✦ Alternatives
- ✓ Waste Management Types: advantages and disadvantages
  - ✦ Landfill
  - ✦ Composting
  - ✦ Incineration
  - ✦ Recycling



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Cadman, Steve. "City Hall (GLA Building), London". *flickr.com*, <http://www.flickr.com/photos/stevecadman/188225528/> (last accessed September 6,

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**Image 8, Iron. Teacher's book, page 119:**

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**Image 9, Coke. Teacher's book, page 119:**

Unknown author. *wikimedia.org*,  
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**Image 10, Chromium. Teacher's book, page 119:**

Jurii. "Piece of chromium metal". *wikimedia.org*,  
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**Image 11, Stainless steel. Teacher's book, page 119:**

Unknown author. "Pressure Cooker". *wikimedia.org*,  
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**Image 12, Bricks. Teacher's book, page 119:**

The greenj. "A brick wall". *wikimedia.org*,  
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**Image 13, Clay. Teacher's book, page 119:**

Howzit, Sam. "Three Clay Pots". *flickr.com*,  
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**Image 14, Concrete. Teacher's book, page 119:**

Thai, Sherri. "Gray concrete cracks". *flickr.com*,  
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**Image 16, Polycarbonate CD. Teacher's book, page 120:**

Vila, Paco. "CD-ROM". *flickr.com*,  
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**Image 17, Plastic bag (PE). Teacher's book, page 120:**

Kriplozoic. "Polyethylene". *wikimedia.org*,  
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**Image 18, Synthetic Rubber. Teacher's book, page 120:**

First Stop - Bridgestone's UK tyre retail network. "Bridgestone Tyre". *flickr.com*,  
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**Image 19, PET Bottles. Teacher's book, page 120:**

Crosby, Dave. "Plastic Bottles". *flickr.com*,  
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**Image 20, PU sponges. Teacher's book, page 120:**

Varlan, Horia. "Plain Blue and pink polyurethane kitchen sponges". *flickr.com*,  
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**Image 21, Neoprene case. Teacher's book, page 120:**

Rapoport, Javier. "Compucasa". *flickr.com*,  
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**Image 22, Paper. Teacher's book, page 121:**

Trujillo, Juan Camilo. "Paper rolls". *flickr.com*,  
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**Image 23, Cotton. Teacher's book, page 121:**

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**Image 24, Polyester jacket. Teacher's book, page 121:**

Lululemon Athletica. "Two way zipper". *flickr.com*, <http://www.flickr.com/photos/lululemonathletica/3989226802/> (last accessed September 5, 2011). This image is licensed under the Creative Commons Attribution ShareAlike 2.0 Generic license.

**Image 25, Fibreglass car. Teacher's book, page 121:**

Lloyd, John. "Brazilian copy of the classic jaguar". *flickr.com*, <http://www.flickr.com/photos/hugo90/3445887226/> (last accessed September 11, 2011). This image is licensed under the Creative Commons Attribution ShareAlike 2.0 Generic license.

**Image 26, Acrylic nails. Teacher's book, page 121:**

Bentley, Lisa. "Nail art. Glitter Diamond". *flickr.com*, <http://www.flickr.com/photos/nailsbylisa/4254695076/> (last accessed September 11, 2011). This image is licensed under the Creative Commons Attribution ShareAlike 2.0 Generic license.

**Image 27, Nylon sport jacket. Teacher's book, page 121:**

Warrantedarrest. "Easton's Men Baseball Sport Jacket". *flickr.com*, <http://www.flickr.com/photos/warrantedarrest/75860910/> (last accessed August 31, 2011). This image is licensed under the Creative Commons Attribution ShareAlike 2.0 Generic license.

**Image 28, Microchip. Teacher's book, page 121:**

Collins, Tim. "Microchip". *flickr.com*, <http://www.flickr.com/photos/tico24/16063683/> (last accessed September 5, 2011). This image is licensed under the Creative Commons Attribution ShareAlike 2.0 Generic license.

