

**Государственное бюджетное профессиональное образовательное учреждение
Республики Крым
«Керченский морской технический колледж»**

**МЕТОДИЧЕСКОЕ ПОСОБИЕ
для студентов III курса
специальности 22.02.06 «Сварочное производство»
по дисциплине
«ИНОСТРАННЫЙ ЯЗЫК»**

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ВВЕДЕНИЕ

Методическое пособие по дисциплине «Иностранный язык» предназначено для студентов ГБП ОУ РК «КМТК» III курса, обучающихся по специальности 22.02.06 «Сварочное производство».

В разработке предоставлен необходимый материал для организации практических занятий по дисциплине «Иностранный язык»: перечень слов, необходимых для усвоения после каждой темы, тексты профессиональной направленности, упражнения, а также контрольные работы.

Целью данной методической разработки является обучение чтению оригинальной литературы по специальности, а также текстов общенаучного содержания и инструктивного характера. Задания позволяют проводить работу по формированию и развитию лексических и грамматических навыков, развитию речевых умений.

Данное методическое пособие может использоваться на практических занятиях по иностранному языку, для самостоятельной работы студентов, а также может пригодиться при подготовке к промежуточной аттестации или текущему контролю.

ТЕМА I. Альтернативные виды сварки

1. Выучите слова и выражения. При необходимости проверьте транскрипцию.

1	cold welding	холодная сварка
2	friction welding	сварка трением
3	laser beam welding	лазерная сварка
4	diffusion welding	диффузионная сварка
5	ultrasonic welding	ультразвуковая сварка
6	explosive welding	сварка взрывом
7	to prepare surface	готовить поверхность
8	axis	ось
9	filler metal	присадочный материал
10	distortion	искажение
11	(dis)similar	(не)похожий
12	workpiece	изделие
13	to rotate rotation	вращать вращение
14	cycle	цикл
15	narrow	узкий
16	to compare	сравнивать
17	consumption	потребление
18	deep	глубокий
19	to require	требовать
20	to apply	наносить
21	(un)suitable	(не)подходящий
22	environmentally friendly	экологически чистый
23	rapid	быстрый

2. Прочитайте и переведите текст:

Cold welding. Cold welding, the joining of materials without the use of heat, can be accomplished simply by pressing them together. Surfaces have to be well prepared, and pressure sufficient to produce 35 to 90 percent deformation at the joint is necessary, depending on the material. Lapped joints in sheets and cold-butt welding of wires constitute the major applications of this technique. Pressure can be applied by punch presses, rolling stands, or pneumatic tooling. Pressures of 1,400,000 to 2,800,000 kilopascals (200,000 to 400,000 pounds per square inch) are needed to produce a joint in aluminum; almost all other metals need higher pressures.

Friction welding. In friction welding two work pieces are brought together under load with one part rapidly revolving. Frictional heat is developed at the interface until the material becomes plastic, at which time the rotation is stopped and the load is increased to consolidate the joint. A strong joint results with the plastic deformation, and in this sense the process may be considered a variation of pressure welding. The process is self-regulating, for, as the temperature at the joint rises, the friction coefficient is reduced and overheating cannot occur. The machines are almost like lathes in appearance. Speed, force, and time are the main variables. The process has been automated for the production of axle casings in the automotive industry.

Laser welding. Laser welding is accomplished when the light energy emitted from a laser source is focused upon a workpiece to fuse materials together. The limited availability of lasers of sufficient power for most welding purposes has so far restricted its use in this area. Another

difficulty is that the speed and the thickness that can be welded are controlled not so much by power but by the thermal conductivity of the metals and by the avoidance of metal vaporization at the surface. Particular applications of the process with very thin materials up to 0.5 mm (0.02 inch) have, however, been very successful. The process is useful in the joining of miniaturized electrical circuitry.

Diffusion bonding. This type of bonding relies on the effect of applied pressure at an elevated temperature for an appreciable period of time. Generally, the pressure applied must be less than that necessary to cause 5 percent deformation so that the process can be applied to finished machine parts. The process has been used most extensively in the aerospace industries for joining materials and shapes that otherwise could not be made—for example, multiple-finned channels and honeycomb construction. Steel can be diffusion bonded at above 1,000° C (1,800° F) in a few minutes.

