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## **Практический курс научно- технического перевода**

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## Грамматический справочник

### *Структура простого повествовательного предложения*

Простое повествовательное распространенное предложение в английском языке имеет строгий порядок слов. Каждый член предложения занимает определенное место, условно обозначаемое римской цифрой:

*I – подлежащее*

*II – сказуемое*

*III – прямое дополнение*

*IIIo – косвенное беспредложное дополнение, которое обычно предшествует прямому дополнению*

*IV – предложное дополнение или обстоятельство;*

*O – обстоятельство, если оно стоит перед дополнением в начале предложения.*

I                    II                    III                    IV  
[Some metals] [exhibit] [different crystal structure] [at different temperatures]

Определение условной цифры не имеет, т.к. оно может входить в состав любой из вышеперечисленных групп. В зависимости от его положения по отношению к слову, которое оно определяет, мы условно называем определение «левым» или «правым».

В именной группе, состоящей из цепочки существительных, не разделенных ни предлогом, ни запятой, последнее слово, как правило, будет являться основным, а все остальные слова будут определениями к основному слову.

Перевод такой группы следует начинать с последнего существительного, а предшествующие слова могут переводиться на русский язык как левыми, так и правыми определениями.

**Например:**

The metal quality – *качество металла;*

The temperature limit determination – *определение температурного режима;*

Corrosion losses – *потери от коррозии.*

Предложение может начинаться только с групп подлежащего или обстоятельства. Наличие групп I, II обязательно! Групп III и IV может не быть.

В зависимости от места в предложении одно и то же слово может быть различным членом предложения.

1. The device measures the temperature inside the furnace. – *сказуемое (измеряет)*
2. They took measures to improve the work of the laboratory. – *прямое дополнение (меры)*
3. The measures taken were not enough. – *подлежащее (меры)*

### ***Признаки сказуемого в предложении***

Анализ предложения следует начинать с выделения группы сказуемого. Его признаки:

1. Все формы вспомогательных (*to be, to have, to do*) и модальных глаголов (*can, may, must, ought, shall, will, should, would*).

Это правило, из которого нет исключений!

2. Окончание глагола **-(e)s** в 3-ем лице ед. ч. Present Simple. Не путать с окончанием **-(e)s** множественного числа в существительных.

The result of his work leaves to be desired. – существительное (мн. ч.) (*результаты*)

His bad work results in our lagging behind. – Present Simple глагола (*приводит к ...*)

3. Окончание глаголов – *ed* (Past Simple), либо II-ая форма неправильных глаголов. Не путать с Participle II (причастие II)!

He played a great game. – Past Simple (*сыграл*)

The game played **wasn't honest**. – Participle II (*сыгранная*)

He read this book. – Past Simple (*прочитал*)

The book read **wasn't interesting**. – Participle II (*прочитанная*)

4. Подлежащее, выраженное личным местоимением.

5. Наречие, стоящее перед сказуемым или после него.

We still leave behind for future generations a beautiful world.

6. Прямое (*беспредложное*) дополнение, которое занимает III место и всегда стоит после группы сказуемого.

These boundaries play an important role in metal properties.

## **ИНФИНИТИВ**

### **Формы Инфинитива**

	Active	Passive	<b>Выражает действие</b>
Indefinite	to ask to write	to ask to write	1.Одновременное со сказуемым 2.Будущее 3.Безотносительное во времени
Continuous	to be asking to be writing		
Perfect	to have asked to have written	to have been asked to have been written	<b>Предшествующее сказуемому</b>
Perfect Continuous	to have been asking to have been writing		<b>Предшествовавшее сказуемому, длительное</b>

### **Функции Инфинитива**

	Active	Passive
<b>Подлежащее</b>	To solve the problem is very important <i>Решить (решение) проблему очень важно.</i>	
<b>Часть составного сказуемого</b>	His aim is to solve this problem Его цель состоит в том, чтобы решить эту проблему.	The problem is to be solved. <i>Проблема должна быть решена.</i>

	<p>He is to solve this problem. Он должен <b>решить</b> эту проблему.</p>	
<b>Прямое дополнение</b>	<p>He likes to solve difficult problems. Он любит <i>решать</i> трудные проблемы</p>	<p>He doesn't like to be objected to. Он не любит, <i>когда ему возражают</i></p>
<b>Обстоятельство цели</b>	<p>They must take a number of experiments to solve this problem. Они должны проделать ряд экспериментов (для того), чтобы <i>решить</i> эту проблему</p>	<p>The problem must not be too difficult to be solved right now. <i>Для того, чтобы решить</i> проблему прямо сейчас, она не должна быть слишком трудной</p>
<b>Определение</b>	<p>The scientists to solve this problem work at our institute. <i>Ученые, которые должны решить</i> эту проблему, работают в нашем институте. He was the first to solve the problem. Он <i>первый</i> решил проблему.</p>	<p>The problem <i>to be solved</i> is very interesting. <i>Проблема, которую надо решить</i>, очень интересная. It was the first problem to be solved. <i>Это была первая проблема, которую надо было решить.</i></p>
<b>Инфинитивный оборот с предлогом "for"</b>	<p>New conditions are needed for him to solve the problem. <i>Для того, чтобы он решил</i> (смог решить) эту проблему, нужны новые условия.</p>	<p>For the problem to be solved you must join your forces. <i>Чтобы проблема была решена, Вы должны объединить Ваши силы.</i></p>

Инфинитив в начале предложения может выполнять три функции:

### *1. Подлежащее*

Переводится инфинитивом или существительным.

a) To learn a foreign language is to practice regularly.

*Учить* иностранный язык значит регулярно тренироваться.

b) To measure the voltage was not easy.

*Измерить* напряжение было нелегко.

**Примечание.** Инфинитив после безличных оборотов типа “*it is easy*”, “*it was necessary*” выполняет функцию подлежащего:

It was not easy to measure the voltage.

*Измерить* напряжение было нелегко.

### *II. Инфинитив – вводный член в начале предложения, отделяется запятой*

To sum up	Суммируя (подводя итоги)
To summarise	Следует сказать, что
To begin with	Прежде всего, начнем с того, что
To anticipate	Забегая вперед, следует сказать, что
To be sure	Несомненно
To put it briefly	Короче говоря

To begin with, this error will not affect the result.

*Начнем с того, что* эта ошибка не повлияет на результат.

To be sure, you will find this publication in the library.

*Несомненно, Вы* найдете эту работу в библиотеке.

### *III. Обстоятельство*

1) **Обстоятельство цели.** Переводится инфинитивом с союзом «чтобы» или существительным с предлогом «для».



### Например:

To measure the current we must have an ammeter.

(Для того) чтобы измерить (для измерения) силу тока, мы должны иметь амперметр.

В этой функции инфинитив может стоять не только в начале предложения.

We must have an ammeter (*in order*) to measure the current.

### 2) **Обстоятельство следствия.**

Употребляется после слов:

too

слишком

enough, sufficiently

достаточно

Часто переводится с модальным значением «мочь».

a) Molecules are too small to be seen even with a microscope.

Молекулы *слишком малы, чтобы их можно было увидеть* даже под микроскопом.

b) This method is not accurate enough to give reliable results.

Этот метод *недостаточно точен, чтобы дать (чтобы он мог дать)* надежные результаты.

## *IV. Определение*

После определяемого существительного инфинитив переводится:

1) Определительным придаточным предложением со сказуемым в **будущем времени или с модальными значениями**—*должен, может, надо*.

a) The phenomenon to be considered later was discovered in 1923.

*Явление, которое будет рассмотрено позже*, было открыто в 1923г.

b) These questions will be discussed at the conference shortly to open in Moscow.

Эти вопросы будут обсуждаться на конференции, *которая вскоре должна открыться (откроется)* в Москве.

2) После слов: the first, the last, the only (*единственный*), the next инфинитив переводится глаголом в личной форме и в том же времени, что и сказуемое (без модальности).

Newton was the first to discover the law of gravitation.

Ньютон первым *открыл* закон гравитации.

## *V. Инфинитив как часть сказуемого*

1) именной части составного именного сказуемого после глагола-связки to be.

Our task was to reduce pressure.

Наша задача *состояла в уменьшении (в том, чтобы уменьшить) давления.*

2) составного глагольного сказуемого после модальных глаголов и их эквивалентов, а также глаголов, обозначающих начало, продолжение или конец действия.

I was to measure the voltage.

*Я должен был измерить напряжение.*

## *VI. Дополнение*

He forgot to register the results.

Он забыл *записать результаты.*

I expect to be invited to the conference.

*Я полагаю, что меня пригласят на конференцию.*

## ***Инфинитивные обороты Сложное Дополнение***

Инфинитивный оборот «сложное дополнение» представляет собой следующую конструкцию:

*Существительное (в общем падеже) или  
местоимение (в объектном падеже)  
в функции дополнения*

+ *инфинитив смыслового глагола (с частицей to или без нее)*

Specialists consider metal working industry to be promising.

*Специалисты считают, что металлообрабатывающая промышленность является перспективной.*

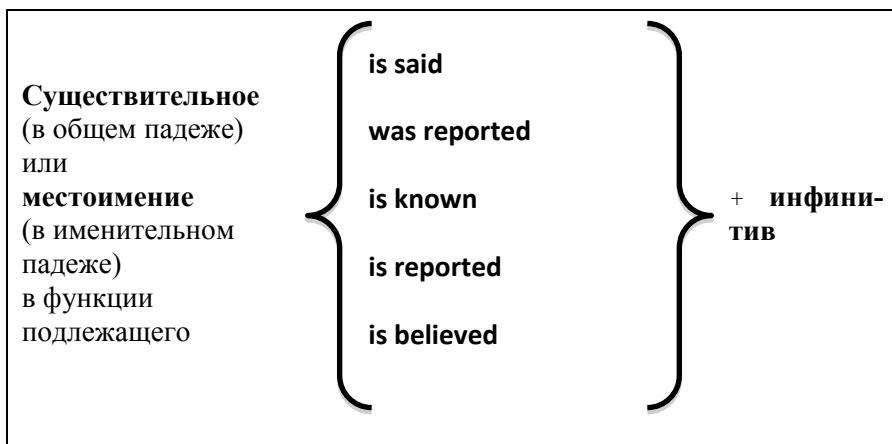
На русский язык инфинитивный оборот «сложное дополнение» часто переводится дополнительным придаточным предложением, вводимым словами что, как, чтобы.

Инфинитив смыслового глагола употребляется с частицей *to* после глаголов *want/ would like хотеть, know знать, think/believe/consider полагать, считать, expect ожидать*:

После глаголов, обозначающих чувства и восприятие, и некоторых других инфинитивов употребляется без *to* (*feel чувствовать, hear слышать, see видеть, watch наблюдать, notice замечать, make заставлять и др.*).

### Сложное Подлежащее

Инфинитивный оборот «сложное подлежащее» представляет собой следующую конструкцию:



На русский язык этот инфинитивный оборот переводится сложно-подчинённым предложением. Сказуемое английского предложения (*is said, is known* и др.) переводится неопределённо-личным глаголом во мн.ч. *говорят, сообщают* и т.д., за которым следует придаточное дополнительное предложение с союзом *что*, причём инфинитив становится сказуемым этого придаточного предложения.

«Сложным подлежащим» называют также сочетание глаголов to seem/to appear *казаться*, to prove *оказываться*, to happen *оказываться* и прилагательных likely *вероятный*, unlikely *маловероятный*, sure *вероятный* с инфинитивом.

He is considered to be one of the best specialists in this field.	<i>Он считается (Его считают) одним из лучших специалистов в этой области.</i>
He is thought to have been killed in an air crash.	<i>Считают, что он погиб в авиационной катастрофе.</i>
The method appears to be effective.	<i>По-видимому, этот метод эффективен.</i>

## **ПРИЧАСТИЕ**

### **Формы причастия**

Participle I	Indefinite	Active	Passive
		using	being used
	Perfect	having used	having been used
Participle II			used

### **Функции причастия**

		<b>Определение</b>	<b>Обстоятельство</b>
Participle I – Indefinite	Active	The device using the energy <i>использующий, использовавший</i>	Using the energy the device ... <i>используя</i>
	Passive	The device being used is rather old. <i>используемый, который используется, использовавшийся</i>	Being used the device ... <i>будучи использован, когда прибор используют, когда прибор использовали</i>

Participle I - Perfect	Active		Having used the device <i>использовав, когда прибор использовали</i>
	Passive		Having been used the device ... <i>когда (после того, как) прибор использо- вали</i>
Participle II		This device thus used is ... <i>используемый, использованный</i>	When used the device ... <i>когда прибор исполь- зуют, использовали, будут использовать</i>

## **ПРИЧАСТНЫЕ ОБОРОТЫ**

### **(Союз + Причастие)**

a) Unless tested the device can't be used.

*Если прибор не испытан, им нельзя пользоваться.*

b) If tested the device will be used in the experiments.

*Если прибор будет испытан, его используют в опытах.*

c) Once adopted the law might change the standard of living. Если закон будет принят, он, вероятно, изменит уровень жизни.

### **Независимый причастный оборот**

Он содержит отдельное подлежащее и причастие. Обычно отделяется запятой, иногда вводится предлогом "with".

В начале или в середине предложения обычно переводится придаточными предложениями с союзами «когда», «если», «так как», «теперь, когда», «хотя».

a) The students testing the devices, we couldn't use them.

*Так как студенты испытывали приборы, мы не могли пользоваться ими.*

b) (With) the devices tested, we can use them.

*Теперь, когда приборы испытаны, мы можем пользоваться ими.*  
 c) The students tested the devices themselves, the demonstrator watching them.

Студенты испытывали прибор сами, а лаборант наблюдал за ними.

### ***Сложное Дополнение (дополнение и причастие)***

a) We saw them testing the devices.

Мы видели, как они испытывали приборы.

b) We saw the devices being tested.

Мы видели, как испытывали приборы.

## **ГЕРУНДИЙ**

Герундий переводится на русский язык существительным, инфинитивом, деепричастием или придаточным предложением.

### ***Формы Герундия***

Indefinite	Active	Passive
	using	being used
Perfect	having used	having been used

### ***Функции Герундия***

<b>Подлежащее</b>	Solving physical problems is a difficult job. <i>Решение (решать) ...</i> His having solved the problem surprised me. <i>То, что он решил ...</i>
<b>Часть сказуемого</b>	Our aim is solving the problem. <i>... решить (решение) ...</i>
<b>Предложное дополнение</b>	I know of the problem having been solved <i>..., что задача (была) решена ...</i>
<b>Прямое дополнение</b>	He likes solving difficult problems. <i>... решать (решение) ...</i>

<b>Определение</b>	The way of solving the problem is not clear. <i>... решения (решить)</i>	
<b>Обстоятельство</b>	in	In solving the problem he made some mistakes. <i>Решая (при решении) ...</i>
	on	On solving the problem he proceeded to the experiment. <i>Решив (после решения) ...</i>
	by	By solving the problem he got good results. <i>Решая (решив) ...</i>
	without	You can't complete the experiment without solving the problem. <i>... не решив (без решения)</i>
	through	Through solving the problem he was able to estimate the dependence. Благодаря решению (из-за)

***Герундий употребляется после глаголов с предлогами, а также после следующих глаголов:***

acknowledge — подтверждать  
admit - признавать

anticipate - ожидать  
appreciate - ценить  
avoid - избегать  
cannot help - не мочь не  
cannot stand - не мочь терпеть  
delay - откладывать  
deny - отрицать  
detest - ненавидеть  
enjoy - наслаждаться  
excuse — извинять (-ся)  
fancy - хотеть, любить

involve - включать в себя  
look forward to - ждать с нетерпением  
look like - быть похожим  
mention - упоминать  
mind возражать  
miss - пропускать  
postpone - откладывать  
practice - практиковаться)  
prevent - препятствовать  
propose - предлагать  
quit - прекращать  
resent — возмущаться  
resist - сопротивляться

feel like - хотеть  
finish - заканчивать  
forgive – прощать

imagine — представлять себе

resume — продолжать  
risk - рисковать  
spend/waste time- проводить  
время  
suggest – предлагать

***Герундий употребляется после абстрактных существительных с предлогами:***

advantage of / in  
chance of  
difficulty (in)  
effect of  
experience in  
idea of  
interest in  
matter of  
objection to  
opportunity of  
pleasure of / in  
point of / in

possibility of  
problem of / in  
purpose of / in  
question about/of  
reason for  
satisfaction with  
success in  
surprise at  
way of  
it's no use  
it's no good  
it's worth

## ***ИНВЕРСИЯ***

***Инверсия*** – это обратный порядок слов, когда сказуемое или его часть выносятся перед подлежащим.

1) **Инверсия в случаях выделения обстоятельства и дополнения:**

a) Included in this section is a description of a typical system.

*В этот раздел ...*

b) Acting upon a body are few forces which cannot be neglected.

*На тело действуют.....*

2) **Инверсия в уступительных придаточных предложениях с союзами:**

*though*  
*as*

*хотя, как ни,*  
*как бы ни*



a) Important as this work is, it does not cover the problem on the whole.

*Как ни важна эта работа, она не охватывает проблему в целом.*

b) Possible as (though) it may be to construct a chart ...

*Хотя и можно построить график ...*

**3) Инверсия в предложениях, начинающихся с отрицательных слов:**

*never (before)*

***not only ... but (also)***

***not sooner ... than***

*neither*

a) Carbon dioxide doesn't burn nor does it support combustion.

