

5. PROPERTIES OF MATERIALS

INTRODUCTION

1. Give examples of different materials. What objects are made of them?
2. What are the properties of the following things? Write the adjectives under the pictures.



3. Compare these pairs:

Wooden chair x plastic chair Plastic cup x porcelain cup Cotton jacket x soft-shell jacket

READING

1. What stainless steel products do you use?
2. Why is it that stainless steel is *stainless*?





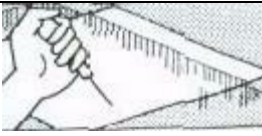
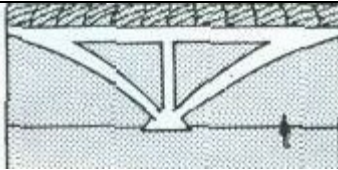



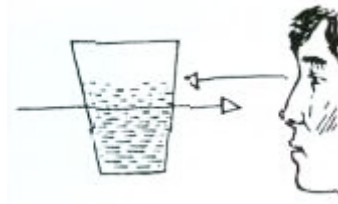
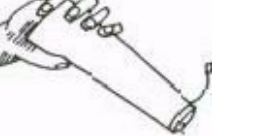

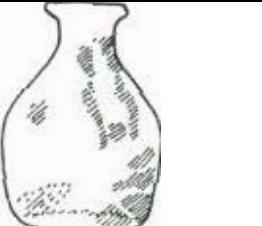
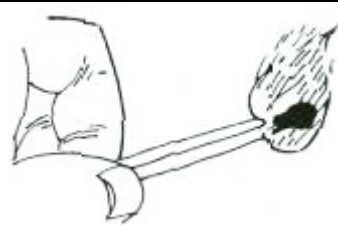
Why Is Stainless Steel Stainless?³

In 1913, English metallurgist Harry Brearly accidentally discovered that adding chromium to low carbon steel gives it stain resistance. It is the addition of a minimum of 12% chromium to the steel that makes it resist rust, or stain 'less' than other types of steel. The chromium in the steel combines with oxygen in the atmosphere to form a thin, invisible layer of chrome-containing oxide, called the passive film. The sizes of chromium atoms and their oxides are similar, so they pack neatly together on the surface of the metal, forming a stable layer only a few atoms thick. If the metal is cut or scratched and the passive film is disrupted, more oxide will quickly form and recover the exposed surface, protecting it from oxidative corrosion. The passive film requires oxygen to self-repair, so stainless steels have poor corrosion resistance in low-oxygen and poor circulation environments.

3. Having read the text, explain the answer in your own words.
4. What properties are mentioned? Highlight the words.

VOCABULARY

1. Adjectives describing properties: Form nouns from the adjectives:¹

	A brittle material or thing breaks easily; e.g. (for example, for instance, such as, like) glass, egg, . . noun:		A soft material is easy to scratch e.g. chalk noun:
	A tough material / thing does not <i>break</i> easily; e.g. steel, . . . noun:		A flexible material <i>bends</i> easily; e.g. rubber, .. noun:
	A hard material is difficult to <i>scratch</i> . e.g. glass, . . . noun:		A rigid material does not <i>bend</i> easily; e.g. concrete, ... noun:
	Some materials have a smooth surface; they produce little <i>friction</i> when they are rubbed; e.g. ice, ... noun:		You can see through transparent materials; e.g. water, . . . noun:
	Some materials have a rough surface and produce a lot of friction; e.g. sandpaper, . . . noun:		You cannot see through translucent materials but the light passes through them; e.g. dirty water, . . . noun:
	Soluble materials dissolve easily; e.g. salt, ... noun:		You cannot see through opaque materials and the light cannot pass through them; e.g. metal, . . . noun:
	Materials which are insoluble do not <i>dissolve</i> ; e.g. glass, ... noun:		Combustible materials <i>burn</i> easily e.g. wood, ... noun:

2. Complete the sentences below with appropriate words from exercise 3.

- The carbonates and phosphates of all metals are _____ in water but _____ in dilute acids.
- Some colloids are _____ because of the Tyndal effect, which is the scattering of light by particles in the colloids.
- System Soft Shot is a booster for dry and _____ hair.
- _____ materials are liable to catch fire very easily and burn.
- _____ is an important property of steel.
- This PVC tubing offers excellent wear resistance and rubber-like _____.
- A _____ substance or object is stiff & does not bend, stretch or twist easily.

3. Listening²:

Listen to some properties of materials. Make notes in the form of a table.