Ultrasonic welding. Ultrasonic joining is achieved by clamping the two pieces to be welded between an anvil and a vibrating probe or sonotrode. The vibration raises the temperature at the interface and produces the weld. The main variables are the clamping force, power input, and welding time. A weld can be made in 0.005 second on thin wires and up to 1 second with material 1.3 mm (0.05 inch) thick. Spot welds and continuous seam welds are made with good reliability. Applications include extensive use on lead bonding to integrated circuitry, transistor canning, and aluminum can bodies.

Explosive welding. Explosive welding takes place when two plates are impacted together under an explosive force at high velocity. The lower plate is laid on a firm surface, such as a heavier steel plate. The upper plate is placed carefully at an angle of approximately 5° to the lower plate with a sheet of explosive material on top. The charge is detonated from the hinge of the two plates, and a weld takes place in microseconds by very rapid plastic deformation of the material at the interface. A completed weld has the appearance of waves at the joint caused by a jetting action of metal between the plates.

3. Заполните пропуски необходимым типом сварки и переведите данные предложения:

1. ...welding is successfully used in manufacture of small elements of electric circuits.
2. Heat is not used in ... welding.
3. ... is widely used in aerospace industries.
4. Vibration is used in ...welding.
5. Plastic deformation is the basic principle in ... welding.
6. ... welding is impossible without pressure and high temperature.
7. In ... welding one of the parts being welded revolves.

4. Соотнесите вид сварки с его определением:

1. Cold welding	A. Light energy is used to weld parts together.
2. Friction welding	B. The weld is formed at the expense of the applied pressure at a high temperature for a long period of time.
3. Laser welding	C. Vibration is used to generate heat necessary to produce a weld
4. Diffusion bonding	D. The heat to accomplish the joint is generated

	by rotation.
5. Ultrasonic welding	E. The most important factor to accomplish the weld is pressure. No heat is applied.
6. Explosive welding	F. Rapid plastic deformation of the welded materials is caused by detonation.

5. Прочитайте и переведите предложения:

1. При холодной сварке поверхности должны быть тщательно подготовлены.
2. Скорость и толщина свариваемых деталей зависит не столько от мощности лазера, сколько от теплопроводности металла.
3. Этот вид сварки наиболее широко используется в авиакосмической промышленности.
4. Холодная сварка — это сварка без использования тепловой энергии, когда две свариваемые поверхности, обладающие высокой пластичностью, с силой прижимают друг к другу.
5. Использование точечной и шовной сварки позволяет получать сварные соединения высокой прочности.
6. Основными переменными величинами при этом виде сварки являются подводимое тепло, время сварки и сила сжатия.
7. Фрикционным разогревом добиваются пластичности материала, затем вращение цапфы останавливают и увеличивают давление для обеспечения сваривания поверхностей.
8. Сварной шов имеет чешуйчатый вид, что является результатом обдува струей сжатого воздуха.

6. Выполните контрольную работу:

I. Match the words to make up the expressions:

- | | | | |
|----|-----------------|---|------------------|
| 1 | to prepare | a | control |
| 2 | environmentally | b | velocity (speed) |
| 3 | filler | c | friendly |
| 4 | ultrasonic | d | force |
| 5 | mechanical | e | joints |
| 6 | quality | f | metal |
| 7 | narrow and deep | g | consumption |
| 8 | dissimilar | h | materials |
| 9 | energy | i | beam |
| 10 | protective | j | surface |
| 11 | high | k | atmosphere |
| 12 | laser | l | welding |

II.

a) Match the expressions to their definitions:

1	Cold welding	a	One part of the metal is static, the other one rotates with high velocity
2	Diffusion bonding	b	The energy beam makes narrow and deep joints with low heat input
3	Friction welding	c	High temperatures are generated in the explosive denotation
4	Ultrasonic welding	d	Metals are between an anvil and vibrating probe
5	Laser welding	e	It is made by the long-term application of considerable

			pressure at high temperature
6	Explosive welding	f	No heat is used

b) Translate these sentences.

III. Make up the sentences using the given words:

1. Is, surface, preparation, required, minimal. 2. Low, welding, consumption, ultrasonic, has, energy. 3. Short, the, is, cycle, extremely, welding. 4. Possible, welding, dissimilar, of, is, materials. 5. Needed, vacuum, or, is, atmosphere, a, protective. 6. Workpieces, vibrations, are, to, applied, acoustic.