*Двуокись углерода не горит и не поддерживает горения.*

b) No sooner had the aeroplane lifted into the air than the pilot reported an emergency.

*Как только самолет поднялся в воздух, пилот сообщил об аварии.*

**4) Инверсия в предложениях, начинающихся со слов, отрицательных по смыслу:**

hardly            *едва ли, вряд ли*

little            *мало*

seldom            *редко*

only            *только*

a) Hardly can piston theory be valid ....

*Едва ли поршневая теория может быть справедлива ...*

b) Only in two cases did we find a similar construction.

*Только в двух случаях мы нашли подобную конструкцию.*

**5) Инверсия в предложениях, начинающихся со слов:**

now, here, there, out, away

Now under construction is the research plane...

*Сейчас строится опытный самолет ...*

**6) Инверсия в предложениях, вводимых наречием "so":**

Sputnik II recorded the intensity of micrometeors, so did Sputnik III.

*Спутник 2 зарегистрировал интенсивность метеоров, и Спутник 3 также (зарегистрировал).*

## ***ДВОЙНОЕ ОТРИЦАНИЕ***

Отрицание в сочетании с отрицательной приставкой прилагательного или наречия усиливает любые члены предложения, кроме подлежащего и дополнения. Такое сочетание перед прилагательным или наречием обычно переводится: *довольно, весьма, вполне*.

a) The case is not improbable.

Этот случай *довольно* (вполне, весьма) *вероятен*.

b) It is not unlikely that the temperature will increase in this reaction.

*Вполне вероятно, ...*

## ***СЛОВООБРАЗОВАНИЕ***

<b>Префиксы</b>	<b>Значение</b>	<b>Примеры</b>
<i>un- dis- in- im- il- ir- non-</i>	отрицательные	unhappy - <i>несчастный</i> to dismount - <i>демонстрировать</i> inexperienced - <i>неопытный</i> immovable - <i>неподвижный</i> illogical - <i>нелогичный</i> irresponsible - <i>безответственный</i> non-ferrous - <i>цветной</i>
<i>re-</i>	повтор действия	To re-use - <i>вновь (снова) использовать</i> to remake - <i>переделать</i>
<i>mis-</i>	ошибочно, неверно	to misuse - <i>неправильно употреблять</i>
<i>over-</i>	сверх, чрезмерно	to overpay - <i>переплачивать</i>
<i>under-</i>	недостаточно	to underpay - <i>недоплачивать</i>
<i>pre-</i>	перед, ранее; предварительное	to preheat - <i>предварительно нагревать</i>
<i>post-</i>	после	post-war - <i>послевоенный</i>
<i>anti-</i>	анти-, против-	antifriction - <i>антифрикционный</i> antiphase - <i>противофаза</i>

<i>counter-</i>	контр-, проти- во-	countershaft - <i>контрпривод</i> counter-pressure - <i>противо- давление</i>
<i>inter-</i>	между-, взаим- но-	intergranular- <i>межзерни- стый</i> intercoagulation- <i>взаимная коагуляция</i>
<i>sub-</i>	под-	subscale - <i>подокалина</i>
<i>super-</i>	сверх-, супер-	superfast- <i>сверхскоростной</i> superheat - <i>перегрев</i> superfinish - <i>суперфиниширо- вать</i>

### ***Составные предлоги***

According to  
Because of  
By means of  
By virtue of

*согласно*  
*из-за*  
*посредством, при помощи*  
*посредством, в силу, на основа-  
нии*

Due to  
In accordance with  
In addition to  
in case of  
in spite of  
owing to  
thanks to  
With respect to

*благодаря, из-за*  
*в соответствии с*  
*кроме, в дополнение к*  
*В случае*  
*Не смотря на*  
*благодаря*  
*благодаря*  
*по отношению к, что касается*

## *Многофункциональные слова*

### To do

<b>Смысловой глагол</b>	<b>Вспомогательный глагол</b>	<b>Усилительный глагол</b>	<b>Заместитель предшествующего сказуемого</b>
<p>This machine-tool does various operations.</p> <p><i>Этот станок выполняет различные операции.</i></p>	<p>Do you know any special properties of non-ferrous metals?</p> <p><i>Знаешь ли ты какие-либо особые свойства, которые присущи цветным металлам?</i></p>	<p>Today we do know about 66 metals.</p> <p><i>На сегодняшний день мы <u>действительно</u> знаем приблизительно 66 металлов.</i></p>	<p>Metals conduct electricity better than most of the non-metals do.</p> <p><i>Металлы проводят электричество лучше, чем большинство неметаллов</i></p>

### That (those)

<b>Указательное местоимение (that – ед. ч., those – мн. ч.)</b>	<b>Союз (вводит дополнительное предложение)</b>	<b>Слово-заменитель упомянутого ранее существительного</b>	<b>Союзное слово</b>
<p>The commercial production of that metal began only in 1888.</p> <p><i>Коммерческое производство этого металла началось только в 1888.</i></p>	<p>It is important to note that some metals are good conductors of electricity.</p> <p><i>Важно отметить, что некоторые металлы являются хорошими проводниками электричества</i></p>	<p>The calorific power of coal is 2-3 times greater than that of wood.</p> <p><i>Теплотворная способность угля в 2-4 раза больше, чем дерева.</i></p>	<p>The furnace that is used for separating iron from other elements is called blast furnace.</p> <p><i>Печь, которая используется для очистки железа от примесей, называется доменной печью.</i></p>

It

<b>Личное местоимение</b>	<b>Указательное местоимение</b>	<b>Формальное подлежащее в безличных предложениях</b>	<b>Вводное слово в предложениях с эмфатическим оборотом</b>
Concrete is cheaper. It is often used in building.  <i>Бетон дешевле. Он часто используется в строительстве.</i>	It was your idea to use an alloy of copper and aluminium.  <i>Это была твоя идея использовать сплав меди и алюминия.</i>	It is necessary to know some properties of the elements that play an important part in metallurgy.  <i>Необходимо знать некоторые свойства элементов, которые играют важную роль в металлургии.</i>	It is pig iron that is used in the production of steel.  <i>Именно чугун используется в производстве железа.</i>

One

<b>Числительное «один»</b>	<b>Формальное подлежащее (имеет форму притяжательного падежа one's)</b>	<b>Слово-заменитель упомянутого существительного(имеет форму мн. числа - ones)</b>
Copper is one of the most ductile metals. <i>Медь – один из наиболее ковких металлов.</i>	One can see... <i>Можно видеть...</i> One must say... <i>Нужно сказать...</i> One has to recover impurities from lead	These metals are in many respects better than those ones. <i>Эти металлы во многих отношениях лучше, чем те.</i>

	bullion. <i>Следует удалить примеси из свинцовых слитков.</i>	
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### ***Местоимения. Парные союзы***

<b>Местоимение</b>	<b>Парный союз</b>
Either - <i>тот или другой; и тот, и другой</i>	Either ... <i>or</i> либо ... <i>либо;</i> или ... <i>или;</i>
Neither - <i>ни тот, ни другой; ни один(из них)</i>	<b>Neither... nor</b> - <i>ни...ни</i>
Both - <i>оба</i>	Both... and- <i>и ... и, как ...так и</i>

### ***Чтение наиболее употребительных математических символов и формул***

Addition [ə'dɪʃən] - сложение

Subtraction [səb'trækʃən] - вычитание

Multiplication [ˌmʌltɪplɪ'keɪʃən] - умножение

Division [dɪ'vɪʒən] - деление

### **Примеры**

$$4 + 7 = 11$$

Four plus seven equals eleven

Four plus seven is equals to eleven

---


$$a + b = c$$

*a* plus *b* equals *c*

---


$$11 - 4 = 7$$

Eleven minus four equals seven

---


$$a - b = c$$

*a* minus *b* is equals to *c*

$4 \times 4 = 16$

Four times four is sixteen

---

 $12 \times 12 = 144$

Twelve (multiplied) by twelve equals one hundred and forty four

---

 $a \cdot b = c$

*a* multiplied by *b* is equal to *c*

---

 $25 : 5 = 5$

Twenty-five divided by five equals five

---

 $a : b = c$

*a* divided by *b* is equal to *c*

---

$$\frac{a+b}{a-b} = \frac{c+d}{c-d}$$

*a* plus *b* over *a* minus *b* is equal to *c* plus *d* over *c* minus *d*

---

Fractions ['frækʃəns] - дроби

Common fractions ['kɒmən 'frækʃəns] - простые дроби

Numerator ['nju:məreɪtə] - числитель

Denominator [dɪ'nɒmɪneɪtə] - знаменатель

Integer ['ɪntɪdʒə] - целое число

Cardinal numbers ['kɑ:dɪnəl 'nʌmbəz] - количественные числительные

Ordinal numbers ['ɔ:dɪnəl 'nʌmbəz] – порядковые числительные

Nought [nɔ:t] – ноль (главным образом в математике)

Zero ['ziərou] – ноль (главным образом в шкалах)

Decimal ['desɪməl] - десятичный

В простых дробях числитель выражается количественным числительным, знаменатель – порядковым.

Если числитель больше единицы, то знаменатель принимает окончание s.

В смешанном числе целое число читается как количественное числительное, а дробь присоединяется к нему союзом and.

## Примеры

$\frac{1}{2}$	One half (a half)
$\frac{1}{3}$	One third (a third)
$\frac{2}{7}$	Two sevenths
$3\frac{1}{2}$	Three and a half
$4\frac{1}{7}$	Four and a seventh
$4\frac{5}{7}$	Four and five sevenths

## Decimal Fractions [ $^{\circ}$ desɪməl `frækʃəns] десятичные дроби

В Англии и Америке знаки десятичных дробей отделяют точкой – point [pɔɪnt], которая может стоять внизу, в середине или вверху строки. Каждая цифра читается отдельно. Ноль читается любым из трех следующих способов: zero [ $^{\circ}$ zɪərou], nought [nɔ:t], O [ou]. Ноль целых можно совсем не читать, а читать только point.

## Примеры

0.2	O point two Nought point two Zero point Point two
0.002	O point O O two Point two oes two Point nought nouthgt two



---

1.1 One point one

---

1.25 One point two five

---

involution [ˌɪnvəˈluːʃən] - **возведение в степень**

power [ˈpaʊə] **степень, показатель степени**

raise to a power [ˈreɪzɪtəʊˈpaʊə] **возвышать в степень**

### Примеры

---

$3^2$  Three squared (Three square)  
Three (raised) to the second power  
Three to the power two  
The second power of three

---

$5^2 = 25$  The second power of five is twenty five

---

$5^3$  Five cubed  
Five cube  
Five (raised) to the third power  
Five to the power three  
The third power of five  
The cube of five

---

$8 = 2^3$  Eight is the third power of two

---

$10^7$  Ten to the seventh power

---

$10^{-7}$  Ten to the minus seventh power

---

$Z^{-10}$  Z to the minus tenth power  
Z to the minus tenth

---

## **ТАБЛИЦА ХИМИЧЕСКИХ ЭЛЕМЕНТОВ**

Al	Aluminum [ˌæljʊmɪnjəm]	Алюминий
Ar, A	<b>Argon</b> [ˈɑːgən]	Аргон
As	Arsenic [ˈɑːsnɪk]	Мышьяк
B	Boron [ˈbɔːrən]	Бор
Ba	Barium [ˈbɛəriəm]	Барий
Be	<b>Beryllium</b> [bɛˈrɪliəm]	Бериллий
Br	Bromine [ˈbrɔʊmɪn]	Бром
C	<b>Carbon</b> [ˈkɑːbən]	Углерод
Ca	Calcium [ˈkælsiəm]	Кальций
Cd	Cadmium [ˈkædmɪəm]	Кадмий
Cr	Chromium [ˈkroumɪəm] = Chrome [ˈkroum]	Хром
Cs	C(a)esium [ˈsiːziəm]	Цезий
Cu	Cuprum [ˈkjuːprəm] = Copper [ˈkɒpə]	Медь
F	Fluorine [ˈfluəriːn]	Фтор
Fe	Ferrum [ˈferəm]	Железо
Ga	Gallium [ˈgæliəm]	Галлий
Ge	Germanium [dʒɛˈmeɪniəm]	Германий
H	Hydrogen [ˈhaɪdrɪdʒən]	Водород
He	<b>Helium</b> [ˈhiːljəm]	Гелий
Hg	Hydrargyrum [ˈhaɪˈdraːdʒɪrəm] = Mercury [ˈmɜːkjʊrɪ]	Ртуть
Ir	Iridium [aɪˈriːdiəm]	Иридий
J, I	Iodine [ˈaɪədiːn]	Йод
K	Kalium [ˈkæliəm] = Potassium [pəˈtesjəm]	Калий
Li	Lithium [ˈliθiəm]	Литий
Mg	Magnesium [mæɡˈniːziəm]	Магний
N	Nitrogen [ˈnaɪtrɪdʒən]	Азот
Na	Natrum [ˈneɪtrɪəm] = Sodium [ˈsɔʊdiəm]	Натрий
Nb	Niobium [naiˈɔʊbiəm]	Ниобий
Nd	Neodymium [ˌniəˈdiɪmiəm]	Неодим(ий)

Ne	Neon [ˈni:ən]	Неон
Ni	Nickel [ˈni:kl]	Никель
O	Oxygen [ˈɒksɪdʒən]	Кислород
P	Phosphorus [ˈfɒsfərəs]	Фосфор
Pb	Plumbum [ˈplʌmbəm] = Lead [led]	Свинец
Pt	Platinum [ˈplætɪnəm]	Платина
Pu	Plutonium [plu:ˈtʊnjəm]	Плутоний
Ra	Radium [ˈreɪdɪəm]	Радий
S	Sulphur [ˈsʌlfə]	Сера
Sb	Stibium [ˈstɪbjəm] = Antimony [ˈæntɪməni]	Сурьма
Sc	Scandium [ˈskændɪəm]	Скандий
Se	Selenium [siˈliɪnəm]	Селен
Si	Silicon [ˈsɪlɪkən]	Кремний
Sr	Strontium [ˈstrɒŋʃiəm]	Стронций
Te	<b>Tellurium</b> [təˈljʊ:riəm]	Теллур
Ti	Titanium [taɪˈtenɪəm]	Титан
U	Uranium [juˈreɪnɪəm]	Уран
V	<b>Vanadium</b> [vəˈneɪdɪəm]	Ванадий
W	<b>Wolfram(ium)</b> [ˈwʊlfrəm] = Tungsten [ˈtʌŋstən]	Вольфрам
Zn	Zinc(um), Zink [zɪŋk]	Цинк
Zr	Zirconium [zəˈkɒnrɪəm]	Цирконий

## UNIT ONE

Грамматика:

Структура простого повествовательного предложения.

Признаки сказуемого в предложении.

Текст А. Metals

Текст Б. Metals and Nonmetals

**Упр. 1. Прочитайте и запомните следующие слова и выражения.**

1. to add – добавлять
2. alloying – легирование стали
3. annealing - отжиг
4. to arrange – располагать
5. to cast - отливать
6. composition - состав
7. conductivity - проводимость  
electrical ~ - электропроводимость  
thermal ~ - теплопроводность
8. condition - состояние
9. contaminant – загрязнитель
10. crystal - кристалл  
irregular ~ - кристалл неправильной формы
11. to deform – деформировать
12. demand - спрос
13. density – плотность
14. to depend on - зависеть
15. to draw – вытягивать
16. drawing – волочение (проволоки)
17. to bend – гнуть, сгибать
18. to extract – извлекать
19. extrusion – выдавливание, выталкивание
20. fracture – разрушение, разрыв, трещина
21. grain – зерно, гранула  
coarse ~ - крупное зерно  
small ~ - мелкое зерно

22. grinder – шлифовальный станок, дробилка
23. growth – рост, увеличение
24. hammering – ковка на молоте
25. heat – накаливание  
red ~ - температура красного каления
26. lathe – токарный станок
27. lead – свинец, графит
28. to link – соединять, связывать
29. machine – станок  
milling ~ - фрезерный станок
30. to melt - плавить
31. metal – металл  
malleable ~ - ковкий металл  
ductile ~ - тягучий металл  
pure ~ - чистый металл (без примесей)
32. mold = mould – литейная форма
33. to mine – добывать
34. mining – добыча
35. nature – структура
36. periodic table – таблица периодических элементов
37. property – свойство
38. quenching – закалка (резким охлаждением)
39. rolling - прокатка
40. reduction - восстановление  
electrolytic ~ - электролитическое восстановление  
chemical ~ - химическое восстановление
41. separation – отделение
42. size – размер
43. shape – форма
44. shaper – строгальный станок
45. to slide – скользить
46. soft – мягкий
47. strong – прочный, твёрдый
48. structure – структура  
crystalline ~ - кристаллическая структура
49. tempering – отпуск, закалка с последующим отпуском
50. tool – инструмент

machine-tool - станок

51. treatment – обработка

heat ~ - термообработка

52. wire – проволока, провод

53. to work – обрабатывать

54. working – обработка

hot ~ - термообработка при высокой температуре

**Упр. 2. Прочитайте следующие интернациональные слова и переведите их без словаря.**

Metal, metallic, metallurgy, chemical, electrolytic, materials, periodic, industry, atoms, economic, crystal, structure, mineral, combination, process, carbonate, material.