**Image 29, Solar cell made with silicon. Teacher's book, page 121:**

E., Marlon. "Mega Solar Cell Phone Charger". *flickr.com*, <http://www.flickr.com/photos/sjsharktank/2789195084/> (last accessed August 31, 2011). This image is licensed under the Creative Commons Attribution ShareAlike 2.0 Generic license.

**Image 30, Silicon. Teacher's book, page 121:**

Roonguthai, Warut. "Polycrystalline Silicon rod". *wikipedia.org*, <http://en.wikipedia.org/wiki/Silicon> (last accessed September 11, 2011). This image is licensed under the Creative Commons Attribution ShareAlike 3.0 Generic license.

**Image 31, Transistor. Teacher's book, page 121:**

Windell, Oskay. "2N3904 Transistor". *flickr.com*, <http://www.flickr.com/photos/oskay/275142789/> (last accessed September 11, 2011). This image is licensed under the Creative Commons Attribution ShareAlike 2.0 Generic license.

**Image 32, Tail of helicopter, CFRP. Teacher's book, page 122:**

Unknown author. "Tail of an RC helicopter, made of CFRP". *wikipedia.org*, [http://en.wikipedia.org/wiki/Carbon-fiber-reinforced\\_polymer](http://en.wikipedia.org/wiki/Carbon-fiber-reinforced_polymer) (last accessed September 11, 2011). This image is licensed under the Creative Commons Attribution ShareAlike 3.0 Generic license.

**Image 33, Cermet Panel Potentiometer. Teacher's book, page 122:**

Vishay Intertechnology. "New P13SM Submersible Cermet Panel Potentiometer". *flickr.com*, <http://www.flickr.com/photos/vishay/5913585018/> (last accessed September 11, 2011). This image is licensed under the Creative Commons Attribution ShareAlike 2.0 Generic license.

**Image 34, Corrugated Cardboard. Teacher's book, page 122:**

Wheeler, Richard. "Corrugated Cardboard". *wikipedia.org*, [http://en.wikipedia.org/wiki/File:Corrugated\\_Cardboard.JPG](http://en.wikipedia.org/wiki/File:Corrugated_Cardboard.JPG) (last accessed February 14, 2011). This image is licensed under the Creative Commons Attribution ShareAlike 3.0 license.

**Image 35, Shovel. Teacher's book, page 122:**

Goun, Roger. H. "Shovel". *flickr.com*, <http://www.flickr.com/photos/sskennel/4928809639/> (last accessed September 5, 2011). This image is licensed under the Creative Commons Attribution ShareAlike 2.0 Generic license.

**Image 36, Pottery. Teacher's book, page 122:**

Howzit, Sam. "Three Clay Pots". *flickr.com*, <http://www.flickr.com/photos/aloha75/6086902866/> (last accessed September 5, 2011). This image is licensed under the Creative Commons Attribution ShareAlike 2.0 Generic license.

**Image 37, Plastic bottles. Teacher's book, page 123:**

Crosby, Dave. "Plastic Bottles". *flickr.com*, <http://www.flickr.com/photos/wikidave/3053082343/> (last accessed September 5, 2011). This image is licensed under the Creative Commons Attribution ShareAlike 2.0 Generic license.

**Image 38, Polyester jacket. Teacher's book, page 123:**

Lululemon Athletica. "Two way zipper". *flickr.com*, <http://www.flickr.com/photos/lululemonathletica/3989226802/> (last accessed



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**Image 39, Microchip. Teacher's book, page 123:**

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**Image 40, Formula One car. Teacher's book, page 123**

Ardle, Mark. "The Iceman commeth". *flickr.com*, <http://www.flickr.com/photos/12169388@N05/2565084307> (last accessed September 5, 2011). This image is licensed under the Creative Commons Attribution ShareAlike 2.0 Generic license.