IV. Translate the sentences s into English:

1. При холодной сварке вы должны тщательно подготовить поверхность. 2. При сварке трением металлы соединяются без плавления и присадочных материалов. 3. Тепло генерируется механическим трением между вращающейся и статичной частями. 4. Ультразвуковая сварка использует колебательную энергию, которая трансформируется в тепло. 5. Сварка взрывом имеет важное преимущество: она не затрагивает (affect) качества металла. 6. До 19 века основным видом сварки была сварка ковкой, которую использовали кузнецы.

V. Fill in the gaps using the words from the box:

dissimilar , electricity, workpieces, solid-state, heat source, deep, filler, sound waves, heating, principle , properties, friction

Cold welding or contact welding is a _____(1) welding process in which joining takes place without _____ (2). _____ (3) welding is a solid-state welding process that generates heat through mechanical friction between _____ (4) . Laser beam welding is a welding technique used to join pieces of metal or thermoplastics through the use of a laser beam that provides a concentrated _____ (5), allowing for narrow and _____ (6) welds. 4. Diffusion bonding operates on the _____ (7) of solid-state diffusion and makes it possible to join two similar or _____ (8) metals. 5. Ultrasonic welding makes use of _____ (9) instead of heat or _____ (10) to weld together two different components. 6. Explosive welding does not require any _____ (11) material and in this kind of welding metals do not lose their _____ (12).

ТЕМА II. Правила техники безопасности

1. Выучите слова и выражения. При необходимости проверьте транскрипцию.

1	burn	ожог, обжигать
2	health problems	проблемы со здоровьем
3	dust	пыль
4	emit	излучать, выпускать
5	fume	дым, гарь, дымить
6	illness	заболевание
7	injury	рана
8	skin	кожа
9	splash	всплеск, брызги
10	wet	влажный, сырой
11	hazard	опасность
12	slip	скольжение, скользить

13	noise	шум
14	ache	боль
15	irritation	раздражение
16	fever	лихорадка, жар
17	(im)possible	(не)возможный
18	breath	дыхание
19	unconsciousness	бессознательное состояние
20	cancer	рак
21	fire extinguisher	огнетушитель
22	first aid	первая помощь
23	blood	кровь
24	pay attention	обращать внимание
25	leak	утечка
26	to inhale	вдыхать
27	treatment	лечение
28	precautions	меры предосторожности

2. Прочитайте правила техники безопасности и переведите:

7 Safety Precautions to Enforce Today to Ensure Welding Safety

Welding can be a dangerous procedure if proper precautions are not taken. When workers are tasked with welding, for any application, safety should always be the number one priority. Welding requires adequate training and knowledge of safety standards.

1. Need for Protective Equipment and Proper Maintenance

Welders need protective gloves, goggles, helmets and respiratory protection that will safeguard welders from injuries. Employees should also be fully trained in hazards and equipment operation.

Equipment needs to be thoroughly checked and maintained on a regular basis to ensure they are safe for use.

Protection Against Burns and Harmful X-rays

It is advisable to use a darker lens and gradually transition to a lighter lens, for visibility and protection of the eyes and skin from exposure to x-rays. The gloves used should be flame resistant to help protect from burns.

2. Fire and Health Safety Precautions

Welding is a fire hazard, especially in the presence of flammable materials. Fire extinguishers need to be in proximity to the welding area as well as a fire alarm. Fire extinguishers should also be checked to ensure that the gauge is full.

There should be standard procedures in place, that give instant guidance to those that find themselves in dangerous situations.

Health should be taken into consideration, which includes having a fully stocked first aid kit nearby to attend to any injuries immediately.

3. Clear Working Environment

Welding should only be carried out in safe areas that are free from clutter and free from the risk of fire. In a construction site, flammable-materials should be removed. Welding should be done in a dry location.

4. Regular Inspection for Gas Leaks

Gas cylinders should be handled in a correct manner. They should be maintained in an upright position and regulators should not be switched between the cylinders.

5. Proper Storage of Flammable Products

Flammable liquids and gases should be stored away from the welding area. Specialized storage is recommended for construction sites.

6. Proper Checking and Maintenance of Electrical Nodes

Equipment should be properly insulated to prevent electrical shock to welders. Welders should wear proper gloves; ensuring that electrodes do not come in contact with wet clothing or skin.

Maintain proper electrical insulation from the welding metal and the welder's body. Electrodes should also be inspected before welding commences.