**Упр. 3. Переведите следующие существительные:**

а) с суффиксом *-ity*

locality, probability, conductivity, density

б) с суффиксами *-tion, -ion, -ition*

reduction, production, separation, orientation, composition, prevention, oxidation, contribution, addition

с) с суффиксом *-ment*

arrangement, treatment, displacement, development

д) с суффиксом *-ing*

hammering, quenching, tempering, annealing, alloying, working.

**Упр. 4. Образуйте от глагола в скобках нужное существительное и переведите предложения.**

1. A metal is a material with high electrical (*to conduct*).

2. The regular (*to arrange*) of atoms in metals gives them a crystalline structure.

3. Iron can only be worked by (*to hammer*) at red heat.

4. Heat (*to treat*) controls the nature of the grains and their size in the metal.

5. The ways of (*to work*) a metal depend on its properties.

6. (*to alloy*) changes the grain structure and properties of metals.

7. All metals can be formed by (*to draw*), rolling, (*to hammer*) and extrusion.

**Упр. 5. Переведите следующие именные группы.**

metal ores, electrical conductivity, thermal conductivity, electrolytic reduction, periodic table, red heat, regular arrangement, crystalline structure, irregular crystals, coarse grains, heat treatment, grain structure, special conditions, economic growth, pure metal.

**Упр. 6. Определите, какой частью речи являются следующие слова.**

typically, conductivity, chemical, reduction, contaminant, periodic, regularly, arrangement, malleable, crystalline, tempering, extrusion, economic.

**Упр. 7. Найдите в правой колонке русские эквиваленты следующих словосочетаний.**

- |                              |                                     |
|------------------------------|-------------------------------------|
| 1. high thermal conductivity | a. обрабатывать металл              |
| 2. high density              | b. свойства металлов                |
| 3. electrolytic reduction    | c. кристаллы неправильной формы     |
| 4. malleable metal           | d. высокая теплопроводность         |
| 5. ductile metal             | e. тягучий металл                   |
| 6. irregular crystals        | f. высокая плотность                |
| 7. composition of grains     | g. ковкий металл                    |
| 8. orientation of grains     | h. отлить в формы                   |
| 9. properties of the metal   | i. состав зёрен                     |
| 10. to slide over each other | j. электролитическое восстановление |
| 11. to work metal            | k. расположение зёрен               |
| 12. to cast in moulds        | l. скользить друг по другу          |

**Упр. 8. Соотнесите слова с их определениями.**

metal, alloy, crystal, ore, mould, metallurgy

1. science and technology of metals; of separating metal from ore, purifying it and of working in metal
2. any of a class of mineral substances such as tin, iron, copper

3. definite and regular shape taken naturally by the molecules of certain substances
4. mixture of metals, or a metal of low value mixed with a metal of higher value
5. container into which molten metal or a soft substance is poured to cool into a desired shape
6. kind of rock or mineral from which metal can be mined or extracted

**Упр. 9. Переведите слова в скобках на английский язык, используя активный словарь урока.**

1. A metal is a material that is hard, has high (*электропроводность*), high (*теплопроводность*), and high (*плотность*).
2. The (*разделение*) between the atoms in metals is small, so most metals are (*плотные*) dense.
3. Metals are (*ковкие*) and (*тягучие*).
4. Lead is (*мягкий*) and can be (*знутья*) by hand, while iron can only be worked by hammering at red heat.
5. The regular arrangement of atoms in metals gives them a (*кристаллическая структура*).
6. (*Термообработка*) controls the nature of the grains and their size in the metal.
7. All metals can be formed by (*волочением*), (*прокаткой*), (*ковкой*) and extrusion, but some require hot-working.

**Упр. 10. В 1-м абзаце текста найдите предложение со словом «once» - как только; после того, как; однажды, переведите это предложение на русский язык.**

**Упр. 11. Во 2-м абзаце текста найдите предложение с парным союзом «because of» - в следствие; из-за; по причине, переведите это предложение на русский язык.**

**Упр. 12. Переведите следующие предложения на русский язык.**

1. Casting stresses occur because of non-uniform shrinkage.
2. Non-ferrous metals find many applications because of some valuable characteristics they possess.



3. Molybdenum improves strength of stainless steels because of its influence on microstructure.
4. **Because of its high heat conductivity and capacity, zinc oxide cannot be used in plastics.**
5. Because of its being expensive silver is not widely used in industry.
6. Because gold is visually pleasing and workable and does not tarnish or corrode, it was one of the first metals to attract human attention.
7. Because pure gold is too soft to resist prolonged handling, it is usually alloyed with other metals to increase its hardness for use in jewelry, goldware or coinage.
8. Because the mechanical properties of pure lead are relatively poor, it is alloyed with other elements.

**Упр. 13. В 3-м и 4-м абзацах текста найдите предложения с многозначным словом «one», определите его функцию.**

**Упр. 14. Переведите следующие предложения, обращая внимание на функции «one».**

1. These metals are in many respects better than those ones.
2. The most important properties of metals are the ones grouped together as mechanical properties.
3. To use engineering metals in practice one must know their properties.
4. One must choose only one of those variants.
5. There are many insulating materials from which one may choose.
6. Physics is one of the most ancient sciences about nature.
7. **One can't speak of the pressure or temperature of one molecule.**
8. Collisions of molecules with one another play a very great part in the gas behaviour.

**Упр. 15. Найдите в тексте предложения со сказуемым, которое выражено глаголом в страдательном залоге. Переведите эти предложения на русский язык.**

## Упр. 16. Переведите текст на русский язык.

### Text A. Metals

1. A metal is a material that is typically hard, has high electrical conductivity, high thermal conductivity, and high density. Metal ores are often extracted from the Earth by means of mining. Once the ore is mined, the metals must be extracted, usually by chemical or electrolytic reduction. The methods used depend on the metal and their contaminants. About 91 of the 118 elements in the periodic table are metals.

2. Metals are materials most widely used in industry because of their properties. The study of the production and properties of metals is known as metallurgy. The separation between the atoms in metals is small, so most metals are dense. The atoms are arranged regularly and can slide over each other. That is why metals are malleable (can be deformed and bent without fracture) and ductile (can be drawn into wire). Metals vary greatly in their properties. For example, lead is soft and can be bent by hand, while iron can only be worked by hammering at red heat.

3. The regular arrangement of atoms in metals gives them a crystal-line structure, irregular crystals are called grains. The properties of the metals depend on the size, shape, orientation, and composition of these grains. In general, a metal with small grains will be harder and stronger than one with coarse grains. Heat treatment such as quenching, tempering, or annealing controls the nature of the grains and their size in the metal. Small amounts of other metals (less than 1 per cent) are often added to a pure metal. This is called alloying and it changes the grain structure and properties of metals.

4. All metals can be formed by drawing, rolling, hammering and extrusion, but some require hot-working. Metals can be worked using machine-tools such as lathe, milling machine, shaper and grinder. One can say that the ways of working a metal depend on its properties. Many metals can be melted and cast in moulds, but special conditions are required for metals that react with air.

Demand for metals is closely linked to economic growth. During the 20th century, the variety of metals uses in society grew rapidly.

**Упр. 17. Укажите, какие предложения соответствуют содержанию текста.**

1. Metal ores are often extracted from the Earth by means of mining.
2. Metals are materials most widely used in science because of their properties.
3. The atoms are arranged regularly and can slide over each other.
4. Lead is hard and can be bent by hand, while iron can only be worked by hammering at red heat.
5. The irregular arrangement of atoms in metals gives them a crystalline structure.
6. The properties of the metals depend on the size, shape, orientation, and composition of these grains.
7. A metal with small grains will be softer and stronger than one with coarse grains.
8. Metals can be worked using machine-tools such as lathe, milling machine, shaper and grinder.

**Упр. 18. Соотнесите части предложения.**

- |   |  |
|---|--|
| 1. Metal ores are often extracted                       | a. is known as metallurgy                    |
| 2. Metals are materials most widely used in industry    | b. so most metals are dense.                 |
| 3. The study of the production and properties of metals | c. from the Earth by means of mining.        |
| 4. The separation between the atoms in metals is small, | d. because of their properties.              |
| 5. The regular arrangement of atoms in metals           | e. drawing, rolling, hammering and extrusion |
| 6. The ways of working a metal                          | f. gives them a crystalline structure.       |
| 7. All metals can be formed by                          | g. depend on its properties.                 |

**Упр. 19. Ответьте на следующие вопросы.**

1. What is metal?
2. Are metal ores extracted from the Earth by means of mining?
3. What is metallurgy?

4. Are the atoms in metals arranged regularly or irregularly?
5. Can the atoms in metals slide over each other?
6. What does give metals a crystalline structure?
7. The properties of metals depend on the size, shape, orientation, and **composition of grains, don't they?**
8. What is alloying?
9. All metals can be formed by drawing, rolling, hammering and extrusion, **can't they?**
10. Is the demand for metals closely linked to economic growth?

**Упр. 20. Перескажите текст А.**

### ***Грамматический практикум***

**Упр. 1. Исправьте ошибки. Восстановите структуру предложения.**

1. Metals by their high conductivity for heat and electricity are distinguished.
2. Several important groups there are of metals.
3. Aluminium, berillium and titanium in aircraft and rocket construction are important.
4. Metals in their properties vary greatly.
5. Small amounts of other metals to a pure metal are often added.
6. Metals using machine-tools can be worked such as lathe, milling machine, shaper and grinder.
7. Organic coatings metals and steel protect from corrosion.
8. Various kinds there are of steel, such as mild steel, carbon steel, alloy steel etc.

**Упр. 2. Проанализируйте 2-е предложение 1-го абзаца текста. Разберите его по членам предложения.**

**Упр. 3. Найдите группу «подлежащее-сказуемое» в следующих предложениях.**

1. The main advantage of metals is their strength and toughness.
2. The properties of a metal can be further improved by use of heat treatment.

3. Hardening is used to make metals harder and tempering makes them softer and less brittle.
4. There are two kinds of materials used in engineering – metals and non-metals.
5. The ways of working a metal depend on its properties.
6. During the 20th century, the variety of metals uses in society grew rapidly.
7. Small amounts of other metals are often added to a pure metal.

**Упр. 4. Определите признаки сказуемого в следующих предложениях.**

1. Pure metals are rarely found in nature.
2. Metallic ores are recovered from the earth in many ways.
3. A metal with small grains will be harder and stronger than one with coarse grains.
4. Iron can only be worked by hammering at red heat.
5. Many elements are classified as semimetals because they have much poorer conductivity than common metals.
6. Nonmetals in the solid state are usually brittle materials.
7. All metals can be formed by drawing, rolling, hammering and extrusion.

**Упр. 5. Переведите предложения. Обратите внимание на перевод сказуемого в страдательном залоге в сочетании с модальным глаголом.**

1. This powder can then be hot pressed into consolidated bars with better mechanical properties than those produced by ingot casting.
2. Fine powders can be mixed with a wax, injection molded to form several parts at once, and then sintered.
3. Zinc chloride can be prepared by a direct reaction or it can be produced by evaporating the aqueous solution formed in various reactions.
4. Because under the influence of light, the electrical conductivity of zinc oxide can be increased many times.
5. Nickel concentrates may be leached with sulfuric acid or ammonia, or they may be dried and smelted in flash and bath processes.
6. Matter may be roasted to produce high-grade nickel oxides.

## Text B. Metals and Nonmetals

### **Упр.1. Переведите текст на русский язык в письменной форме.**

1. There are some distinctions between metals and nonmetals. Metals are distinguished from nonmetals by their high conductivity for heat and electricity, by metallic lustre and by their resistance to electric current. Their use in industry is explained not only by those properties, but also by the fact that their properties, such as strength and hardness, can be greatly improved by alloying them with other metals.

2. There are several important groups of metals and alloys. The common metals such as iron, copper, zinc, etc. are produced in great quantities.

3. The so-called precious metals include silver, gold, platinum and palladium. The light metals are aluminium, beryllium and titanium. They are important in aircraft and rocket construction.

4. Many elements are classified as semimetals (bismuth, for example) because they have much poorer conductivity than common metals.

5. Nonmetals (carbon, silicon, sulphur) in the solid state are usually brittle materials without metallic lustre and are usually poor conductors of electricity. Nonmetals show greater variety of chemical properties than common metals do.

6. Metals can undergo corrosion, changing in this case their chemical and electromechanical properties. In order to protect metals from corrosion the products made of metals and steel are coated by some films (coatings). Organic coatings protect metals and steel from corrosion by forming a corrosion-resistant barrier between metal or steel and the corrosive environment.

### **Упр. 2. Продолжите следующие предложения в соответствии с текстом В.**

1. Metals are distinguished from nonmetals by ....

2. The common metals such as ....

3. The so-called precious metals include ....

4. The light metals are ....

5. Many elements are classified as semimetals....

6. Nonmetals in the solid state are usually ....

7. In order to protect metals from corrosion ....

**Упр. 3. Вместо пропусков в предложениях вставьте нужное слово в соответствии с текстом.**

metals, distinctions, conductivity, semimetals, alloys, nonmetals, corrosion, barrier, properties, coatings.

There are some ... between metals and nonmetals. ... are distinguished from ... by their high ... for heat and electricity, by metallic lustre and by their resistance to electric current. There are several important groups of metals and ... . Many elements are classified as ... because they have much poorer conductivity than common metals. Nonmetals show greater variety of chemical ... than common metals do. Metals can undergo ... . Organic ... protect metals and steel from corrosion by forming a corrosion-resistant ... between metal or steel.

**Упр. 4. Расположите следующие предложения в той последовательности, в которой они находятся в тексте В.**

1. There are several important groups of metals and alloys.
2. Metals are distinguished from nonmetals by their high conductivity for heat and electricity.
3. There are some distinctions between metals and nonmetals.
4. Many elements are classified as semimetals.
5. The light metals such as aluminium, berillium and titanium are important in aircraft and rocket construction.
6. Metals can undergo corrosion, changing in this case their chemical and electromechanical properties.
7. Organic coatings protect metals and steel from corrosion.
8. Nonmetals in the solid state are usually brittle materials without metallic lustre and are usually poor conductors of electricity.

**Упр. 5. Дайте ответы на вопросы.**

1. By what properties are metals distinguished from nonmetals?
2. What common metals are produced in great quantities?
3. What metals are called light?
4. What properties do nonmetals have?
5. What is done to protect metals from corrosion?

**Упр. 6. Найдите в каждом абзаце текста В предложения, выражающие его основную мысль.**

**Упр. 7. Кратко передайте содержание текста В на английском и русском языках.**

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## UNIT TWO

**Грамматика:**

**Инфинитив. Его формы и функции.**

**Текст А.** Ferrous Metals. Cast Iron.

**Текст Б.** Non-Ferrous Metals.

**Упр. 1. Прочитайте и запомните следующие слова и выражения.**

1. available - доступный
2. application - применение, использование
3. brittle – хрупкий, ломкий
4. cast iron – чугун  
white ~ - белый чугун  
grey ~ - серый чугун  
malleable ~ - ковкий чугун
5. castability - жидкотекучесть (металла)
6. ductile – пластичный, ковкий
7. fluidity - текучесть
8. furnace - печь  
blast~ - доменная печь
9. hardness – твердость, жесткость
10. iron - железо  
pig ~ - чугун в чушках, чушковый чугун
11. machinability - обрабатываемость (материала, заготовки)
12. to melt – плавить, выплавлять  
melting - плавка  
melting point - температура (точка) плавления



13. metal  
ferrous ~ - **черный металл**  
non-ferrous ~ - **цветной металл**
14. mold=mould– **литейная форма**
15. property - **свойство**
16. quantity - **количество**
17. resistance – **сопротивление, стойкость**
18. solid - **твердый**
19. strength - **прочность**

**Упр. 2. Прочитайте следующие интернациональные слова и переведите их без словаря.**

Phosphorous, element, form, carbon, plasticity, structure, physical, method, nickel, molybdenum, chromium, process, ton, temperature, engineering, gram.

**Упр. 3. Переведите следующие выражения на русский язык.**

to cast into molds, intricate shapes, alloying elements, to improve hardness, wear resistance, malleable cast iron, to remove castings, resistance to deformation, white metallic appearance, commercial use, a wide range of applications, quantity of carbon.

**Упр. 4. Найдите в правой колонке русские эквиваленты следующих словосочетаний.**

- |                                       |  |
|---------------------------------------|--|
| 1. to derive from                     | a. хорошая текучесть                         |
| 2. desired shapes                     | b. улучшать прочность и твердость            |
| 3. solid state                        | c. желательные формы                         |
| 4. pig iron and scrap                 | d. самая дешевая технология плавки           |
| 5. process of annealing               | e. процесс отжига                            |
| 6. addition of some alloying elements | f. получать, извлекать                       |
| 7. relatively low melting point       | g. добавление некоторых легирующих элементов |

- |  |  |
|--|--|
| 8. good fluidity                         | h. чушковый чугун и скрап (лом)              |
| 9. the cheapest of melting processes     | i. твердое состояние                         |
| 10. to improve the strength and hardness | j. относительно низкая температура плавления |

**Упр. 5. Соотнесите слова с их определениями.**

plasticity, to improve, cast iron, to cast, blast-furnace, to melt, strength, steel.

1. a smelting furnace in the form of a tower which is used chiefly to make iron from a mixture of iron ore, coke, and limestone;
2. the capacity of an object or substance to withstand great force or pressure;
3. the quality of being easily shaped or molded;
4. to shape (metal or other material) by pouring it into a mold while molten;
5. a hard, strong, gray or bluish-gray alloy of iron with carbon and usually other elements, used extensively as a structural and fabricating material
6. to change (something) to a liquid condition by heating it;
7. a hard, relatively brittle alloy of iron and carbon that can be readily cast in a mold and contains a higher proportion of carbon than steel;
8. to make or become better.

