

▶ **TASK 6** ▶ **Vocabulary practice. Collocations.**

Form collocations, using the words provided in the table. Use each word once only.

products	extractive	cracking	civilizations	metallic
properties	a craft	temperatures	enriched	methods
native	the ore	fatigue	meteoric	metal

1. .... elements
2. elevated .....
3. .... metals
4. .... iron
5. .... metallurgy
6. a superior .....
7. ancient .....
8. to master .....
9. mining .....
10. to reduce .....
11. waste .....
12. .... solution
13. material .....
14. .... resistance
15. prone to .....

▶ **TASK 7** ▶ **Speaking practice. Pair work.**

Memorize these collocations. Ask a speaking partner to write as many collocations as they can from memory. They have two minutes. Then switch roles. Finally, compare the results and see who has written more collocations.

# UNIT 2

## Iron



### WARM-UP



How much do you know about iron? Take the quiz and circle the correct answer.

- Iron derives its abbreviated chemical symbol of 'Fe' from:
  - Greek
  - Latin
  - English
- The atomic number of iron is:
  - 26
  - 36
  - 46
- The mass number of iron is:
  - 36
  - 46
  - 56
- The common ore from which iron is extracted is:
  - galena
  - hematite
  - chalcocite
- What percentage of Earth's crust is iron?
  - 0.5 percent
  - 25 percent
  - 5 percent
- Which facility is used to obtain pig iron from iron ore?
  - the electric arc furnace
  - the Bessemer converter
  - the blast furnace
- Which element do you have to eliminate from iron ore to obtain iron?
  - oxygen
  - hydrogen
  - nitrogen
- Which of the following **is not true** of iron?
  - It can be magnetized.
  - It is corrosion resistant.
  - It can be alloyed with different chemical elements.

Now read the text and check your answers.

Iron is a chemical element with symbol Fe (from Latin: ferrum), atomic number 26, and mass number 56. It is by mass the most common element on Earth, forming much of the Earth's outer and inner core. The Earth's crust is 5% iron. Pure iron is soft, very ductile, malleable, and lustrous silvery-grey in appearance. It is reactive to oxygen and water, so a layer of rust is formed on it. Rust (iron oxide) occupies more volume than

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7. Grubość ścian pieca dochodzi do 1 metra; sam piec obudowany jest płaszczem z blach stalowych.

.....  
 .....

8. Produktami ubocznymi wielkiego pieca są żużel i gazy wielkopieczowe. Żużel wielkopieczowy jest używany między innymi do wyrobu żużlobetonu. Gazy wielkopieczowe wykorzystywane są w celach energetycznych.

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

◀ **TASK 4** ▶ Translation practice.

Provide the English translation for the words / phrases in bold.

1. Blast furnace gas has a very low heating ..... (**wartość**) because it .....  
 (**składa się z**) about 60% ..... (**azot**) and 18–20% .....  
 (**dwutlenek węgla**), which are not ..... (**palny**).
2. The ..... (**skład chemiczny**) of a slag varies .....  
 (**znacznie**) depending on the composition of the ..... (**surowce**) in  
 the iron production process.
3. .... (**czyste**) iron, which is relatively soft, is unobtainable in the blast furnace  
 process due to various ..... (**zanieczyszczenia**).
4. The ..... (**mechaniczne**) properties of iron and its alloys can be evaluated  
 using a ..... (**różnorodność**) of tests, including the Brinell test, Rockwell  
 test and the Vickers ..... (**twardość**) test.

▶ **TASK 6A** ▶ **Speaking practice. Pair work.**

Student A: match the definitions with the words / phrases provided in the table. You have twice as many words / phrases as definitions. Student B goes to task 6B.

cementite	pig iron	castings	ductility	tensile strength	nodular cast iron
corrosion	damping capacity	cast iron	wear resistance	carbon	brittleness
malleable cast iron		heat treatment	graphite	compressive strength	