7. Continued Education

This will help welders follow proper safety procedures and stay up to date with best welding practices and standards.

3. Запишите новые слова. Отработайте их чтение:

safety engineering - техника безопасности
accident - несчастный случай
safety rules - правила техники
lack - нехватка, отсутствие безопасности
training workshop - учебный цех (мастерская)
to ensure – обеспечивать

4. Замените русское слово на английское. Используйте новые слова:

This was *несчастный случай*.
All people should keep *технику безопасности*.
Do you know *правила техники*?
We work in *мастерской*.
I *обеспечиваю* safety engineering.

5. Прочитайте и переведите текст:

SAFETY ENGINEERING

Accidents to people in industrial enterprises are called industrial traumatism (injury). They occur when workers have not acquired the requisite for skill and lack the necessary experience in

handling tools and equipment. Accidents are also caused through neglect of safety rules and regulations in the factories and training workshops.

The purpose of safety engineering is to prevent accidents and to create such conditions of work in industry which will ensure maximum productivity of labour.

When taking up new duties or when first going to work at any industrial enterprise each worker is obliged to acquaint him thoroughly with, and to master the safety instructions.

6. Ответьте письменно на вопросы

- How are the accidents to people in industrial enterprises called?
- When do the accidents to people occur?
- What must one do to prevent accidents?
- What is the purpose of safety engineering?
- What is a worker obliged to do when taking up new duties?

7. Выполните контрольную работу:

I. Match the words to make up the expressions:

1	health	a	the skin
2	to pay	b	problems
3	fire	c	injuries
4	to burn	d	level
5	to inhale	e	attention
6	to get	f	liquid
7	eye	g	a cylinder
8	to drink	h	dust
9	fireproof	i	clothing
10	gas	j	extinguisher
11	to refill	k	irritation
12	noise	l	leak

II. Translate these sentences into Russian;

1. The arc gives extremely bright light and UV radiation that can damage eyes.
2. If a welder inhales gases, fumes and vapours for a long period, it can have a negative effect on his health.
3. Typical treatment for this professional illness is resting in bed, drinking a lot of liquid and taking aspirin.
4. The protective clothing should include the following: gloves, a helmet, an overall and steel-toed boots.
5. It is illegal and dangerous to deface or change the name, number or other markings on a cylinder.
6. Never try to mix gases in a cylinder; never refill a cylinder; never use leaking cylinders.

III. Translate the sentences s into English:

1. Не работайте в сырых помещениях; ваша спецодежда должна быть сухой.
2. Замените защитные линзы, если они повреждены.
3. Посторонним вход запрещен в опасную зону.
4. Существует опасность скольжения и падения во время сварочных операций.
5. Пожар может случиться, если поблизости есть горючие материалы.
6. Никогда не смотрите на дугу без защиты глаз.

IV. Fill in the gaps using the words from the box:

irritants , cylinder, ache, pressure, skin, remove, first aid, precautions, illnesses,
 sparks. symptoms, well-ventilated

Do not weld near containers under (1) _____. (2) _____ flammable materials from the worksite. Work in (3) _____ areas. (4) _____ equipment should always be near when welding. Never allow an electrode to touch a (5) _____. You should take (6) _____ at work. Noise makes ears (7) _____. Molten metal splashes and (8) _____ can burn the (9) _____. Welders inhale respiratory (10) _____ and they can develop serious (11) _____. What are the (12) _____ of metal fume fever?

ТЕМА III. Сварочный аппарат

1. Выучите слова и выражения. При необходимости проверьте транскрипцию.

1	welding machine	сварочный аппарат
2	direct/alternating current	постоянный/переменный ток
3	power source	источник питания
4	duty cycle	рабочий цикл
5	voltage	электрическое напряжение
6	absorbed current	потребляемый ток
7	overheating	перегрев
8	adjustment	настройка, регулировка
9	remote control	пульт управления
10	earth (ground) wire	заземленный провод
11	arc length	длина дуги
12	button	кнопка
13	capacity	мощность, емкость
14	confirm	подтверждать
15	install installation	устанавливать установка
16	light-emitting diode (LED)	светодиод
17	manufacturer's settings	настройки изготовителя
18	overload	перегрузка
19	plug	вилка, подключать
20	socket	розетка, разъем, контакт
21	warning	предупреждение
22	flow meter	счетчик расхода
23	mode	режим
24	specification	техническая характеристика
25	to prevent	предотвращать
26	short circuit	короткое замыкание

2. Прочитайте и переведите текст:

There are three basic welding methods: manual, semiautomatic and automatic.