**Упр. 6. Переведите слова в скобках на английский язык, используя активный словарь урока.**

1. It is known that metals and alloys are divided into (*черные*) and (*цветные*).
2. The (*применение*) of metals has to be based on their (*свойствах*).
3. It is to be noted that (*чистое железо*) is soft, (*ковкое*) and relatively weak.
4. (*Серый чугун*) is soft, easily machined and only moderately (*хрупкий*).
5. (*Сплавы*) are used to (*улучшить*) the (*прочность*) and (*твердость*) of the castings.
6. Almost the only commercial use for (*белый чугун*) is making (*ковкий чугун*).
7. Some metals have to be (*плавиться*) at very high temperatures.
8. Production of castings requires different types of melting (*печей*).

**Упр. 7. Найдите в 1-м и 3-м абзацах текста предложения с конструкцией "There + be" и переведите их на русский язык.**

**Упр. 8. Переведите следующие предложения с конструкцией «There + be».**

1. There are also occasional references to iron in earlier periods, but this material was of meteoric origin.
2. There are always admixtures of valueless minerals, collectively called gangue.
3. There is evidence that meteorites were used as a source of iron before 3000 BC.
4. There are a number of alkaline, acid, and thermal methods of refining bauxite, clay, or others ores to obtain alumina.
5. There are many useful alloys of copper and nickel.
6. There are several casting techniques at the disposal of foundry men.
7. There are different metals in nature.

**Упр. 9. Найдите в 4-м и 6-м абзацах инфинитивы в функции обстоятельства и переведите их вместе с относящимися к ним словами.**

**Упр. 10. Найдите во 2-м и 5-м абзацах предложения с многофункциональным словом «it», определите его функцию и переведите предложения на русский язык.**

**Упр. 11. Переведите следующие предложения на русский язык.**

1. The first metal to be used by man was copper. It made the lives of people much easier.
2. Mineral deposits may occur in the mantle, but with present technology it is not possible to discover them.
3. It is important to know how the atoms are arranged in grain of metal.
4. It was possible to produce steel which is a superior material.
5. As the hot carbon dioxide rises in the furnace, it meets more hot coke and is reduced to carbon monoxide (CO).
6. It is half aluminium and half oxygen by weight, bonded so firmly that neither chemicals nor heat alone can separate them.

7. It was from this ores, studied by Axel Fredrik Cronstedt, that nickel was isolated and recognized as a new element in 1751.

**Упр. 12. Во 2-м и 4-м абзацах найдите предложения с многофункциональным словом «one». Какую функцию оно выполняет? Переведите предложения на русский язык.**

**Упр. 13. Во 2-м абзаце текста А найдите предложения с многофункциональным словом «to do». Переведите его на русский язык.**

**Упр. 14. Переведите предложения с многофункциональным глаголом «to do» на русский язык и определите его функции.**

1. Nonmetals show greater variety of chemical properties than common metals do.
2. Refining is done to remove deleterious gases and elements from the molten metal to avoid casting defects.
3. What do ferrous metals consist of?
4. We can and do increase the productivity of labour by introducing new machines and methods of work.
5. What properties of copper do you know?

**Упр. 15. Переведите текст А на русский язык.**

#### Text A. Ferrous Metals. Cast Iron

1. There are two groups of metals: ferrous metals and non-ferrous metals. Ferrous metals consist of iron combined with carbon, silicon, phosphorous and other elements. Carbon is the most important of all elements present in ferrous alloys. Ferrous metals are now being used in industry in two general forms: steel and cast iron, which differ in the quantity of carbon. These two ferrous alloys are derived from pig iron which is produced in a blast-furnace in the form of pigs.

2. Cast iron is one of the oldest ferrous alloys known to man. It is the cheapest of the ferrous metals and must be cast into shape as it does not possess the necessary plasticity to form it into desired shapes by plastic methods when in the solid state.

3. There are many variations in the structure and physical properties available in so-called “cast iron”. However, we may classify all cast irons into three groups: grey cast iron, white cast iron and malleable cast iron.

4. Grey cast iron constitutes one of the most valued cast metals. It may be made by melting pig iron and scrap in the cheapest of melting processes, the cupola, and then cast into molds forming intricate shapes that may vary from a few grams to many tons on weight. Many grey cast irons are now cast with the addition of some alloying elements, such as nickel, copper, molybdenum, chromium. The alloys are used to improve the strength and hardness of the castings.

5. When all the carbon in cast iron is in the combined form, the metal has a white metallic appearance. It is therefore called white iron. It is difficult to machine it because most of the carbon present is in the chemical combination with the iron. Almost the only commercial use for white iron is making malleable iron.

6. Malleable cast iron is made by a process of annealing a hard, brittle white cast iron. A white iron casting is placed in a furnace and slowly heated to 1550-1600<sup>0</sup> F, which usually requires two days. Then the cast metal is cooled slowly until the heat reaches 1200<sup>0</sup>F. At this temperature the door of the furnace may be opened and castings removed to cool in air. This treatment changes the hard brittle white cast iron into soft, ductile product called malleable cast iron. This form of cast iron finds many applications.

7. Cast iron tends to be brittle, except for malleable cast irons. With its relatively low melting point, good fluidity, castability, excellent machinability, resistance to deformation and wear resistance, cast irons have become an engineering material with a wide range of applications and are widely used in all fields of engineering.

### **Упр. 16. Соотнесите части предложения.**

- |   |                                     |
|---|-------------------------------------|
| 1. Carbon is the most important                       | a. except for malleable cast irons. |
| 2. These two ferrous alloys are derived from pig iron | b. ferrous alloys known to man.     |
| 3. Cast iron is one of the oldest                     | c. such as nickel, copper, mo-      |

4. We may classify all cast irons into following groups:

5. Many grey cast irons are now cast with the addition of some alloying elements,

6. The alloys are used to improve

7. Almost the only commercial use for white iron

8. Malleable cast iron is made by a process of

9. Cast iron tends to be brittle,

10. Cast irons have become an engineering material

lybdenum, chromium.

d. the strength and hardness of the castings.

e. with a wide range of applications.

f. of all elements present in ferrous alloys.

g. which is produced in a blast-furnace.

h. annealing a hard, brittle white cast iron.

i. grey cast iron, white cast iron and malleable cast iron.

j. is making malleable iron.

**Упр. 17. Расположите предложения в той последовательности, в которой они находятся в тексте.**

1. Cast iron is one of the oldest ferrous alloys known to man.

2. There are two groups of metals: ferrous metals and non-ferrous metals.

3. When all the carbon in cast iron is in the combined form, the metal has a white metallic appearance.

4. We may classify all cast irons into three groups: grey cast iron, white cast iron and malleable cast iron.

5. Grey cast iron constitutes one of the most valued cast metals.

6. Cast iron tends to be brittle, except for malleable cast irons.

7. Malleable cast iron is made by a process of annealing a hard, brittle white cast iron.

**Упр. 18. Ответьте на следующие вопросы.**

1. What do ferrous metals consist of?

2. What are the two most important forms of ferrous metals?

3. What are they derived from?

4. What are the three groups of cast irons?

5. What is important to know about grey cast iron?
6. What is the only commercial use for white iron? Why?
7. What process is malleable cast iron made by?
8. What are the main properties of cast irons?

**Упр. 19. Найдите в каждом абзаце текста А предложение, выражающее его основную мысль.**

**Упр. 20. Передайте содержание текста А в 8-10 предложениях.**

### *Грамматический практикум*

**Упр. 1. Переведите следующие пары предложений, обращая внимание на разные функции инфинитива.**

1. a) To save time is a necessity.  
b) To save time we use calculators.
2. a) The task is to obtain an absolutely new structure.  
b) They are to obtain an absolutely new structure.
3. a) To follow these instructions is really difficult.  
b) To follow these instructions you should read them attentively first.
4. a) To improve the quality of work we use automated devices.  
b) To improve the quality of work is extremely important.
5. a) Our aim is to produce metals of new generation.  
b) This scientist wants to create a metal with the strength of titanium and the beauty of gold.

**Упр. 2. Выберите правильную форму инфинитива и переведите предложения на русский язык.**

1. We study English ... the books on speciality.  
a) to be read  
b) to have read  
c) in order to read
2. The test is ... the properties of the new alloy.  
a) to determine  
b) to have been determined  
c) to be determining

3. ... this alloy in the new construction the engineers should find out its properties first.
  - a) to be used
  - b) to be using
  - c) to use
4. The laboratory assistant changed the temperature ... a crystal structure of this metal.
  - a) to have transformed
  - b) to be transforming
  - c) to transform
5. We were the first ... about the results obtained.
  - a) to be known
  - b) in order to know
  - c) to know
6. Here is the data ...
  - a) to check
  - b) to be checked
  - c) to have been checked
7. The new alloy ... in this structure is very hard.
  - a) to use
  - b) to be using
  - c) to be used
8. The ability ... chemical reactions is a special property of metal surfaces.
  - a) to be catalyzed
  - b) to catalyze
  - c) to be catalyzing

**Упр. 3. Выберите правильный вариант перевода инфинитива в страдательном залоге в функции определения.**

1. The magnetic field to be developed around the coil is rather weak.
  - a) созданное
  - b) которое будет создано
2. This is the substance to be examined.
  - a) которое нужно исследовать
  - b) исследуемое



3. The report to be presented by student Maximov deals with an absolutely new alloy.
  - a) представленный
  - b) который будет представлен
4. The first ores of iron to be mined were deposits of magnetite.
  - a) которые можно было добыть
  - b) добываемые
5. Cast iron is a general term to be applied to iron-carbon containing more than 2.14% of carbon.
  - a) который можно применить
  - b) применяемый

**Упр. 4. Найдите в тексте А инфинитивы и определите их функции.**

**Упр. 5. Переведите следующие предложения на русский язык и определите функции инфинитивов.**

1. The alchemists were the first to take up the study of metals in the mediaeval times.
2. They wanted to change base metal into gold and to find an elixir of life.
3. Perhaps, the use of zinc to protect steel and iron is more important nowadays.
4. Non-ferrous alloys are nearly all alloys which have been developed to meet the specialized needs of industry.
5. Brasses are very ductile and may be treated without heating them.
6. About 3% lead may be added to make brass more machinable.
7. The above-mentioned non-ferrous metals may be mixed in various proportions to form many alloys.
8. These allow to choose casting as a process to be preferred over shaping process in a particular case.
9. To achieve the desired result various kinds of machine-tools are employed.
10. Engineering materials have large industrial applications and their mechanical properties to be studied require much attention.
11. His task was to investigate the effects of various alloying elements on the properties of steel.

12. P. P. Anosov was the first to use microscope for examining the structure of metals and alloys.
13. Many devices to measure different properties of substances are used in our laboratories.
14. To measure pressure is often very important.
15. Pig iron to be used in the production of steel contains impurities.

**Упр. 6. Восстановите структуру предложений с инфинитивом и переведите их на русский язык.**

1. With, to obtain, our task, is, new properties, mixture.
2. Greatly, engineers, the properties of, to improve, modern metals, hope.
3. The life of a man, is, more comfortable, modern industry, to make.
4. To a substance, its temperature, to raise, means, heat, to supply.
5. Are used, special machines, to test metals, for strength.
6. To be discussed, wide industrial applications, have, engineering metals.

Text B. Non-Ferrous Metals

**Упр. 1. Переведите текст на русский язык в письменной форме.**

1. Some non-ferrous metals do not contain iron, such as copper, nickel and tin. Other metals and alloys in which iron may be present but not in the principal proportion are also classed as non-ferrous.

2. Non-ferrous metals are more expensive than ferrous ones. They are used, therefore, only where special properties are required. Most non-ferrous metals have better resistance to corrosion than steel; they are usually more easy to cast and to work, some of them have especially high thermal and electrical conductivity or light weight, etc. The metals most frequently used to make non-ferrous metal casting are copper, tin, zinc, lead, nickel, gold and aluminium.

3. Copper is a reddish-brown metal. It has very high electrical conductivity and high corrosion-resistant qualities. Its electrical conductivity is higher than that of any other metal except the much more expensive silver. The alloying of copper with other elements increases the strength of the metal in some cases and improves the anticorrosive and antifric-tion properties in others. Copper alloys comprise two main groups -

brasses and bronzes. Copper is used for making electrical contacts and wires, pipes, telephone cables, etc.

4. Zinc, a hard, brittle, bluish-white metal, which we use today in a hundred ways was not known in the ancient world. It was almost in modern times that pure zinc was first made in Germany. We use zinc for making brass today. But, perhaps, the use of zinc to protect steel and iron is more important nowadays.

5. Lead is a very heavy bluish-grey metal which is very soft. This metal is highly resistant to corrosion, but its strength is so low that it must be supported by a core of some other metal. Lead is used for lining pipes, acid tanks, etc.

6. Aluminium is a soft silvery white metal. It is ductile, malleable, and can be rolled. It is light in weight, has high corrosion-resistant qualities and is used for automobile and airplane parts as well as for making different light-weight objects-frames, chairs, etc.

7. Tin is a silvery, corrosion-resistant metal. It is hardly used in pure form, but is employed as an alloying element.

9. Nickel is a hard silvery metal. It has high corrosion-resistant qualities and is used for plating iron, steel, brass, and other base metals. The thickness of nickel is often 0.0003 in. for plating on brass and 0.001 in for plating on steel. It really did not come into general use until the 16th century in Germany where it got its name of nickel which means “old Nick” or “demon”. It was so called because it was difficult to work.

9. The above-mentioned non-ferrous metals may be mixed in various proportions to form many alloys.

## **Упр. 2. Прочтите текст В и выберите один из ответов на поставленные вопросы.**

1. What metals are more expensive?
  - a) non-ferrous metals;
  - b) ferrous metals.
2. What do you know about copper?
  - a) it is a reddish-brown metal;
  - b) it has low electrical conductivity;
  - c) it has not very high corrosion-resistant qualities;
  - d) it is used for making electrical contacts and wires.

3. What properties does aluminium possess?
  - a) it is a hard metal;
  - b) it is light in weight;
  - c) it is used for automobile and airplane parts;
  - d) it has low corrosion-resistant qualities.
4. What do you know about nickel?
  - a) it is a soft metal;
  - b) it has high corrosion-resistant qualities;
  - c) it is a silvery metal.

**Упр.3. Вместо пропусков в предложениях вставьте нужное слово в соответствии с текстом.**

ductile, thickness, malleable, strength, rolled, brasses, bronzes,  
expensive, electrical conductivity, brittle, an alloying element,  
corrosion-resistant

1. Non-ferrous metals are more ... than ferrous ones.
2. Copper has very high ... and high ... qualities.
3. Copper alloys comprise two main groups - ... and ... .
4. Zinc is a hard, ... , bluish-white metal which we use today in a hundred ways.
5. Lead is highly resistant to corrosion, but its ... is so low that it must be supported by a core of some other metal.
6. Aluminium is ... , ... , and can be ....
7. Tin is employed as ... .
8. The ... of nickel is often 0.0003 in. for plating on brass and 0.001 in for plating on steel.

**Упр. 4. Ответьте на следующие вопросы.**

1. Do non-ferrous metals contain iron?
2. Are non-ferrous metals more expensive than ferrous ones?
3. What metals are most frequently used to make non-ferrous metal castings?
4. What properties does copper possess?
5. What is zinc used for?
6. What is lead used for?
7. What is aluminium used for?

8. Is tin used in pure form?
9. What is nickel used for? What is the origin of its name?

**Упр. 5. Найдите в каждом абзаце текста В предложения, выражающие его основную мысль.**

**Упр. 6. Кратко передайте содержание текста В на русском и английском языках.**

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## UNIT THREE

**Грамматика:**

Сложные обороты с инфинитивом.

Сложное подлежащее.

Сложное дополнение.

Текст А. Basic Engineering Processes

Текст В. Metal Casting - A Basic Manufacturing Process

**Упр. 1. Прочитайте и запомните следующие слова и словосочетания:**

1. bar – заготовка, болванка, чушка
2. billet – заготовка
3. brazing – пайка, пайка твёрдым припоем
4. to cast – отливать
5. casting – отливка
  - investment ~ - точное литьё по выплавляемым моделям
  - mould ~ - формовочное литьё
  - precision ~ - точное литьё
  - sand ~ - литьё в землю
  - centrifugal ~ - центробежное литьё
6. cross-section – поперечное сечение
7. forging – ковка
8. forming – формовка

9. joining – присоединение, соединение
10. to impart – придавать
11. ingot – слиток
12. to melt – плавить
13. machine – станок
  - boring ~ - станок для расточки
  - forging ~ - станок дляковки
  - milling ~ – фрезерный станок
  - pressing ~ - обжимной пресс
  - stamping ~ - станок для штамповки
14. machining - обработка
15. mill – стан
  - rolling ~ - прокатный стан
  - cold rolling ~ - стан холодной прокатки
  - hot trolling ~ - стан горячей прокатки
16. object – предмет
  - wrought ~ - кованый предмет
17. plate – пластина, листовая сталь
18. to pour – наливать
19. pressing – штамповка, прессование
20. pressure – давление
  - static ~ - постоянное давление
21. process – процесс
  - manufacturing ~ - производственный процесс
  - shaping ~ - строгание
22. processing – обработка
  - metal~ - обработка металла
23. to remove - удалять
24. riveting – склёпывание, заклёпочный шов
25. rod – стержень
26. rolling – прокатка
27. sheet – тонколистовое железо, лист
28. solidify – твердеть, затвердевать
29. soldering – пайка
30. squeezing - сжатие, выжимание
31. stamping – штамповка
32. strip – полоска, планка

33. treatment – обработка  
heat ~ - термическая обработка

34. tube – трубка

35. welding – сварка

**Упр. 2. Выпишите из текста существительные с суффиксом –ing, переведите их с помощью терминологического словаря. От каких глаголов эти существительные образованы?**

**Упр. 3. С помощью терминологического словаря переведите именные группы, в которых**

а) слово «*process*» является определяющим.

manufacturing process, metal-casting process, shaping process, sand - casting process, mould casting process, investment process, precision-casting process, centrifugal casting process.