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**Image 1, Planet Earth. Teacher's book, page 125:**

Goddard Space Flight Center Nacional. "Exquisite, extremely hi-def Earth". *flickr.com*, <http://www.flickr.com/photos/wwwworks/2222523978/> (last accessed September 4, 2011). Photograph courtesy of Goddard Space Flight Center Nacional.

**Image 2, Coltan. Teacher's book, page 126:**

Subberculture. "Congolese people". *flickr.com*, <http://www.flickr.com/photos/photojoy/23087589/> (last accessed September 4, 2011). Photograph courtesy of Subberculture.

**Image 3, Gold. Teacher's book, page 126:**

Oquendo, Jose. "Bosque del Pueblo / Adjuntas, Puerto Rico" *flickr.com*, <http://www.flickr.com/photos/oquendo/1303665073/> (last accessed September 4, 2011). Photograph courtesy of Jose Oquendo.

**Image 4, Diamonds. Teacher's book, page 126:**

Cliff1066. "Oppenheimer Diamond". *flickr.com*, <http://www.flickr.com/photos/nostrimago/2926135936/> (last accessed September 4, 2011). Photograph courtesy of Cliff1066.

**Image 5, Oil. Teacher's book, page 126:**

Faherty, Mike. "Worgret, oil well". *geograph.org* . <http://www.geograph.org.uk/photo/2059178> (last accessed September 4, 2011). Photograph courtesy of Mike Faherty.

**Image 6, Coal. Teacher's book, page 126:**

Woodard, Jennifer. "The effects of coal mining". *flickr.com*, <http://www.flickr.com/photos/jenniferwoodardmaderazo/2527670737/> (last accessed September 6, 2011). Photograph courtesy of Jennifer Woodard.

**Image 7, Loading cargo. Teacher's book, page 127:**

Labrador, Emilio. "Loading cargo at the Mopti River Front". *flickr.com*, <http://www.flickr.com/photos/3059349393/3367266547/> (last accessed September 6, 2011). Photograph courtesy of Emilio Labrador.

**Image 8, Miners. Teacher's book, page 127:**

Cdelaf. "Mina de san José". *arteyfotografia.com*. <http://www.arteyfotografia.com.ar/10982/fotos/333749/> (last accessed September 6, 2011). Photograph courtesy of Cdelaf.

**Image 9, Demonstration. Teacher's book, page 128:**

Fibonacci Blue. "Minneapolis demonstration against the escalation of the U.S. war in Afghanistan on December 5, 2009". *flickr.com*, <http://www.flickr.com/photos/fibonacciblue/4161395654/> (last accessed September 6, 2011). Photograph courtesy of Fibonacci Blue.

**Image 10, Contamination. Teacher's book, page 128:**

Davezza. "Fukushima damage left, unit 3, right, unit 4". *flickr.com*, <http://www.flickr.com/photos/vizpix/5533208192/> (last accessed September 6, 2011). Photograph courtesy of Davezza.

## **Environmental Impacts.ppt**

**Image 1, 2, 5 Landfill. Teacher's book, page 130, 131, 132:**

Arcy, Norman. "Calgary NW Landfill - 4". *flickr.com*, <http://www.flickr.com/photos/dnorman/251647296/> (last accessed September 11, 2011). This image is licensed under the Creative Commons Attribution ShareAlike 2.0 Generic license.

**Image 3, Composting Facility. Teacher's book, page 131:**

Red58bill. "CVRD4Chamber Air". *wikipedia.org*, <http://en.wikipedia.org/wiki/Biofilter> (last accessed September 11, 2011). This image is licensed under the Creative Commons Attribution 3.0 Generic license.

**Image 4, Bales of paper to recycle. Teacher's book, page 131:**

Chadwick, Nigel. "Bales of paper to recycle". *geograph.org*, <http://www.geograph.org.uk/photo/1218067> (last accessed September 11, 2011). This image is licensed under the Creative Commons Attribution ShareAlike 2.0 Generic license.