Manual welding is the oldest method, and though its proportion of the total welding market diminishes yearly, it is still the most common. Here an operator takes an electrode, clamped in a hand-held electrode holder, and manually guides the electrode along the joint as the weld is made. Usually the electrode is consumable; as the tip is consumed, the operator manually adjusts the position of the electrode to maintain a constant arc length.

Semiautomatic welding is becoming the most popular welding method. The electrode is usually a long length of small-diameter bare wire, usually in coil form, which the welding operator manually positions and advances along the weld joint. The consumable electrode is normally motor-driven at a preselected speed through the nozzle of a hand-held welding gun or torch.

Automatic welding is very similar to semiautomatic welding, except that the electrode is automatically positioned and advanced along the prescribed weld joint. Either the work may advance below the welding head or the mechanized head may move along the weld joint.

3. Согласиться или не согласиться с утверждениями:

1. Manual welding is the newest method.
2. A welder can use manual position during semiautomatic welding.
3. Semiautomatic welding is the most popular welding method because the weld joint is accurate.
4. Semiautomatic welding is not the most popular welding method.
5. The welding operator manually adjusts the position of the electrode to maintain a constant arc length.

4. Соотнесите сварочные методы и их описания:

- | | | |
|--|-------------------------|---------------------|
| 1. <i>manual</i> | 2. <i>semiautomatic</i> | 3. <i>automatic</i> |
| a) the work may advance below the welding head or the mechanized head | | |
| b) the operator manually adjusts the position of the electrode to arc length | | |
| c) the oldest method | | |
| d) the electrode is usually a long length of small-diameter bare wire | | |
| e) the consumable electrode is normally motor-driven at a preselected speed | | |
| f) the electrode is automatically positioned and advanced along the prescribed weld joint. | | |

5. Найдите в тексте следующие выражения:

- 1) берёт электрод
- 2) зажимаемый в электрододержателе для ручного сварочного процесса
- 3) вручную проводить электродом по стыку
- 4) вручную регулировать положение электрода
- 5) поддерживать стабильную длину дуги
- 6) электрод большой длины с маленьким диаметром голой проволоки в форме катушки
- 7) плавящийся электрод механизмуется на заданной скорости через сопло ручной сварочной горелки или сварочного пистолета
- 8) сварочная или механизированная головка

6. Прочитайте и переведите предложения:

1. This means that the current coming to the transformer is 220 V.
2. By means of electric arc, the great amount of electrical energy is transformed into heat energy.
3. An increase of current means deeper penetration and even burn though.
4. The other means such as heating, melting and fusing may be used.
5. Metals to be welded were heated and melted by means of the electric arc.
6. This, of source, means higher welding current.
7. In many cases, this does not mean application of special technique.
8. Modern means of welding inspection include ultrasonic, X-rays, and other techniques.
9. The heating of the surface is provided by means of the electric arc and by other means.
10. There are various means that can be applied to inspect the weld.

7. Подберите к английским словам соответствующие эквиваленты:

1. melt	1. держать
2. join	2. поддерживать
3. fuse	3. переменный
4. create	4. подсоединять
5. strike	5. заземлять
6. provide	6. наплавлять
7. flow	7. плавиться
8. hold	8. источник
9. connect	9. создавать
10. maintain	10. увеличивать
11. deposit	11. цепь
12. result (in)	12. приводить к чему-либо
13. increase	13. протекать, течь
14. depend	14. зависеть
15. penetrate	15. проворачивать
16. mean	16. обеспечивать
17. ground	17. зажигать
18. circuit	18. сплавлять, расплавлять
19. alternating	19. значить, означать
20. source	20. канавка, разделка

8. Выполните контрольную работу:

1. Match the words to make up the expressions:

- | | |
|--------------------|------------------|
| 1. duty | a) specification |
| 2. arc | b) circuit |
| 3. serial | c) control |
| 4. technical | d) length |
| 5. alternating | e) number |
| 6. flow | f) gas |
| 7. earth | g) diode |
| 8. manufacturer's | h) wire |
| 9. short | i) current |
| 10. remote | j) meter |
| 11. shielding | k) cycle |
| 12. light-emitting | l) settings |

2. Translate the sentences into Russian:

1. By selecting the needed mode, you may weld aluminium, its alloys, brass and magnesium or stainless steel, iron and copper.
2. The welding machine is protected by a thermostat, which prevents the machine from operating if the allowable temperatures are exceeded.
3. Remember to switch off the machine, close the gas cylinder valve and disconnect the power source, when you have finished welding.
4. In the event of malfunction, a flashing number may appear on the display; each number has its own meaning.