б) слово «*machine*» является определяющим.

forging machine, stamping machine, pressing machine, milling machine, boring machine, turning machine, grinding machine.

**Упр. 4. Определите способ словообразования следующих слов. Какой частью речи они являются? Переведите эти слова на русский язык.**

treatment, principally, adaptable, requirement, production, commonly, investment, disadvantage, generally, deformation, cross-section, prehistoric, thickness, machine-tool, reproduce, represent.

**Упр. 5. Образуйте от данных существительных глаголы, переведите их на русский язык.**

work – ...

use – ...

cast – ...

alloy – ...

mould – ...

process – ...

machine – ...

fracture – ...

shape – ...

heat – ...

**Упр. 6. Найдите в тексте интернациональные слова, проверьте их перевод и произношение по словарю.**

**Упр. 7. Соотнесите слова с их определениями.**

casting, rolling, forging, grinding, machining, joining,  
heat treatment

1. producing wrought iron from cast iron by heating and hammering it.
2. forming molten metal into a particular shape by pouring or pressing into a mould.
3. crushing into bits or fine particles between two hard surfaces.
4. a hot or cold metalworking process to form the metal from an ingot to a sheet or bar.
5. producing an object by cutting metal with a suitable tool.
6. is the process used to cause the desired property by means of temperature changes.
7. comprises a variety of methods which are used for attaching one surface to another.

**Упр.8. Переведите слова в скобках на русский язык, используя активный словарь урока.**

1. The (*обработка*) of metals is most indispensable part of fabricating a wide range of products.
2. (*Отливка*) is the process of forming metal objects by melting metal and pouring it into (*формы*).
3. (*Формовка*) applies to shaping the metal in the solid state.
4. (*Прокатка*) is considered to be the most economical process for producing a large quantity of simple shapes.
5. (*Обработка*) is the term applied to a group of processes consisting in removing excess metal from cast.
6. (*Термическая обработка*) is used to cause the desired property by means of temperature changes.
7. The most commonly used casting processes are (*литьё в землю*), (*формовочное литьё*), (*центробежное литьё*) and others.
8. Joining comprises a variety of methods such as: (*сварка*), (*пайка*), (*пайка твёрдым припоем*) and others.



**Упр. 9. Найдите в 7-м и 8-м абзацах текста предложения с многофункциональным словом «one», какую функцию оно выполняет. Переведите эти предложения на русский язык.**

**Упр. 10. В 5-м абзаце текста найдите предложение с парным союзом «both...and» и переведите его на русский язык.**

**Упр. 11. Переведите следующие предложения на русский язык. Обратите внимание на перевод парного союза -both...and(u...u, как...так и ) и местоимения both( оба ).**

1. Both pure metals and their alloys are produced from ores at metallurgical plants.
2. Low alloy cast irons usually contain both chromium and nickel.
3. Both dolomite and magnesite are mined and concentrated by conventional methods.
4. Both methods of casting are in use.
5. Both subjects are of great importance for the future engineer.
6. Both fractions would be put back into solution and the process repeated on each of them.
7. Both these processes are used on a commercial scale for separating silver and gold.

**Упр. 12. Во 2-м и 4-м абзаце текста найдите предложения с многофункциональным словом «it», определите его функцию и переведите предложения на русский язык.**

**Упр. 13. В 6-м абзаце текста найдите предложение с конструкцией «there are», переведите предложение на русский язык.**

**Упр.14. В 1-м, 4-м, 5-м абзацах текста найдите предложения с инфинитивным оборотом «сложное подлежащее» и переведите их на русский язык.**

**Упр.15. В 3-м абзаце текста найдите предложения с инфинитивным оборотом «сложное дополнение» и переведите их на русский язык.**

## Упр. 16. Переведите текст на русский язык.

### Text A. Basic Engineering Processes

1. The processing of metals is considered to be the most indispensable part of fabricating a wide range of products. Metal processing is known to involve the following major techniques: casting, forming, machining, joining, and heat treatment. Each of these manufacturing processes are considered to represent a particular branch of the metal-processing industry.

2. *Casting* is the process of forming metal objects by melting metal and pouring it in to moulds. Castings obtain their shape principally when molten metal solidifies in the desired form. Wrought objects, however, are casting to sand then plastically worked to the desired shape.

3. Specialists know metal-casting processes to have certain advantages in comparison with some other shaping processes. Engineers consider metal casting to be highly adaptable to the requirements of mass production. The most commonly used casting processes are: sand casting, mould casting, investment and precision casting, centrifugal casting, and others, each of them possessing its own peculiarities, advantages and disadvantages.

4. *Forming* applies to shaping the metal in the solid state. It is generally assumed to include: rolling, forging, stamping and pressing, that is, the process involving plastic deformation of the metal being shaped.

5. *Rolling* is considered to be the most economical process for producing a large quantity of simple shapes, such as: billet, plate, sheet, strip, bar, rod, wire, tube, etc., on corresponding rolling mills and may be both hot and cold. Rolling operations are aimed at reducing the initial cross-section of the material in such a way that the final predetermined thickness may be either uniform throughout the whole length of the piece, or varying, as desired.

6. *Forging, stamping, and pressing* may be briefly defined as the art of plastically deforming a piece of metal by means of hammering, squeezing, or bending, that is, by applying either impact or static pressure. Forging is used to produce a desired shape with good mechanical properties by means of dies. There are various types of forging, stamping and pressing machines, each type designed for specific purposes.

7. *Machining* is the term applied to a group of processes consisting in removing excess metal from cast, rolled or forged parts in order to obtain a desired shape. To achieve the desired result various kinds of machine-tools are employed, the most important ones are: milling, boring, turning and grinding machines and the lathe.

8. *Joining* comprises a variety of methods such as: welding, soldering, brazing, and riveting, which are used for attaching one surface to another.

9. *Heat treatment* is used to cause the desired property by means of temperature changes. Only by heat treatment it is possible to impart metal the high mechanical properties required for the operation of modern machinery and tools.

**Упр. 17. Укажите, какие предложения соответствуют содержанию текста.**

1. The processing of metals is the most indispensable part of fabricating a wide range of products.
2. Casting is the process of forming metal objects by melting metal and pouring it into cans.
3. Wrought objects are casting to sand then plastically worked to the desired shape.
4. Metal-casting processes have certain disadvantages in comparison with some other shaping processes.
5. Forging is used to produce a desired shape with good mechanical properties by means of dies.
6. Machining is the term applied to a group of processes consisting in removing excess metal from cast, rolled or forged parts in order to obtain a desired shape.
7. Forging, stamping, and pressing are used for attaching one surface to another.

**Упр. 18. Соотнесите части предложения.**

- |  |   |
|--|---|
| 1. Castings obtain their shape principally                 | a. to the requirements of mass production.          |
| 2. Engineers consider metal casting to be highly adaptable | b. for producing a large quantity of simple shapes. |
| 3. Forming applies to shaping the metal                    | c. each type designed for specific purposes.        |

4. Rolling is the most economical process
5. There are various types of forging, stamping and pressing machines,
6. Joining comprises a variety of methods such as:
- d. welding, soldering and brazing which are used for attaching one surface to another.
- e. when molten metal solidifies in the desired form.
- f. in the solid state.

**Упр. 19. Ответьте на следующие вопросы:**

1. What techniques does metal processing involve?
2. Casting is the process of forming metal objects by melting metal and pouring it into **moulds, isn't it?**
3. What are the most commonly used casting processes?
4. What is forming?
5. Is rolling considered to be the most economical process for producing a large quantity of simple shapes?
- 6 There are various types of forging, stamping and pressing machines, **aren't there?**
7. What kinds of machine-tools are employed in order to obtain a desired shape?
8. What methods does joining comprise?
9. Is heat treatment used to cause the desired property by means of temperature changes?

**Упр.20. Перескажите текст А.**

***Грамматический практикум***

**Упр. 1. Переведите следующие предложения на русский язык, обращая внимание на перевод инфинитивного оборота «сложное подлежащее»:**

1. High-grade steel is known to have been frequently used in the constructions of high buildings.
2. A material which breaks with little permanent deformation is said to be brittle.

3. Metals are believed to be the most abundant of materials to supply man's present needs.
4. Molybdenum appears to be the most potent element that can be added to grey iron to improve its toughness.
5. They are certain to increase the strength of steel and alloys by 2 times.
6. Aluminium is said to be a white silver metal that does not rust in the air.
7. All chemical elements, including the metals, are known to be composed of atoms.

**Упр. 2. Восстановите предложения с инфинитивным оборотом «*сложное подлежащее*» и переведите их на русский язык:**

1. is known, aluminium, light metal, to be.
2. is expected, to improve, tin, to the same extent, as chromium, toughness.
3. machine parts, the new alloy, to be used, is reported, for producing.
4. for tensile strength, this metal, to have been tested, was thought.
5. their application, to affect, physical and chemical properties of metal, are known.
6. in some cases, cast steel, to be used, to replace, is known, cast iron.
7. metal, lead, to be ,very, is known, malleable.

**Упр. 3. Переведите следующие предложения на русский язык, обращая внимание на перевод инфинитивного оборота «*сложное дополнение*»:**

1. We know copper to have been used in prehistoric times for making tools.
2. Vanadium makes steel become vibration resistant.
3. We consider non-ferrous metals to play an important role in our economy.
4. They report the new alloy to be used for manufacturing machine parts.
5. This information allows us to predict the properties of the substance.
6. I heard them create an absolutely new alloy with outstanding properties.
7. Every technical student knows this alloy to be used in industry.

**Упр. 4. Выберите предложения, в которых есть инфинитивный оборот «сложное дополнение» и переведите их на русский язык:**

1. We know alloys to be mixed from commercially pure elements.
2. Alloys are known to be mixed from commercially pure elements.
3. The chief engineer wants a new method to be used immediately.
4. The chief engineer wants to use a new method.
5. Everybody knows the advantages of this alloy.
6. We believe ferrous metals to be cheaper than non-ferrous ones.
7. In most cases the metal to be forged is heated to its correct forging temperature but sometimes cold forging is done.

**Упр. 5. Восстановите предложения с инфинитивным оборотом «сложное дополнение» и переведите их на русский язык:**

1. One, to be, alloys, important, assume, extremely, can.
2. We, to be, know, aluminum, metal, the oldest.
3. Alloying of copper, to be increased, the metal, with other metals, enables, the strength, of.
4. Heat, by a liquid, absorbed, to evaporate, causes, the liquid.
5. Suppose, in hardness, they, to vary, metals, and electric conductivity.
6. Some, to resist, make steel, alloying elements, corrosion.

Text B. Metal Casting - A Basic Manufacturing Process

**Упр. 1. Запомните следующие слова и словосочетания:**

1. foundry - литейное производство
2. furnace mold /mould/ - печь, литейная форма, изложница  
sand mold /mould/ - песочная форма
3. refractory - огнеупорный материал
4. heat-resisting material - теплоустойчивый материал
5. surface finish - отделка, окончательная обработка поверхности
6. smooth - гладкий, ровный
7. rough - неровный, шероховатый
8. to pour - разливать
9. die casting - литье под давлением

## **Упр. 2. Переведите текст на русский язык в письменной форме.**

1. Numerous methods have been developed through the ages for producing metal castings, but the oldest method is that of making sand castings in the foundry. Primarily, work is known to consist of melting metal in a furnace and pouring it into suitable sand molds, where it solidifies and assumes the shape of the mold.

2. There are few metal-working industries that do not use castings of one or more kinds. Most castings prove to serve merely as details or component parts of complex machines and products.

3. Metal-casting methods may be classified into three groups, depending upon the type of mold used and the manner in which the molten metal introduced into the mold.

4. The mold may be made from a refractory or heat-resisting material, such as sand, some suitable ceramic material, or plaster. Specialists proved such molds to be used only once. The kind of material, chosen to make the mold, is determined primarily by the melting temperature of the cast metal. Other factors involved are the porosity of the molding material, i.e., the ability to transmit air and gases, and the type of surface finish desired for the product. For example, to obtain a product with smoother finish a finer molding sand is needed; for rougher finish a coarser molding sand is needed.

5. Molten metals may be poured into the mold by gravity or by pressure. The latter method is known as die casting. Die-casting may be furnished by air, hydraulic means, mechanical means or centrifugally.

## **Упр. 3. Продолжите следующие предложения в соответствии с текстом.**

1. The oldest method of metal casting is that of ... .
2. Work consists of ..... .
3. Most castings serve as ..... .
4. Metal-casting methods may be classified into three groups depending upon ... .
5. The mold may be made from ... .
6. To obtain a product with smoother finish ... .
7. Molten metals may be poured into the mold... .
8. Die-casting may be furnished... .

**Упр. 4. Расположите следующие предложения в той последовательности, в которой они находятся в тексте.**

1. Most castings serve merely as details or component parts of complex machines and products.
2. The mold may be made from a refractory or heat-resisting material, such as sand, some suitable ceramic material, or plaster.
3. Numerous methods have been developed through the ages for producing metal castings, but the oldest method is that of making sand castings in the foundry.
4. Metal-casting methods may be classified into three groups.
5. Molten metals may be poured into the mold by gravity or by pressure.
6. The kind of material, chosen to make the mold, is determined primarily by the melting temperature of the cast metal.

**Упр. 5. Ответьте на следующие вопросы:**

1. What is the oldest method of producing metal castings?
2. How can metal casting methods be classified?
3. What material is used for making the mold?
4. To obtain a product with smoother finish a finer molding sand is needed, isn't it?
5. How can the molten metals be poured into the mold?
6. What can you say about die casting?

**Упр. 6. Найдите в каждом абзаце текста В предложения, выражающие его основную мысль**

**Упр. 7. Передайте краткое содержание текста на английском языке, используя разговорные клише.**

It is well-known that ....

It is possible to say ...

In my opinion ....

As far as I know ....

It is important to say .....



## UNIT FOUR

**Грамматика:**

**Причастие.**

**Текст А.** Steel.

**Текст В.** Methods of steel heat treatment.

### **Упр. 1. Прочитайте и запомните следующие слова и выражения.**

1. addition - добавка
2. to apply - применять
3. brine-solution - концентрированный соляной раствор
4. circulation - циркуляция, круговорот
5. to corrode - разъедать
6. cracking - растрескивание
7. ductile - ковкий
8. emulsion - эмульсия
9. to immerse - погружать
10. inclusion - включение
11. material - материал  
raw ~ - сырьё
12. to occur - происходить, случаться
13. pipe - труба, трубопровод
14. plentiful - изобильный
15. quench ant - закалочная среда
16. quenching - закалка
17. to resist - оказывать сопротивление
18. rusty - ржавый
19. steel - сталь  
rust proof ~ - нержавеющая сталь  
stainless ~ - нержавеющая сталь  
medium carbon ~ - средне-углеродистая сталь  
low carbon ~ - низко-углеродистая сталь  
high carbon ~ - высоко-углеродистая сталь  
structural ~ - конструкционная сталь  
tool (silver) ~ - инструментальная сталь

20. stiff – жесткий
21. to strengthen - усиливать, упрочнять
22. tempering – отпуск (стали); закалка с последующим отпуском
23. to toughen - делать жестким
24. welding – сварка
24. wire - проволока, провод

**Упр. 2. Прочитайте следующие интернациональные слова и переведите их без словаря.**

Steel, metal, machine, transport, article, nature, manufacture, number, complex, operations, industrial, method, produce, nation, industry, material, carbon, corrosion, per cent, structural, affect, electromagnet, resistance.

**Упр. 3. Определите, какой частью речи являются следующие слова и переведите их. Обратите внимание на случаи изменения корневой гласной.**

- |                               |  |
|-------------------------------|--|
| 1. strong-strength-strengthen | 6. hard –hardness-harden                         |
| 2. wide-width- widen          | 7. soft-softness-soften                          |
| 3. deep-depth-deepen          | 8. solid-solidification-solidify                 |
| 4. long-length-lengthen       | 9. tough-toughness –toughen                      |
| 5. short-shortage-shorten     | 10. to apply-application-applicable-inapplicable |

**Упр. 4. Переведите на русский язык следующие именные группы.**

Thousands of everyday articles, a sure measure of national development, high-carbon steels, the amount of carbon, razor blades and springs, nitrogen-rich materials, a method of mass steel production, transformer cores, corrosion resistance.

**Упр. 5. Укажите способ словообразования следующих слов и переведите их на русский язык.**

Freely, manufacture, industrial, plentiful, disposal, basic, ability, development, ferrous, stainless, suitable, toughness, production, measure, strengthen, toughen.