From *Nucleus of General Science*. Unit 1, Listening Practice 2.

material
salt

property
soluble

verbal structure
dissolves easily

Example:

4. Some other properties of materials. Form adjectives from these nouns.

Czech translation	Noun	Adjective
a) pružnost	elasticity	elastic
b) křehkost	fragility	
c) tažnost	malleability	
d) kujnost	ductility	
e) vodivost	conductivity	
f) žáruvzdornost	heat-resistance	
g) zápalnost	flammability	
h) jedovatost, toxicita	toxicity	
i) reaktivita	reactivity	
j) netečnost	inertness	
k) lehkost	lightness	
l) těžkost	heaviness	
m) savost, absorpčnost	absorbency	
n) viskozita, lepkavost	viscosity	
o) hustota	density	
p) trvanlivost, odolnost	durability	
q) odolnost proti korozi	corrosion resistance	
r) síla	strength	
s)		
t)		
u)		
v)		
w)		

5. Read the article and complete the empty lines in exercise 4 with more properties.

According to the World Steel Association, there are over 3,500 different grades of steel, with unique physical, chemical and environmental properties. They can be broadly categorized into four groups.

1) Carbon Steels:

Carbon steels contain trace amounts of alloying elements and account for 90% of total steel production. The most widely used grades of steel contain only 0.1-0.25% carbon.

2) Alloy Steels:

Alloy steels contain alloying elements (e.g. manganese, silicon, nickel, titanium, copper, chromium and aluminium) in varying proportions in order to manipulate the steel's properties, such as its hardenability, corrosion resistance, strength, formability, weldability or ductility. Applications for alloys steel include pipelines, auto parts, transformers, and electric motors.

3) Stainless Steels:

Stainless steels generally contain between 10-20% chromium and are valued for high corrosion resistance. These steels can be divided into three groups based on their crystalline structure:

Austenitic: Austenitic steels are non-magnetic and non heat-treatable, and generally contain 18% chromium, 8% nickel and less than 0.8% carbon. Austenitic steels are often used in food processing equipment, kitchen utensils and piping.

Ferritic: Ferritic steels contain trace amounts of nickel, 12-17% chromium, less than 0.1% carbon, along with molybdenum, aluminium or titanium. These magnetic steels cannot be hardened with heat treatment, but can be strengthened by cold works.

Martensitic: Martensitic steels contain 11-17% chromium, less than 0.4% nickel and up to 1.2% carbon. These magnetic and heat-treatable steels are used in knives, cutting tools, as well as dental and surgical equipment.

4) Tool Steels:

Tool steels contain tungsten, molybdenum, cobalt and vanadium in varying quantities to increase heat resistance and durability, making them ideal for cutting and drilling equipment.

6. Find the English names of chemical elements in the text:

C O Cr Mn Si Ni Ti Cu Al Mo W Co V

LISTENING

Composite materials

<https://www.youtube.com/watch?v=dbywZ4PJ3QA>

Pre-listening

- What do you think composite materials are?
- Why are they sometimes characterized by $1+1=3$?
- Do you know these words?

reinforcement fibre resin matrix

Watch the video and answer the questions.

1. What are the properties of the ancient bricks from mud and straw?
2. What is a composite material?
3. Give two examples of things which use resin.
4. What is the material for the big bench composed of?
5. What shape is the bench board?

SPEAKING

Work in pairs. One student describes something, using as many adjectives as he or she can. The second one should guess what it is (can ask yes/no questions). You can describe the colour, size, shape, origin, appearance, use etc. Then swap roles.

Useful phrases:

<i>The object</i>	<i>is</i>	<i>slightly / relatively / quite / extremely</i>	<i>small / soluble in water / hot / silvery</i>
<i>The</i>	<i>colour / shape / durability</i>	<i>of the object</i>	<i>is</i>
			<i>blue / circular / high</i>

HOMEWORK⁴

Science and Technology: Fill in the gap with the correct word.

- are being carried out to find a cure for cancer.
Experiences Experiments Trials Research
- Microscopesvery small objects many times to make them visible.
magnify enlarge expand increase
- Radio signals are now oftenby satellite.
received delivered transmitting dispersed
- Computers are able to vast amounts of data very quickly.
digest convert adapt process
- Solar power stations are able to the energy of the sun.
maximise drive convert harness
- Other energy sources include wind and wave power.
recyclable returnable reusable renewable
- In some types of power station steam is used toturbines.
force turn drive rotate
- Mercury isat room temperature
fluid liquid solid gas
- Hydrogen and oxygen are the two that make up water.
compounds atoms molecules elements
- Allis composed of atoms.
stuff material substance matter
- The of lead is greater than that of aluminium.
viscosity absorbency density volume
- When water is heated itmore quickly.
evaporates condenses melts solidifies
- The of iron and oxygen produces rust.
reaction separation decomposition composition
- Chemists study the composition of natural
substances machines mixtures alloys
- The of water is 100°C.
melting point boiling point point of condensation freezing point

Adapted from: ¹Jirků, Dana et al. *English for Future Engineers*. Praha: ČVUT, 2007.

² Bates, Martin and Dudley-Evans, Tony: *Nucleus of General Science*. Longman 1990.

³ World Steel Association website: <http://worldsteel.org>

⁴ J.Harbord: *Topic-based Vocabulary*.