5. Shut off the machine and turn on it once again. If the flashing numbers continue to appear on the display, contact technical service.
6. Make sure that the supply voltage matches the voltage indicated on the specifications plate of the welding machine.

3. Translate the sentences into English:

1. Я хочу использовать этот сварочный аппарат. Не могли бы Вы пояснить, что значит этот режим?
2. Какие характеристики делают сварку безопаснее, быстрее и легче?
3. Низкое потребление энергии и высокая эффективность очень важны в сварке.
4. К достоинствам этого сварочного аппарата можно отнести малый вес, маленький размер, цифровой дисплей и легкий контроль всех параметров.
5. Удерживание этой кнопки более трех секунд открывает меню сервисных функций.
6. Удерживание этой кнопки возвращает выбранную функцию к настройкам производителя.

4. Fill in the gaps:

machine plate, precautions, light-emitting diode, adapter, socket, cooling system, electrode, convenient, INVERTER, instructions, maladjusted, overheating

1. Remove the _____ from the clamp after welding.
2. Efficient _____ is a key part of the welding process.
3. It is important to follow the _____.
4. The abbreviation *LED* stands for _____.
5. Do not connect other equipment to this _____.
6. It is _____ to have a digital display.
7. This welding machine is based on the modern _____ technologies.
8. The welding machine may run at a certain current without _____.
9. The technical specifications are listed on the _____.
10. I haven't read the instruction, that's why the machine is _____.
11. An _____ block makes the process safer.
12. What _____ should you take?

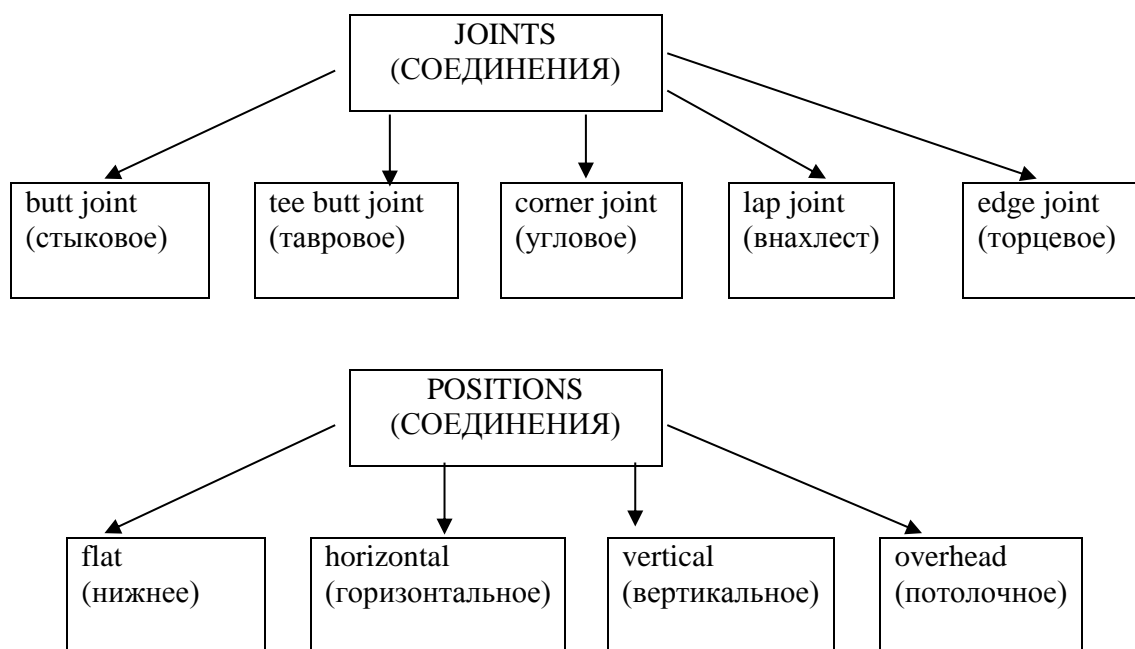
ТЕМА IV. Соединения, швы, положения и дефекты при сварке

1. Выучите слова и выражения. При необходимости проверьте транскрипцию.