**Упр. 6. Найдите в тексте предложения с многофункциональным словом «it». Переведите их на русский язык.**

**Упр. 7. Во 2-м абзаце текста найдите предложение со словом «only» и переведите его на русский язык.**

**Упр. 8. Найдите в 3-м и 4-м абзацах предложения со словом «as», переведите их на русский язык.**

**Упр. 9. Переведите следующие предложения на русский язык, обращая внимание на функции слова «as».**

1. As the time passed the demand for good engineer didn't decrease.
2. I have been a teacher as much as 10 years.
3. The composition of this alloy has been discussed as much as 3 times.
4. As it is rather soft and ductile, copper is alloyed with other elements.
5. Each year nearly as much copper is recovered from recycled material as is obtained from newly mined ore.
6. Natural combinations of metals containing various impurities are known as ores.
7. As an expert you must know all the properties of metals.
8. At present there are several metals which are known as noble ones.

**Упр.10. В 5-м абзаце найдите предложение со словом «for», определите его функцию и переведите предложение на русский язык.**

**Упр. 11. Переведите следующие предложения на русский язык, обращая внимание на функции слова «for».**

1. Copper to be used for tubing has high corrosion resistance.
2. Scientists and engineers devise robots both for home and industry.
3. For that reason exact determinations are difficult.
4. For the reaction to be possible the temperature must be different.
5. It is for him to decide.
6. For a force to exist there must be two objects involved.
7. It is possible for the reaction to occur.
8. Two hours are sufficient for the reaction to occur.
9. The temperature was too low for the substance to decompose.

**Упр.12. Переведите предложения на русский язык. Обратите внимание на перевод «*either...or*» - или...или, ни...ни (в отрицательных предложениях), «*neither...nor*» - ни...ни.**

1. Either tin or copper may be helpful in this application.
2. The most useful alloys are those with either copper or silver or both.
3. Either copper or nickel or both are added to gray iron to improve its strength.
4. Neither titanium nor boron are added to iron for ductility.
5. Neither chromium nor lead are effective in this respect.

**Упр. 13. В 5-м абзаце текста найдите предложение с многофункциональным словом «*to have*». Переведите предложение на русский язык.**

**Упр.14. Переведите следующие предложения на русский язык, обращая внимание на функции глагола «*to have*».**

1. Engineers have to know the best and most economical materials to use.
2. Grey cast iron has its term because of special colour of its fracture.
3. As a structural material steel has two drawbacks.
4. Yet steel has long been used, and in great quantities in structural applications.
5. The scientists had to study the composition of these substances.
6. We have to reduce the amount of carbon in this steel.
7. Steel and cast iron have different carbon content.
8. It has been found that all substances are different combinations of chemical elements.
9. They have made accurate measurements of the temperatures and pressures at different stages of the process.
10. Low carbon steel has to contain from 0.05 to 0.15 per cent of carbon.
11. Aluminium and magnesium have come into production on an industrial scale in the last century.

**Упр. 15. Найдите в тексте предложения с причастием и переведите их на русский язык.**

## Упр. 16. Переведите текст на русский язык.

### Text A. Steel

1. The most useful metal known to people today is steel. It is part of anything we make. Our buildings, machines, roads, transport are all depend on steel. It is our shoes, our watches and thousands of everyday articles. Metal does not occur freely in nature. Instead, we must manufacture it by a number of complex operations.

2. While the use of iron dates back to ancient times, the story of steel is the story of this industrial age. Only a century ago people discovered a method of mass producing steel. Thereafter steel became plentiful and **expensive, displacing iron as the most useful metal at man's disposal.**

3. As a nation grows, so its industries and its people need more and more steel. Steel is the basic raw material of modern industry. The ability to make steel is a sure measure of national development. Steel is a ferrous material with some carbon content. There are two kinds of steel: carbon and alloy steel.

4. The most important metal in industry is iron and its alloy – steel. Steel is an alloy of iron and carbon. It is strong and stiff, but corrodes easily through rusting, although stainless and other special steels resist corrosion. The amount of carbon in steel influences its properties considerably. Steels of low carbon content are quite ductile and are used in the manufacture of sheet iron, wire, and pipes. Medium-carbon steels containing from 0.2 to 0.4 per cent carbon are tougher and stronger and are used as structural steels. Both mild and medium-carbon steels are suitable for forging and welding. High-carbon steels contain from 0.4 to 1.5 per cent carbon, are hard and brittle and are used in cutting tools, surgical instruments, razor blades and springs. Tool steel, also called silver steel, contains about 1 per cent carbon and is strengthened and toughened by quenching and tempering.

5. The inclusion of other elements affects the properties of the steel. Manganese gives extra strength and toughness. Steel containing 4 per cent silicon is used for transformer cores or electromagnets because it has large grains acting like small magnets. The addition of chromium gives extra strength and corrosion resistance, so we can get rust-proof steels. Heating in the presence of carbon or nitrogen-rich materials is

used to form a hard surface on steel (case-hardening). High-speed steels, which are extremely important in machine-tools, contain chromium and tungsten plus smaller amounts of vanadium, molybdenum and other metals.

**Упр. 17. Найдите в правой колонке русские эквиваленты следующих словосочетаний.**

- |                                     |   |
|-------------------------------------|---|
| 1. basic raw material               | a. сплав железа и углерода                              |
| 2. an alloy of iron and carbon      | b. основной сырьевой материал                           |
| 3. manufacture of sheet iron        | c. использоваться для изготовления режущих инструментов |
| 4. to be used in cutting tools      | d. производство листового железа                        |
| 5. surgical instruments             | e. хирургические инструменты                            |
| 6. to be used for transformer cores | f. литейное напряжение                                  |
| 7. large grains                     | g. использоваться для сердечников трансформаторов       |
| 8. casting stress                   | h. большие зерна  |
| 9. yield strength                   | i. предел текучести                                     |

**Упр. 18. Вместо пропусков в предложениях вставьте нужное слово в соответствии с текстом.**

freely, raw material, high-carbon steels, steel, alloy, medium-carbon steels, quenching, heat treatment, tool steel, tempering

1. The most useful metal known to people today is ....
2. Metal does not **occur** ... in nature.
3. Steel is the basic ... of modern industry.
4. Steel is an ... of iron and carbon.
5. ... containing from 0.2 to 0.4 per cent carbon are tougher and stronger and are used as structural steels.
6. ... **contain** from 0.4 to 1.5 per cent carbon.
7. ... **contains** about 1 per cent carbon and is strengthened and toughened by ... **and** ... .
8. **Annealing** is a ... in which a material at high temperature is cooled slowly.

**Упр. 19. Соотнесите части предложения в соответствии с текстом.**

- |  |  |
|--|--|
| 1. Our buildings, machines, roads, transport are   | a) of mass producing steel.                |
| 2. Only a century ago people discovered a method   | b) all depend on steel.                    |
| 3. Steel is a ferrous material                     | c) carbon and alloy steel.                 |
| 4. There are two kinds of steel                    | d) with some carbon content                |
| 5. The amount of carbon in steel                   | e) for forging and welding.                |
| 6. Both mild and medium-carbon steels are suitable | f) strength and toughness.                 |
| 7. Manganese gives extra                           | g) contain chromium and tungsten           |
| 8. High-speed steels,                              | h) influences its properties considerably. |

**Упр. 20. Ответьте на следующие вопросы.**

1. What is steel?
2. What are the main properties of steel?
3. What are the drawbacks of steel?
4. What kinds of steel do you know? Where are they used?
5. What does the addition of manganese, silicon and chromium give to steel?
6. What can be made from mild steels (medium-carbon steels, high-carbon steels)?
7. What kinds of steels can be forged and welded?
8. How can we get rust-proof (stainless) steel?
9. What is used to form a hard surface on steel?
10. What are high-speed steels alloyed with?

**Упр.21. Найдите в каждом абзаце текста А предложения, выражающие его основную мысль.**

**Упр.22. Перескажите текст А на русском и английском языках.**

## ***Грамматический практикум***

**Упр. 1. Переведите следующие предложения, обращая внимание на причастие /.**

1. Alloy is a material consisting of two or more elements.
3. Adding heat we can change the state of the substance studied.
4. Metals can be worked using different machine tools.
5. Natural combinations of metals, containing various impurities, are known as ores.
6. Silicon and manganese can also be used as alloying elements.
7. Hard alloys for cutting tools are produced in this way.
8. Depending on the amount of alloying elements, cast iron is divided into three main groups.
9. One of two processing methods are used to refine concentrated copper.
10. All remaining organics and acids are reused.
11. Isolating and separating radium, Mme Curie found other radioactive elements.

**Упр. 2. Переведите следующие предложения, обращая внимание на причастие //.**

1. The technique applied increased the rate of production.
2. Alloys are usually obtained in the molten state.
3. The concentrated metal is then smelted.
4. The best properties of concrete and steel combined together result in entirely new stronger material.
5. The most common rolled product is sheet.
6. Plastic mixes easily segregate when transported in trucks.
7. Tempering is a heat treatment applied to steel and certain alloys.
8. Hardened steel is too brittle because of internal strains.
9. Copper may be easily rolled and drawn into wire.
10. When burnt, coal produces heat.
11. All matter should be regarded as built of atoms.
12. When freshly prepared, this substance is colourless.



**Упр. 3. Переведите следующие предложения, обращая внимание на причастный оборот и его место в предложении.**

1. Chromium having been added, strength and hardness of steel increased.
2. The melting point of pure iron reaches about 1535 °C, most steels melting in the temperature range from 1300 °C to 1500 °C.
3. Grey cast iron is comparatively easy to machine, most of the carbon being present in a free or uncombined state.
4. Ferrous metals being cheaper, the non-ferrous metals are used only when some characteristic not possessed by iron or steel is essential.
5. The acid tank was made of steel, lead having been used as a lining.
6. Iron and sulphur being ground together, a greenish-black powder is obtained.
7. When being subjected to high temperature, aluminum loses its strength.
8. Having obtained the necessary results, they stopped their experiment.
9. Electrical devices find a wide application in every house, a fridge being one of them.
10. There are different sources of energy, the sun being an unlimited source of all forms of energy.
12. The problem appeared solved when parallel discoveries were made.

**Упр. 1. Прочитайте и переведите текст В на русский язык в письменной форме.**

Text B. Methods of steel heat treatment

1. There is probably no operation in heat treatment that is of greater importance than quenching. Many of the valuable properties of metals, both ferrous and nonferrous, could not be realized without a good quenching operation in one form or another.

2. Quenching is a heat treatment when metal at a high temperature is rapidly cooled by immersion in water or oil. Quenching makes steel harder and more brittle, with small grains structure.

3. The quenchant's most commonly used in commercial heat treating plants are water, brine-solutions, oil and air, but increasing number of applications are being found for molten salts, molten metals and occasionally emulsions of soluble oils and water. Ordinary city water finds

wide use for quenching carbon steels. Water, of course, is the most available and cheapest. Water is generally quite satisfactory if circulation around the work is adequate. Water hardening tool steels are more apt to crack when quenched in fresh water than when quenched in a salt brine. The brine solution contains less dissolved gases and therefore fewer gas bubbles attach themselves to the surface of the steel to cause soft spots.

4. Tempering is a heat treatment applied to steel and certain alloys. Hardened steel after quenching from a high temperature is too hard and brittle for many applications. Tempering, that is re-heating to an intermediate temperature and cooling slowly, reduces this hardness and brittleness. Tempering temperatures depend on the composition of the steel but are frequently between 100 and 650 °C. Higher temperatures usually give a softer, tougher product. The colour of the oxide film produced on the surface of the heated metal often serves as the indicator of its temperature.

5. Annealing is a heat treatment in which a material at high temperature is cooled slowly. After cooling the metal again becomes malleable and ductile (capable of being bent many times without cracking). Such treatment relieves casting stresses, refines the grain, and serves to eliminate the dendritic structure. Annealing raises the tensile and yield strength and increases ductility. It also improves the machinability, especially of high-carbon steels. All these methods of steel heat treatment are used to obtain steels with certain mechanical properties for certain needs.

**Упр. 2. Укажите, какие предложения соответствуют содержанию текста.**

1. Quenching makes steel softer and more brittle.
2. Ordinary city water finds wide use for quenching carbon steels.
3. Tempering is a heat treatment applied to steels and certain alloys.
4. Higher temperatures usually give a softer, tougher product.
5. The length of the oxide film often serves as the indicator of its temperature.
6. Annealing is a heat treatment in which a material at high temperature is cooled quickly.
7. Annealing raises the tensile and yield strength and decreases ductility.

**Упр. 3. Найдите в тексте и переведите на английский язык следующие слова и выражения.**

1. сплав железа и углерода
2. прочный и жесткий
3. легко корродирует
4. нержавеющая сталь
5. низкое содержание углерода
6. ковкость
7. листовое железо, проволока, трубы
8. конструкционные стали
9. пригодный дляковки и сварки
10. твердый и хрупкий
11. режущие инструменты
12. инструментальная сталь
13. упрочнять
14. добавление марганца (кремния, хрома, вольфрама, молибдена, ванадия)

**Упр. 4. Продолжите следующие предложения в соответствии с текстом.**

1. Quenching is a heat treatment ....
2. Water is generally quite satisfactory ... .
3. Tempering temperatures depend on the composition of the steel ... .
4. The colour of the oxide film produced on the surface of the heated metal ... .
5. After cooling the metal again becomes ... .
6. All these methods of steel heat treatment are used to obtain steels ... .

**Упр. 5. Ответьте на следующие вопросы.**

1. What can be done to obtain harder steel?
2. What makes steel softer and tougher?
3. What makes steel more malleable and ductile?
4. What can serve as the indicator of metal temperature while heating it?
5. What temperature range is used for tempering?
6. What are the methods of steel heat treatment used for?

**Упр. 6. Найдите в каждом абзаце текста В предложения, выражающие его главную мысль.**

**Упр. 7. Кратко передайте содержание текста на английском языке, используя следующие выражения.**

1. The text is concerned with... - Текст описывает...
2. The text can be divided into 2, 3... logical parts. – Текст можно подразделить на 2, 3... логические части.
3. ... is described in short ... - ... кратко описывается ...
4. ...are noted - ... упоминаются
5. Attention is drawn to... - Обращается внимание на ...
6. The article is of interest to ... - эта статья представляет интерес для .....

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## UNIT FIVE

Грамматика:

Герундий.

Текст А. Powder metallurgy.

Текст В. Atomization.

**Упр. 1. Прочитайте и запомните следующие слова и выражения.**

1. acicular - игольчатый
2. to achieve - достигать
3. to adhere - прилипать
4. appliance - устройство, приспособление
5. application - применение
6. appreciably - ощутимо, заметно
7. atomization - распыление, пульверизация
8. bar – болванка, чушка
9. brush - щетка

10. capability - способность
11. ceramics - керамика
12. chips - стружка
13. cohesive - связанный, способный к сцеплению
14. coin - монета
15. to consist of- состоять
16. corrosion-resistant - устойчивый к коррозии
17. to decompose - разлагаться
18. die - пресс-форма, штамп
19. to divide into - делить, разделять на
20. droplet - капелька
21. to fuse - плавить
22. to highlight - отмечать, ярко освещать
23. to inject - впрыскивать, вводить, вдувать
24. machining – обработка
25. magnet – магнит  
permanent ~ - постоянный магнит
26. material - материал  
fused ~ - сплавленный материал
27. metallurgy - металлургия  
powder ~ - порошковая металлургия
28. to occur – происходить
29. point – точка  
melting ~ - точка плавления
30. powder – порошок  
pure powder ~ - чистый порошок
31. to powder - превращать в порошок
32. to require - требовать
33. sintering - спекание
34. solidification - застывание, затвердевание
35. stage – фаза, цикл, стадия
36. strength - прочность
37. technique – техническое оснащение, оборудование  
fabrication ~ - производственное оборудование
38. toughness - жесткость, вязкость, прочность
39. to waste – выбрасывать в отходы

**Упр. 2. Прочитайте следующие интернациональные слова и переведите их без словаря.**

Metallurgy, technique, material, individual, structure, manufacture, object, finally, temperature, combination, industry, technology, manner, corrosion, automobile, motor.

**Упр. 3. Переведите следующие существительные и наречия.**

a) с суффиксами *-tion, -sion*

fabrication, dimension, application, solidification, consolidation.

b) с суффиксами *-ence, -ance*

appliance, difference, interference, performance, importance, dependence.

c) с суффиксом *-ing*

forming, processing, sintering, welding, machining, pressing, wrapping, heating.

d) с суффиксом *-ly*

weakly, early, appreciably, ultimately, rapidly, finally, extremely, irregularly, simultaneously.

**Упр. 4. Образуйте от глагола в скобках нужную часть речи и переведите предложения.**

1. The (*result*) part requires very little (*to machine*) to yield a finished product.
2. Little or no (*to machine*) is necessary if the part is made by p/m processes.
3. The (*to consolidate*) metal is then (*to work*) into (*to finish*) parts.
4. First the primary material is physically (*to powder*).
5. P/M consists of (*to make*) solid parts out of metal powders.
6. Small parts for automobiles and appliances are the most common (*to apply*).

**Упр. 5. Определите, какой частью речи являются следующие слова.**

powder, cohesive, intimately, resistant, strength, application, wide, homogeneous, toughness, ceramic, commercial, capability, require, machining, occur, dimensions.