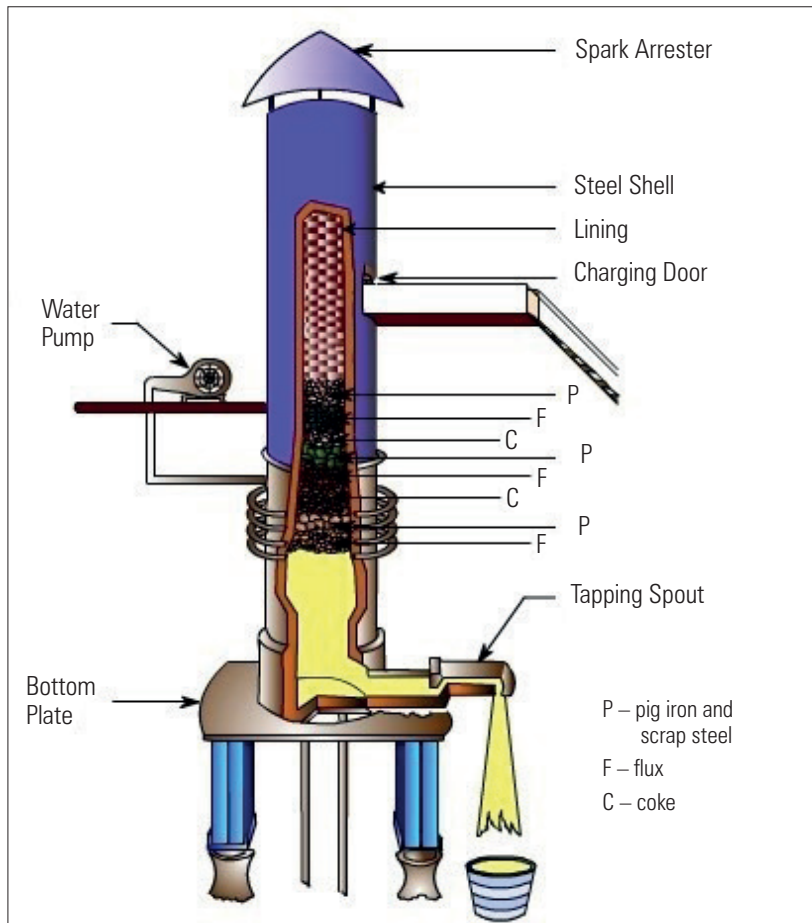
1. A hard structural constituent of the iron-carbon alloys, corresponding to the formula  $Fe_3C$ .  
.....
2. The ability of a material to withstand wear or abrasion.  
.....
3. Inoculated cast iron in which the graphite occurs in the form of spheroids.  
.....
4. A process in which a metallic object or a portion thereof is intentionally submitted to thermal cycles and if required to other physical and / or chemical action in order to achieve desired properties.  
.....
5. The gradual destruction of steel or alloys by a chemical or electrochemical attack caused by the environment.  
.....
6. Objects made by pouring a liquid alloy into a mould.  
.....
7. The greatest value of the compressive stress applied to a test piece during the compression test, referred to its initial cross-section area.  
.....
8. An allotropic variety of carbon, crystallizing in the hexagonal system, occurring in iron-carbon alloys as one of their structural constituents.  
.....

Student A: Read your definitions to student B who has to provide a correct word / phrase for each definition that he / she hears. Then switch roles. Use the table above.

**TASK 3 ➤ Translation practice.**

Study the diagram of a cupola furnace down below. Translate the following words / phrases from English into Polish.

1. spark arrester .....
2. steel shell .....
3. lining .....
4. charging door .....
5. water pump .....
6. tapping spout .....
7. bottom plate .....
8. flux .....
9. coke .....



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◀ **TASK 2** ◀ **Vocabulary practice. Word formation.**

Form a new word for each gap, using the prompts in bold.

1. In addition to carbon (more than 2%), cast irons must also contain .....  
**(appreciate)** silicon, usually 1–3%, and thus they are actually iron-carbon-silicon alloys.
2. .... **(nucleus)** agents, called inoculants, are used in the production of grey cast iron to control graphite size and type.
3. Trace amounts of bismuth and tellurium are used in the production of malleable cast iron, and the presence of a few ..... **(hundred)** of a percent magnesium causes the ..... **(form)** of the spheroidal graphite in nodular cast iron.
4. An unusual ..... **(combine)** of properties is obtained in nodular cast iron because the graphite occurs as spheroids rather than as individual flakes as in grey cast iron.
5. The flake graphite provides grey cast iron with unique properties such as excellent ..... **(machine)** at hardness levels that produce superior wear-resisting characteristics, the ability to resist galling and excellent ..... **(vibrate)** damping.
6. The properties of grey cast iron are influenced by the size, amount and ..... **(distribute)** of the graphite flakes, and by the ..... **(relate)** hardness of the matrix around the graphite.
7. When grey cast iron is broken, most of the fracture occurs along the graphite, thereby ..... **(account)** for the characteristic grey colour of the fracture surface.
8. White cast iron does not have the easy ..... **(cast)** of other irons because its ..... **(solidify)** temperature is generally higher, and it solidifies with carbon in its combined form as iron carbide.

➤ **TASK 6** ➤ **Error correction.**

Each sentence contains one or more factual errors. Find the errors and write correct sentences. The information you need can be found in the text *Heat Treatment Techniques*.

1. In the tempering process, martensite is hardened by high temperature for an appropriate time.

.....

2. Quenching usually follows tempering.

.....

3. When steel is tempered, it always turns purple.

.....

4. Metallic parts which are case hardened have a hard core and a soft surface.

.....

5. Water is one of the most efficient quenching media which is used to avoid tiny cracks and distortions in workpieces.

.....

.....

6. In the process of quenching, cooling can only be accomplished by means of water.

.....

.....

7. Uniformly dispersed particles within an alloy's grain structure facilitate dislocation motion and thereby weaken alloys.

.....

.....

8. Precipitation hardening process provides excellent corrosion resistance.

.....

.....

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◀ **TASK 3** ◀ **Sentence building. Pair work.**

Work with a partner and make correct sentences, using the words / phrases provided.

1. / allows for / to / metal / Age hardening / or no distortion / components / little /

.....  
.....