1	across	через, (по)верх
2	angle, corner	угол
3	butt	стык
4	joint	соединение
5	from side to side	из стороны в сторону
6	groove	выемка, желоб, паз
7	lap to overlap	перекрытие, внахлест перекрывать
8	plane	плоскость
9	pull	тянуть
10	push	толкать
11	spot	точка, пятно, точечный
12	penetration	проникновение
13	piece	кусок
14	sheet	лист, листовой
15	to fill filler	заполнять заполнитель
16	(to) place	место, помещать
17	bead	валик

18	single	одиночный, отдельный
19	tee	Т-образный, тавровый
20	to fasten	прикреплять, пристегивать
21	edge	кромка, край, грань
22	flat position	нижнее положение
23	overhead position	потолочное положение
24	air draft	сквозняк
25	crack	трещина
26	hole	отверстие
27	to prevent	предотвращать
28	nozzle	насадка, наконечник, носик

2. Перечертите схемы и выучите их:



3. Прочитайте и переведите текст:

WELD JOINTS

The weld joint is where two or more metal parts are joined by welding. Welds can be geometrically prepared in many different ways. The five basic types of weld joints are the butt, corner, tee, lap, and edge. Other variations exist as well — for example, double-V preparation joints are characterized by the two pieces of material, each tapering to a single centre point at one-half their height. Single-U and double-U preparation joints are also fairly common — instead of having straight edges like the single-V and double-V preparation joints, they are curved, forming the shape of a U. Lap joints are also commonly more than two pieces thick — depending on the process used and the thickness of the material, many pieces can be welded together in a lap joint geometry.

A butt joint is used to join two members aligned in the same plane. This joint is frequently used in plate, sheet metal, and pipe work. A joint of this type may be either square or grooved.

Corner and tee joints are used to join two members located at right angles to each other. In cross section, the corner joint forms an L-shape, and the tee joint has the shape of the letter T. Various joint designs of both types have uses in many types of metal structures.

A lap joint, as the name implies, is made by lapping one piece of metal over another. This is one of the strongest types of joints available; however, for maximum joint efficiency, you should overlap the metals a minimum of three times the thickness of the thinnest member you are joining. Lap joints are commonly used with torch brazing and spot welding applications.

An edge joint is used to join the edges of two or more members lying in the same plane. In most cases, one of the members is flanged. While this type of joint has some applications in platework, it is more frequently used in sheet metal work. An edge joint should only be used for joining metals 1/4 inch or less in thickness that are not subjected to heavy loads.

Often, particular joint designs are used exclusively or almost exclusively by certain welding processes. For example, resistance spot welding, laser beam welding, and electron beam welding are most frequently performed on lap joints. However, some welding methods, like shielded metal arc welding, are extremely versatile and can weld virtually any type of joint. Additionally, some processes can be used to make multipass welds, in which one weld is allowed to cool, and then another weld is performed on top of it. This allows for the welding of thick sections arranged in a single-V preparation joint, for example. The type of joint selected for any welding job may materially affect the quality and strength of the weld; the cost of labour and materials; the time and expense involved in preparing, jiggling, and positioning the work; and other factors of like importance.

The selection of the proper joint type depends on a number of factors, such as joint thickness and material, desired physical properties in the finished joint, size of the pieces being welded, accessibility of the joint, fit-up obtainable, available edge preparation equipment, number of pieces to be welded, and specifications of regulatory codes (if applicable).

4. Подберите правильный предлог. Переведите предложения:

1. The weld joint is where two or more metal parts are joined ... welding	a) in
2. An edge joint should only be used ... joining metals 1/4 inch or less in thickness	b) of
3. Lap joints are commonly used ... torch brazing and spot welding applications	c) on
4. A joint of this type may be ... square or grooved	d) by
5. Welds can be geometrically prepared ... many different ways	e) over
6. A lap joint is made by lapping one piece of metal ... another	f) for
7. Corner joints are used to join two members located ... right angles to each other	g) either
8. Instead ... having straight edges single-U and double-U preparation joints are curved, forming the shape of a U	h) to
9. Many pieces can be welded together in a lap joint geometry depending ... the process used and the thickness of the material	i) with
10. Double-V preparation joints are characterized by the two pieces of material each tapering ... a single centre point	j) at