**Упр. 6. Переведите следующие именные группы.**

forming and fabrication technique, individual particle, a weekly cohesive structure, less wasted material, the most common application, long setting times, brushes for motors and dynamos, a significant volume of material, the earliest commercial use.

**Упр.7. Переведите следующие предложения на русский язык. Обратите внимание на перевод слов «only»- только, «the only»- единственный.**

1. The remarkable properties of platinum have been appreciated only in recent years.
2. **The only thing that couldn't help them was time.**
3. Boarding schools were opened in our country only in 1956.
4. Metal objects can be broken down and the metals recycled, plastics can only be dumped or burnt.
5. Molecular forces act only when the distance between molecules is very small.
6. Any substance has only one liquid and one gaseous state.
7. Kinetic energy is the only energy which is closely related with potential energy.
8. Kinematics is the only branch of physics which describes motion with respect to speed, time and distance.

**Упр. 8. В 4-м абзаце текста найдите предложение с многофункциональным словом «that», переведите его на русский язык.**

**Упр. 9. Переведите следующие предложения на русский язык. Определите функцию слова «that (those)».**

1. The advantage of this method is that it has been tested.
2. It's a problem that needs to be discussed in details.
3. This method of work is much more efficient than that one.
4. Modern spaceships can cover distances that are measured in millions of km.
5. Those machines are produced by our machine-building plant.
6. That the launching of the manned spaceship is the greatest scientific achievement is clear to everybody.
7. The properties of alloys are much better than those of pure metals.
8. Engineers hope that we will be able to use copper for centuries on.
9. The good news is that we won't run out of copper.
10. Those two alloys are effective in producing acicular iron.

**Упр.10. Во 2-м абзаце найдите предложения с «than» и переведите их.**

**Упр. 11. Во 2-м абзаце найдите предложение с предлогом «since» и переведите его.**

**Упр. 12. Во 2-м, 3-м и 4-м абзацах найдите предложения с различными степенями сравнения прилагательных и переведите их на русский язык.**

**Упр.13. Найдите в тексте предложения с глаголом-сказуемым в страдательном залоге. Переведите эти предложения на русский язык.**

**Упр. 14. Найдите в тексте предложения с герундием и переведите их на русский язык.**

**Упр. 15. Переведите текст А на русский язык.**



## Text A. Powder Metallurgy

1. P/M consists of making solid parts out of metal powders. So P/M is a forming and fabrication technique consisting of three major processing stages. First, the primary material is physically powdered, divided into small individual particles. Next, the powder is injected into a mold or passed through a die to produce a weakly cohesive structure (via cold welding) very near the dimensions of the object ultimately to be manufactured. Finally, the end part is formed by applying pressure, high temperature, long setting times (during which self-welding occurs), or any combination thereof.

2. The technique originated more than a century ago. The earliest commercial use of P/M was in the production of such high-melting point metals as platinum, tungsten and tantalum. Pure powders of these metals could be made by the low temperature reduction of powders, usually oxides and since these metals melt at extremely high temperatures, it was easier to form solid parts by pressing and sintering the powders than by melting and casting. A much wider range of products can be obtained from powder processes than from direct alloying of fused materials.

3. P/M products are today used in a wide range of industries, from automotive and aerospace applications to power tools and household appliances. At the present day P/M is mainly used in making large numbers of identical components usually of relatively small size, such as permanent magnets, coins, medals, small gear wheels and brushes for motors and dynamos. Each year the international P/M awards highlight the developing capabilities of the technology.

4. The greatest volume of P/M parts is now produced from iron powder. Small, complex parts, such as gears, require much work if machined from bars and a significant volume of material is wasted as chips from the machining. However if the part is made by P/M processes, little or no machining is necessary, there is less wasted material, and the cost is much lower. P/M is able to provide certain structures or alloys that are not possible by methods involving melting. Many small parts for automobiles and appliances are produced in this manner.

5. The second greatest volume of P/M parts is made from aluminum powder. These parts are light, corrosion-resistant, and (if alloy is used)

can be heat treated to appreciably increase the strength. Small parts for automobiles and appliances are the most common applications.

**Упр. 16. Укажите, какие предложения соответствуют содержанию текста.**

1. P/M is a technique consisting of two major processing stages.
2. The greatest volume of P/M parts is now produced from iron powder.
3. Small complex parts, such as gears, require much work.
4. Many large parts for automobiles and appliances are produced in this manner.
5. The consolidated metal is then worked into consolidated parts
6. Small parts for automobiles and appliances are not common applications.

**Упр. 17. Соотнесите части предложения.**

- |                                       |   |
|---------------------------------------|---|
| 1. First, the primary material        | a. more than a century ago.                 |
| 2. The technique originated           | b. injected into a mold.                    |
| 3. The greatest volume of P/M parts   | c. production of high melting point metals. |
| 4. The earliest use of P/M was in the | d. require much work.                       |
| 5. Next the powder is                 | e. is produced from iron powder.            |
| 6. Small complex parts                | f. is physically powdered.                  |
| 7. Significant volume of material     | g. light and corrosion-resistant.           |
| 8. These parts are                    | h. is wasted as chips.                      |

**Упр. 18. Ответьте на следующие вопросы.**

1. What does P/M consist of?
2. What is P/M?
3. What are the three major processing stages?
4. When did the technique originate?
5. What is now produced from iron powder?
6. When is the cost much lower?
7. What are the most common applications?
8. What is the second greatest volume of P/M parts made from?

**Упр.19. Закончите следующие предложения.**

1. Powder metallurgy is ... .
2. The end part is ... .
3. The technique originated ... .
4. Pure powders of these metals ... .
5. A much wider range ... .
6. The greatest volume ... .
7. These parts are ... .

**Упр.20. Найдите в каждом абзаце текста А предложение, выражающее его основную мысль.**

**Упр. 21. Перескажите текст на русском и английском языках.**

***Грамматический практикум***

**Упр. 1. Переведите следующие предложения. Обратите внимание на функции герундия.**

1. The purpose of alloying is to increase the strength of iron.
2. For alloying ferro-alloys or naturally alloyed irons are used.
3. Describe the process of pig iron making.
5. Molybdenum and copper are complementary to one another in improving the toughness of grey iron.
6. Molybdenum is the most potent element for improving the toughness of grey iron.
7. Adding heat changed the substance studied.
8. These castings are extremely difficult to machine unless annealed.
9. Chromium is very important for improving wear resistance.
10. The cooling of individual parts of the casting is irregular.
11. Good fluidity favours the filling of the mold.
12. All bodies contract on cooling.
13. Chromium is the most important alloying element for combating general corrosion.
14. In spite of not having any university education, Faraday made his great discoveries.
15. Tempering is a heat treatment applied to steel and certain alloys.

**Упр. 2. Вставьте предлоги (*at, of, in, on/upon*), где необходимо. Переведите предложения на русский язык.**

1. These substances are alike \_\_\_ having high melting points.
2. I didn't know \_\_\_ his having completed the experiment successfully.
3. This depends \_\_\_ the atomic weights of these substances being equal.
4. He thinks \_\_\_ trying another approach.
5. We succeeded \_\_\_ obtaining reliable results.
6. A metal \_\_\_ reacting is often oxidized.
7. The droplets are capable \_\_\_ being photographed.
8. \_\_\_ being heated to a high temperature many metallic compounds are decomposed.
9. The expansive force of water \_\_\_ freezing is enormous.
10. \_\_\_ switching off the current an e.m. force was induced in the secondary winding.
11. You must aim \_\_\_ obtaining accurate results.
12. We insist \_\_\_ his taking part in the conference.
13. There is no necessity \_\_\_ making any corrections.
14. Is this equipment worth buying? –Of course. I even insist \_\_\_ doing this immediately.
15. Do you mind \_\_\_ my testing this new substance?
16. He insisted \_\_\_ modern equipment being used.
17. She was thinking \_\_\_ becoming an engineer.
18. I'm really looking forward \_\_\_ going to London.

**Упр. 3. Восстановите структуру предложения с герундием, переведите их на русский язык.**

1. Melting, ice, polar, warming, will cause, global.
2. Hear of having, invented, been, a new substance, we.
3. Mind, doesn't, the, being helped, the student.
4. Are, interested in, they, new, developing, technologies.
5. Other, there, ways, were, high, of, voltage applying.

**Упр. 15. Прочитайте текст В и переведите на русский язык.**

## Text B. Atomization

1. The most common method of producing metal powders is atomization of a liquid. A stream of molten metal is broken up into small droplets with a jet of water, air, or inert gas such as nitrogen or argon. Atomization in water yields irregularly shaped particles that can be pressed to a higher initial strength and density. In other atomization processes centrifugal force is used. The metal can be poured onto a spinning disk, that breaks up the stream, or a spinning rod can be melted by an electric arc so that it throws off particles as it spins.

2. Any fusible material can be atomized. The liquid metal being atomized may be an alloy or a pure metal that will subsequently be blended with other elements to form an alloy. Powders of different sizes (and of different metals) are then blended for pressing into parts. The resulting parts require very little machining to yield a finished product.

3. Powder compaction, also known as powder pressing is the process of compacting metal powder in a die through the application of high temperature. In a number of these applications the parts may require very little additional work, making for very cost efficient manufacturing. The density of the compacted powder is directly proportional to the amount of pressure applied. In some pressing operations (such as hot isostatic pressing) compact formation and sintering occur simultaneously.

4. Sintering is a method for making objects from powder by heating the material (below its melting point- solid state sintering) until its particles adhere to each other. Sintering is traditionally used for manufacturing ceramic objects, and has also found uses in P/M. A special form of sintering still considered part of P/M, is liquid state sintering. In liquid state sintering at least one but not all elements are existing in a liquid state.

5. Sintered bronze in particular is frequently used as a material for bearings, since its porosity allows lubricants to flow through it or remain captured within it. Sintered bronze and stainless steel are used as filter materials in applications requiring high temperature resistance.

6. Powders can also be rolled to produce sheets. The strip is then sintered and subjected to another rolling and sintering. Rolling is commonly used to produce sheet metal for electrical and electronic components as well as coins.

7. Extrusion processes are of two general types. In one type the powder is mixed with a binder at room temperature. In the other the powder is extruded at elevated temperatures without fortification. Extrusions with binder are used extensively in the preparation of tungsten-carbide composites. There appears to be no limitation to the variety of metals and alloys that can be extruded.

8. Metallurgists can sinter most if not all metals. This applies especially to pure metals produced in vacuum which suffer no surface contamination. Sintering with subsequent reworking can produce a great range of material properties. Changes in density, alloying, or heat treatments can alter the physical characteristics of various products.

**Упр. 1. Продолжите следующие предложения в соответствии с текстом.**

1. Atomization in water yields ... .
2. Powders of different sizes ... .
3. Powder compaction is ... .
4. Sintering is ... .
5. Powders can also ... .
6. Rolling is ... .
7. Metallurgists can ... .

**Упр. 2. Ответьте на следующие вопросы.**

1. What is atomization?
2. What is blended for pressing into parts?
3. What is powder pressing?
4. When do parts require very little work?
5. What is sintering?
6. Where are sintered bronze and stainless steel used for?
7. Can powders produce sheets?
8. What can alter the physical characteristics of various products?

**Упр. 3. Вместо пропусков в предложениях вставьте нужное слово в соответствии с текстом.**

properties, powders, machining, sizes, finished, stainless steel, application, manufacturing, sintering.

1. ... of different ... are blended for pressing into parts.
2. The resulting parts require very little ... to yield a ... product.
3. In some operations compact formation and ... occur simultaneously.
4. Sintering is traditionally used for ... ceramic objects.
5. Sintered bronze and ... are used in ... requiring high temperature resistance.
6. Sintering with subsequent reworking can produce a great range of material ... .

**Упр. 4. Расположите следующие предложения в той последовательности, в которой они находятся в тексте.**

1. Powder compaction is the process of compacting metal powder in a die through the application of high temperature.
2. Powders of different sizes (and of different metals) are blended for pressing into parts.
3. Sintering is traditionally used for manufacturing ceramic objects.
4. Extrusions with binder are used extensively in the preparation of tungsten-carbide composites.
5. Sintered bronze in particular is frequently used as a material for bearings.
6. Metallurgists can sinter most if not all metals.
7. The most common method of producing metal powders is atomization of a liquid.

**Упр. 5. Найдите в каждом абзаце текста В предложения, выражающие его основную мысль.**

**Упр. 6. Кратко передайте содержание текста В на русском и английском языках.**

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## UNIT SIX

Аннотация. Рекомендации по составлению аннотации.

Пример аннотации. The Cupola Furnace.

Текст А. The Bessemer Converter.

Текст Б. The Blast Furnace.

### Рекомендации по составлению аннотации

**Аннотация (от лат. *annotatio*– замечание)** – это краткая характеристика работы(3-5 предложений) с изложением наиболее важных положений. В аннотации перечисляются главные вопросы, проблемы, изложенные в тексте, а также может характеризоваться его структура.

1. Аннотация пишется своими словами, просто и кратко. Следует избегать сложных конструкций и предложений.

2. Изложение аннотируемой части рекомендуется начинать с существа вопроса, избегать повторения заголовка.

3. В тексте аннотаций и рефератов часто вводятся неопределенно-личные местоимения и страдательные конструкции типа "сообщается", "описывается", "излагаются" и т.д., что позволяет усилить справочно-информационную роль аннотации и обобщить информацию.

4. Рекомендуется названия фирм, исследовательских центров, институтов, компаний давать в их оригинальном написании.

5. Следует использовать аббревиатуры и различные сокращения в соответствии с общепринятыми в справочной литературе.

### Список выражений, рекомендуемых для написания аннотации.

1. The article (paper, book, text, etc.) deals with... - Эта статья (работа, книга, текст и т.д.) касается...

2. As the title implies the article describes.... - Согласно названию, в статье описывается...

3. The article under discussion is about... - Обсуждаемая статья...

4. The given text is devoted to the problem of... - Данный текст посвящен проблеме...



5. The text informs the reader of... - Текст информирует читателя о...
6. The text is concerned with... - Текст описывает...
7. The text can be divided into 2, 3... logical parts. – Текст можно разделить на 2, 3... логические части.
8. It is specially noted... - Особенно отмечается...
9. It is spoken in detail... - Подробно описывается.....
10. The text gives a valuable information on.... – Текст дает ценную информацию...
11. Much attention is given to... - Большое внимание уделяется...
12. It (the article) gives a detailed analysis of .... – (В статье) приводится детальный анализ...
13. It draws special attention to... - Особое внимание уделяется...
14. It should be stressed (emphasized) that... - Следует подчеркнуть, что...
15. ...is proposed - ... предлагается.
16. ...are examined - ... проверяются (рассматриваются).
17. ...are discussed - ... обсуждаются.
18. ...are noted - ... упоминаются.
19. ...are emphasized - ... подчеркиваются.
20. The method proposed ... etc. – Предлагаемый метод... и т.д.
21. ... is described in short ... - ... кратко описывается ...
22. ... is described in detail. - ... подробно описывается.
23. is introduced .... - ...вводится ...
24. ...is given ... - ... дается (предлагается) ...
25. ... is investigated .... – исследуется.
26. ... is analyzed. - ...анализируется.
27. ... is formulated. – ... формулируется.
28. ... is reported. – ...сообщается.
29. Attention is drawn to... - Обращается внимание на ...
30. Data are given on... - Приведены данные о ...
31. Data is given on ... - Приводится информация о ...
32. Attempts are made to analyze, formulate... - Делаются попытки проанализировать, сформулировать ....
33. The author arrives at the conclusion that ... - Автор приходит к выводу, что ....
34. Conclusions are drawn .... – Делаются выводы ....
35. Recommendations on ... are given. – Даны рекомендации ...

36. The article is of great help to ... - Эта статья будет полезной ...

37. The article is of interest to ... - эта статья представляет интерес для .....

## The Cupola Furnace

The metal used in various kinds of castings is melted in several types of furnaces. Cast iron is usually melted in a cupola.

The cupola is the oldest type of furnace and the most economical. It may be of different sizes. Cupola capacities vary from 1 to 15 tons of metal per heat /the amount of metal melted at a time/. It is difficult to produce metal of precise uniform quality in the cupola as compared to furnaces in which uniformity of the molten material can be controlled by frequent and periodic tests and adjustment.

The cupola is a cylindrical shell lined with firebrick. The main furnace structure is usually supported on cast-iron legs. The opening at the bottom of the furnace may be closed by cast-iron doors. Refractory sand protects these doors during the melting of the charge, which is placed over the layer of sand. At the end of the melting operation the doors open and materials remaining from the charge drop down through the opening.

A row of openings or tuyeres is arranged around the shell at its base to introduce air to the coke bed. A wind box placed at the level of the tuyeres supplies the air.

The cupola is generally divided into a number of zones: the crucible zone, tuyere zone, combustion zone, melting zone, preheating zone, and the stack zone.

The crucible zone is located at the bottom of the cupola. Molten iron and slag accumulate in this space.

The combustion zone extends from the bottom of the tuyeres to the top of the coke bed.

The melting and preheating zones extend the top of the combustion zone to the charging door. The location of the charging door depends upon the size of the cupola.

The purpose of the stack, which is another zone of the cupola, is to carry off the waste gases. It is located above the charging door.