2. / and the number of dislocations / which / In annealing / decreases / atoms migrate / which leads to a change in / in the crystal lattice / ductility and hardness /

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

3. / a carbon rich atmosphere / into steel / During the carburizing process / at an elevated temperature / steel parts / diffusion to transfer the carbon atoms / are exposed to / allowing /

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

4. / which is suitable for / to the surface / Carburizing, / low carbon steel, / adding carbon / is a process of /

.....  
.....

5. / nitrogen diffuses into / the depth of / During the nitriding process / reaching / the surface of steel / up to 0.65 mm /

.....  
.....



**UNIT 7 ➤ Metal Working Processes**

**TASK 7 ➤ Sentence building. Pair work.**

Work with a partner and make correct sentences, using the words / phrases provided.

1. / a manufacturing process / compressive forces / Forging is / involving the shaping of metal / localized / using /

.....  
.....

2. / either with presses or with hammers / electricity / is done / powered by / Industrial forging / hydraulics or steam / compressed air /

.....  
.....

3. / are / For industrial purposes / in hot conditions / steel alloys / primarily forged /

.....  
.....

4. / where / and increased in length / Roll forging is / is reduced / a process / round or flat bar stock / in / thickness /

.....  
.....

5. / concave / may have / In / a round / a die / or convex surface / open-die forging /

.....  
.....

6. / onto the workpiece / In the drop-forging process / the shape of the die / and then dropped / according to / a hammer is raised / to deform it /

.....  
.....

**OPTIONAL TASK ➤ Writing practice.**

Do some research on other types of rolling such as shape, ring, thread, tube or roll piercing and present your findings in a written form. Write one or two paragraphs.

# English-Polish Glossary

## ➤ A

abrasion ( <i>n</i> )	ścieranie
abundance ( <i>n</i> )	duża ilość
account for ( <i>v</i> )	stanowić
acicular ( <i>adj</i> )	igiełkowaty
acid ( <i>n</i> )	kwas
acidic ( <i>adj</i> )	kwaśny
adhere to ( <i>v</i> )	przylegać do
age hardening ( <i>n</i> )	utwardzanie przez starzenie
agent ( <i>n</i> )	czynnik
agitate ( <i>v</i> )	mieszać
alkali ( <i>n</i> )	zasada ( <i>chem.</i> )
alloy ( <i>n</i> )	stop
~ cast iron ( <i>n</i> )	żeliwo stopowe
~ steel ( <i>n</i> )	stal stopowa
alloyant ( <i>n</i> )	pierwiastek stopowy
aluminium ( <i>n</i> ) [ˌæljəˈmɪniəm] BrE	aluminium / glin
aluminum ( <i>n</i> ) [əˈluːmɪnəm] AmE	aluminium / glin
ambient temperature ( <i>n</i> )	temperatura otoczenia
anneal ( <i>v</i> )	wyżarzać
annealing ( <i>n</i> )	wyżarzanie
anvil ( <i>n</i> )	kowadło
appliance ( <i>n</i> )	urządzenie
application ( <i>n</i> )	zastosowanie
aqueous ( <i>adj</i> )	wodny, wodnisty
austempering ( <i>n</i> )	hartowanie izotermiczne / wytrzymywanie izotermiczne
austenitizing ( <i>n</i> )	austenityzacja
axes ( <i>n, pl.</i> )	osie
axis (in geometry) ( <i>n, sing.</i> )	oś
axle (in a wheel) ( <i>n</i> )	oś

## ➤ B

back-diffusion ( <i>n</i> )	dyfuzja wsteczna
bainite ( <i>n</i> )	bainit
bar ( <i>n</i> )	pręt, sztaba
basic ( <i>adj</i> )	zasadowy
~ oxygen furnace ( <i>n</i> )	~ konwertor tlenowy
beam ( <i>n</i> )	belka

# Polish-English Glossary

## ➤ A

anoda protektorowa	sacrificial anode
arkusz blachy	sheet
atmosfera otoczenia	ambient atmosphere
austenityzacja	austenitizing, austenizing
azot	nitrogen
azotowanie	nitriding

## ➤ B

badać	to investigate
badanie	testing, test, research
~ mikroskopowe	microscopic examination
belka	beam
blacha	sheet (cienka), plate (gruba)
~ walcowana na gorąco	hot-rolled sheet
~ ~ na zimno	cold-rolled ~
brak plastyczności	lack of ductility

## ➤ C

cegła budowlana	building brick
~ szamotowa	fireclay ~
ceownik	channel
charakter przełomu	mode of fracture
charakterystyka materiału	characteristics of material
chłodzenie w powietrzu	cooling in air
chłodzony wodą	water-cooled
ciągadło	drawing die, die
ciągarnia	drawing plant
ciągliwy, kowalny	ductile
ciągnięcie	drawing
ciecz, ciekły	liquid
ciecz przechłodzona	overcooled liquid
cyjanowanie	cyaniding
cząsteczka	molecule
czynnik	agent
~ zanieczyszczający	contaminant, pollutant
czystość	purity
czysty	pure