## **Примечания и комментарии**

1. Adjustment – настройка, регулировка;
2. Capacity – производительность;
3. Charge – загрузка, шихта;
4. Coke bed – коксовый пласт
5. Cupola – вагранка
6. Firebrick – огнеупорный кирпич
7. Opening - отверстие
8. Shell – корпус, кожух
9. Tuyere – дутьевая фурма (вагранки)
10. Wind box –воздушная коробка
11. Zone
  - Crucible ~ - тигельная зона
  - Combustion ~ - зона сгорания
  - Preheating ~ -зона предварительного нагрева
  - Stack ~ - шахта

## **Пример аннотации**

### **Вариант 1**

The text describes the oldest and the most economical type of furnaces. Much attention is given to the cupola furnace design, a number of cupola zones are spoken in detail. The article is of particular use to the students of Mechanical and Technological Faculty.

### **Вариант 2**

The given text informs the reader of the oldest type of furnaces. The text can be divided into 3 logical parts. Advantages and disadvantages of the cupola are considered in the first part. The second part draws our attention to the cupola furnace design. Data on a number of cupola zones is given in the third part. The text is of interest to the students of Mechanical and Technological Faculty.

**Упр. 1. Прочитайте и запомните следующие слова и выражения.**

1. blast - дутье
2. to carry on the process – продолжать процесс
3. clay - глина
4. to convert - превращать
5. to cut off - срезать
6. to free - освобождать
7. to oxidize - окислять
8. tilting vessel – качающийся (опрокидывающийся) сосуд
9. trunnion - цапфа
10. to turn down – поворачивать вниз

**Упр. 2. Найдите в правой колонке русские эквиваленты следующих словосочетаний.**

- |   |   |
|---|---|
| 1. molten pig iron                                      | a. воздух продувается через шихту                         |
| 2. generate heat  | b. металл удаляется из конвертера                         |
| 3. major part   | c. грушевидный качающийся сосуд                           |
| 4. heat-resisting bricks                                | d. вырабатывать тепло                                     |
| 5. the air is blown through the charge                  | e. основная часть   |
| 6. the mouth of the converter                           | f. струя (поток) практически чистого кислорода            |
| 7. very little visibility                               | g. расплавленный чушковый чугун                           |
| 8. the flame changes in character and increases in size | h. жаропрочный кирпич                                     |
| 9. metal is removed from the converter                  | i. незначительная видимость                               |
| 10. low cost of the process                             | j. горловина конвертера                                   |
| 11. a jet of nearly pure oxygen                         | k. характер пламени изменяется и размер его увеличивается |
| 12. pear-shaped tilting vessel                          | l. низкая стоимость процесса                              |

### **Упр.3. Переведите текст на русский язык.**

#### Text A. The Bessemer Converter

In the Bessemer process of making steel air is blown through the molten pig iron, and the oxygen of the air combines with the carbon, manganese, and silicon of the pig iron. This action generates heat and frees the iron from the major part of its impurities thus converting the iron into steel.

The Bessemer converter, in which the process takes place, is a pear shaped tilting vessel made of steel and lined with heat-resisting bricks and clay. It is mounted on trunnion. The top of the converter is cut off to form a mouth through which molten metal is charged and discharged. In the bottom of the vessel are number of holes, called tuyeres, through which air is blown. The air is blown through the charge and oxidizes the silicon, manganese and carbon. The combustion of these materials generates the heat to carry on the process. The progress of the operation is shown by the flame issuing from the mouth of the converter. At first this flame is short and dry with very little visibility; then a reddish-brown flame occurs during the period when silicon and manganese are oxidized. As the carbon burns, the flame changes in character and increases in size, becoming yellowish-white.

Suddenly the flame drops, and the operator must stop the blast of air. The vessel is turned down on its side and metal is removed from the converter.

**The whole operation of “blow” usually takes from 12 to 18 minutes.**

Bessemer steel is used because of the low cost of the process. Today we have a new, more perfect technology of converting pig iron into steel in which the blast of air is replaced by a jet of nearly pure oxygen.

### **Упр. 4. Ответьте на следующие вопросы:**

1. What is the given text about?
2. What is described in detail?
3. What conclusions does the author arrive at?

### **Упр. 5. Составьте аннотацию к тексту А с учетом рекомендаций.**

**Упр. 6. Закончите предложения.**

1. In the Bessemer process the iron is converted...
2. The Bessemer converter is a pear-shaped tilting vessel made of .....
3. The top of the converter is cut off to .....
4. The air is blown through .....
5. The combustion of silicon, manganese and carbon generates...
6. The progress of the operation is shown by .....
7. When the flame drops...
8. The vessel is turned down and...
9. The whole operation of "blow" usually .....
10. Bessemer steel is used because of .....

**Упр. 7. Передайте содержание текста А.**

**Упр. 8. Прочитайте текст В и составьте аннотацию.**

Text B. The Blast Furnace

The modern blast furnace is a tall circular structure about 100 ft. high built of firebrick and reinforced by steel shell on the outside. It is the largest and most complicated metallurgical apparatus in the world. It is capable of producing more than one thousand tons of pig iron every twenty four hours and consumes enormous quantities of raw materials.

Iron is reduced from the ore in the furnace by means of coke charged with ore. The impurities are fluxed or slogged by means of limestone also charged with the ore. The air blown through the furnace is heated by means of stoves that constitute an important part of the apparatus of the blast furnace. These stoves are cylindrical towers lined with firebrick. Gas burnt in the bottom of the stoves heats the brickwork in them to about 1150°C. Thus, air pumped through the stoves is heated to about 900°C before it is blown into the furnace.

The ore, coke, and limestone are conveyed from the ground to the top of the furnace by means of two cars running on an inclined hoist. The cars dump the charge into a hopper from which it is then dropped into the furnace by lowering the upper bell then lowering the lower bell. The use of these two bells prevents gases and flame from being blown into

the air from the top of the furnace every time it is charged. Hot air is blown into the furnace through the tuyeres in the hearth of the furnace.

As the iron and slag are formed, they drop to the hearth at the bottom of the furnace. Since the iron is heavier than the slag, it settles to the bottom while the slag floats on the top of the molten iron. There are two holes in the hearth of the blast furnace. The iron is tapped from the lower hole; the slag is tapped from the upper hole.

The molten iron is transferred by a ladle to the molds where it is cast into pigs or to the steel making furnaces.

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## **Тексты для дополнительного чтения и перевода**

### Text 1

#### A History of Metalworking

Modern life is possible because we have metals and we know how to use them. They support our buildings and bridges, allow us to fly, sail and get around, and are fundamental in industry and trade. With metals we measure time, build monuments, worship, adorn ourselves, make art and wage war. But it has not always been like this.

In the ancient past, metals were unknown. When they were discovered and man learned how to work them, people's lives changed. The history of metals can be traced back to almost nine thousand years ago, in the Near East. The first metal to be used was copper, when the ancient inhabitants of Palestine and Anatolia hammered pieces of natural copper to make tools. Over the following centuries, man learned to extract copper from ores and to mix it with tin to make bronze.

Bronze enabled ancient empires to produce weapons for their conquering armies. Strong tools were used in agriculture and the manufacture of handicrafts, and production increased. Metals have been used for many purposes since those times. Gold and silver adorned great figures and accompanied them to their graves. They were used in religious worship for making ornaments and symbols.

New technical processes made it possible for other metals to be used. Bronze and iron metallurgy and gold and silver metalwork thus grew side by side.

By 1000 B.C., almost all the peoples of the Old World had metals; from the Mediterranean and right across Persia to India, weapons, instruments and a wide range of ornaments were made of bronze and gold. Metallurgy spread from China to Japan, where the samurais were armed, and also to south east Asia, where temples were given golden domes.

By the time the Roman Empire fell, metal implements were part of everyday life. Trade was impossible without coins, as were daily activities without metal tools. The religions of the ancient world in Asia, Africa and Europe turned to gold and silver for making sacred objects.



West African states south of the Sahara began to use bronze around 1300 to decorate their royal cities. Convoys crossed the desert in order to supply blacksmiths with the raw materials they needed and to distribute their products.

Ancient South Americans began to work copper and gold around 1500 B.C. By 500 A.D., metallurgy had become a common activity from central Mexico to northern Chile and Argentina. Individual styles developed in each region

The history of mankind in the last nine thousand years has been the history of metals, as it is with these that we have built the world we live in.

## Text 2 Metalworking

A foundry is a factory that produces metal castings. Metals are cast into shapes by melting them into a liquid, pouring the metal in a mold, and removing the mold material or casting after the metal has solidified as it cools. The most common metals processed are aluminium and cast iron. However, other metals, such as bronze, brass, steel, magnesium, and zinc are also used to produce castings in foundries. In this process, parts of desired shapes and sizes can be formed.

Metalworking is the process of working with metals to create individual parts, assemblies, or large-scale structures. The term covers a wide range of work from large ships and bridges to precise engine parts and delicate jewelry. It therefore includes a correspondingly wide range of skills, processes, and tools.

In metalworking, casting involves pouring liquid metal into a mold, which contains a hollow cavity of the desired shape, and then allowing it to cool and solidify. The solidified part is also known as a casting, which is ejected or broken out of the mold to complete the process. Casting is most often used for making complex shapes that would be difficult or uneconomical to make by other methods.

Melting is performed in a furnace. Virgin material, external scrap, internal scrap, and alloying elements are used to charge the furnace. Virgin material refers to commercially pure forms of the primary metal used to form a particular alloy. Alloying elements are either pure forms of an alloying element, like electrolytic nickel, or alloys of limited composi-

tion, such as ferroalloys or master alloys. External scrap is material from other forming processes such as punching, forging, or machining. Internal scrap consists of gates, risers, and defective castings.

The process includes melting the charge, refining the melt, adjusting the melt chemistry and tapping into a transport vessel. Refining is done to remove deleterious gases and elements from the molten metal to avoid casting defects. Material is added during the melting process to bring the final chemistry within a specific range specified by industry and/or internal standards. Certain fluxes may be used to separate the metal from slag and/or dross and degassers are used to remove dissolved gas from metals that readily dissolve certain gasses. During the tap, final chemistry adjustments are made.

### Text 3 Alloys

An alloy is a mixture of two or more elements in which the main component is a metal. Most pure metals are either too soft, brittle or chemically reactive for practical use. The aim of making alloys is generally to make them less brittle, harder, resistant to corrosion, or have a more desirable color and luster. Of all the metallic alloys in use today, the alloys of iron (steel, stainless steel, cast iron, tool steel, alloy steel) make up the largest proportion both by quantity and commercial value. Iron alloyed with various proportions of carbon gives low, mid and high carbon steels, with increasing carbon levels reducing ductility and toughness. The addition of silicon will produce cast irons, while the addition of chromium, nickel and molybdenum to carbon steels (more than 10%) results in stainless steels.

Other significant metallic alloys are those of aluminium, titanium, copper and magnesium. Alloys specially designed for highly demanding applications, such as jet engines, may contain more than ten elements.

#### *Ferrous metals*

The term "ferrous" is derived from the Latin word meaning "containing iron". This can include pure iron or an alloy such as steel. Ferrous metals are often magnetic, but not exclusively.

Ferrous metals include mild steel, carbon steel, stainless steel and cast iron. These metals are primarily used for their tensile strength and dura-

bility, especially mild steel which helps hold up the tallest skyscrapers and the longest bridges in the world. You can also find ferrous metals in housing construction, industrial containers, large-scale piping, automobiles, rails for railroad and transportation, most of tools and hardware you use around the house, and the knives you cook with at home. Most ferrous metals also have magnetic properties, which makes them very useful in the creation of large motors and electrical appliances.

#### *Non-ferrous metals*

Non-ferrous metals include aluminum, brass, copper, nickel, tin, lead, and zinc, as well as precious metals like gold and silver. While non-ferrous metals can provide strength, they are primarily used where their differences from metals can provide an advantage. For instance, non-ferrous metals are much more malleable than ferrous metals. Non-ferrous metals are also much lighter, making them well-suited for use where strength is needed, but weight is a factor, such as in the aircraft or canning industries. Because they contain no iron, non-ferrous metals **have a higher resistance to rust and corrosion, which is why you'll find** these materials in use for gutters, water pipes, roofing, and road signs. Finally, they are also non-magnetic, which makes them perfect for use in small electronics and as electrical wiring. As far as recycling goes, aluminum is the third most recycled material in the world.

#### *Precious metals*

Precious metals are rare metallic chemical elements of high economic value. Chemically, the precious metals are less reactive than most elements, have high luster and high electrical conductivity. The best-known precious metals are gold and silver. While both have industrial uses, they are better known for their uses in art, jewelry, and coinage. Other precious metals include the platinum group metals: ruthenium, rhodium, palladium, osmium, iridium, and platinum, of which platinum is the most widely traded. The demand for precious metals is driven not only by their practical use, but also by their role as investments and a store of value.

## Text 4

### The Different Types of Stainless Steel

One of the key advantages of stainless steel lies in the materials sheer versatility. The different types of stainless steel are created by adding different levels of various alloys such as chromium or nickel during the manufacturing process. **There are five basic types of stainless steel, each with its' own individual composition and therefore with particular properties.**

*Austenitic stainless steel* is the most commonly used steel. Its basic make up is 18% chromium and 8% nickel and this is boosted by the addition of elements such as manganese and nitrogen. It is highly resistant to corrosion and is easily drawn into wires or hammered into thin sheets. The versatility of this type of steel is demonstrated by the fact that it accounts for more than 70% of all steel production. Common uses for this type of steel include food processing equipment, kitchen sinks and chemical equipment.

*Martensitic* type of steel was actually the first to be commercially developed, and in those initial stages it was used mainly to make cutlery. It has a carbon content which is higher than most other stainless steels at between 0.1 and 1.2%. Additional materials found in martensitic stainless steel include molybdenum and nickel. The application of high temperature to this steel makes it harder and it also has some magnetic properties. The most common uses for this type of stainless steel are the manufacture of things such as spindles, pins, knife blades, shafts and surgical instruments.

*Ferritic steel* contains 10.5% of carbon and about 27% of chromium. Amongst the properties which ferritic steel can boast are the following; it is magnetic, is not as ductile as martensitic and austenitic steel and does not, unlike other types of steel, become harder after intense heating. The fact that it is very highly resistant to corrosion means that it can safely be used in sea water, and this is despite the fact that it is generally actually less durable than austenitic steel. This ability to resist corrosion means that it is also the material of choice when manufacturing the likes of boilers and washing machines. It is also extremely useful when making things such as car trim and exhaust systems.

*Duplex stainless steel* is made by mixing together the basic components of austenitic and ferritic steel. The two types of steel are combined

in equal measure and the resulting steel contains a higher level of chromium and an amount of nickel which is lower. The fact that it is a mix of two different steels means that it brings the best of both types to bear, being more resistant than any other type of steel to corrosion as well as being able to deal with stress and displaying some magnetic properties. It is easy to work with, being simple to weld and to form into specific shapes. The very **best quality stainless steel is actually known as ‘super-duplex’**. **The particular qualities of duplex and super duplex mean that it** is highly suited to use in tools or machinery that are to be employed in marine conditions.

Initially, this type of stainless steel is austenitic in nature and is then changed by the addition of other elements. Once altered, it becomes **extremely tough, durable and hard wearing**. **One of its’ other chief advantages** is the way in which its shape can be altered once it has been heated to a sufficiently high temperature. Whilst being tougher than austenitic steel, it is equally as resistant to corrosion and this feature makes it especially useful in the manufacturing of aircraft parts as well as the creation of shafts and pumps.

## Text 5 Powder metallurgy

Powder metallurgy (P/M) consists of making solid parts out of metal powders. The powder is mixed with a lubricant, pressed into a die to form the desired shape, and then sintered, or heated to a temperature below the melting point of the alloy where solid-state bonding of the particles takes place. In the absence of any external force, sintering typically leaves the sample containing about 5 percent pores by volume, but, when pressure is applied during sintering (a process called hot pressing), virtually zero porosity remains. In some parts made by mixing two different elements, one component melts at the sintering temperature, and this liquid phase aids sintering of the solid particles.

The earliest commercial use of P/M was in the production of such high-melting-point metals as platinum, tungsten, and tantalum. P/M played an important role in the development of tungsten filaments for electric light bulbs.

Another early P/M product was porous-metal bearings and filters. In such parts sintering is conducted at a relatively low temperature so that the pores between the particles remain open and connected.

Cemented carbides form another class of sintered product.

The greatest volume of P/M parts is now produced from iron powder, a process that was first developed during World War II. Small, complex parts, such as gears, require much work if machined from steel bars, and a significant volume of material is wasted as chips from the machining. However, if the part is made by P/M processes, little or no machining is necessary, there is less wasted material, and the cost is much lower. Many small parts for automobiles and appliances are produced in this manner. The second greatest volume of P/M parts is made from aluminum powder. These parts are light, corrosion-resistant, and can be heat treated to appreciably increase the strength. Small parts for automobiles and appliances are the most common applications.

A recent process uses P/M methods to improve the homogeneity and toughness of high-alloy tool steels. Cast ingots of these alloys contain a coarse network of brittle phases that are very difficult to break up by hot working, but if, instead of being cast into ingots, the liquid is atomized (solidified as small droplets), the rapidly solidified particles will be homogeneous. This powder can then be hot pressed into consolidated bars with better mechanical properties than those produced by ingot casting. Consolidation is often achieved by hot isostatic pressing, wrapping the pressed powder in an envelope of steel or glass, and heating it in a hot inert gas at high pressure. The consolidated metal is then worked into finished parts.

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