5. Соотнесите тип соединения с его определением:

A	B
---	---

1. A lap joint	a. A joinery technique in which two members are joined by simply butting them together
2. A butt joint b.	b. A joinery technique in which two members are located at right angles to each other
3. An edge joint	c. A joinery technique used to join the edges of two or more members lying in the same plane
4. Corner and tee joints	d. A joinery technique used to produce a joint by overlapping two ends or edges

6. Выполните контрольную работу:

I. Match the words with their translations:

- | | |
|-----------------|-------------------|
| 1. porosity | a) клапан |
| 2. inclusion | b) шлак |
| 3. slag | c) точка |
| 4. run | d) плоскость |
| 5. sheet | e) прогон |
| 6. valve | f) предотвращение |
| 7. reason | g) пористость |
| 8. crack | h) причина |
| 9. prevention | i) форма |
| 10. plane | j) кромка |
| 11. edge | k) включенность |
| 12. shape | l) трещина |
| 13. tee | m) проникновение |
| 14. penetration | n) лист |
| 15. spot | o) тавровый |

II. Match the names of joints with their definitions. Translate the sentences into Russian:

1. tee butt joint	a) is a joint where two pieces of metal are placed together and welded on the same edge.
2. corner joint	b) is a joint where two pieces of metal are joined in the same plane.
3. lap joint	c) is formed when two bars or sheets are joined perpendicular to each other in the form of a T-shape.
4. butt joint	d) is used to connect two pieces together forming a corner.
5. edge weld	e) is a joint between two pieces of metal in which the edges or ends are overlapped and fastened together.

III. Match the names of positions with their definitions. Translate the sentences into Russian:

1. vertical position	a) is taken when the welding material is in a vertical plane while weld bead is located horizontally
2. overhead position	b) is used when the metal to be welded is at a right angle to the floor.
3. flat position	c) is the most difficult and the most uncomfortable position because the molten metal has a tendency to form drops and fall down.
4. horizontal position	d) the material should be parallel to the floor. It is the most comfortable position to weld in.

IV. Fill in the gaps with the words from the box. Translate the sentences into Russian:

cracks, concave, defective, frost, high, holes, inclusions, inadequate, plugged up, porosity, rusted, speed

1. If you use a bad _____ wire, it will cause _____.
2. A gas flow can be _____, because it is blocked in the gas line.
3. A gas nozzle can be _____ with spatter.
4. If voltage is too _____, it will cause too much spatter.
5. Insufficient gas shielding is due to _____ flow meter.
6. When welding _____ is too fast, it causes lateral cracking.
7. Gas flow _____ can be plugged up.
8. A weld bead is too _____ and it is a defect too.
9. When a gas regulator is covered with _____, the gas flow is insufficient.
10. Low current and high arc voltages make _____.
11. If you don't clean slag after a weld and make a new run, the weld will get _____.

ТЕМА V. Система СИ. Аббревиатуры и условные обозначения**1. Выучите слова и выражения. При необходимости проверьте транскрипцию.**

1	SI (International System of Units)	СИ, международная система единиц
2	sign	знак, символ
3	maintenance	техническое обслуживание, поддержка
4	symbol	условное обозначение, символ
5	reference code	справочный код
6	ISO (International Organization for Standardization)	международная организация по стандартизации
7	AWS (American Welding Symbolization)	американская сварочная система символов
8	to measure	измерять
9	to solve solution	решать решение
10	supervisor	контролер, руководитель
11	to count, calculate	считать
12	figure	цифра
13	odd/even number	нечетное/четное число
14	sum	сумма
15	decimal	десятичный
16	value	величина, ценность
17	to plus, add	прибавлять, добавлять
18	to minus, subtract, take away	вычитать, отнимать
19	to multiply	умножать
20	to divide	делить
21	to be equal	равняться, быть эквивалентным
22	equation	уравнение
23	answer	ответ
24	square/cube root	квадратный/кубический корень
25	dot, point	точка
26	approximation	округление, приближение
27	arrow	стрелка

28	metric system	метрическая система
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2. Прочитайте и переведите текст:

The AWS (American Welding Society) was established in 1919. It's a non-profitable establishment that works to enhance technology, science, and the application of allied joining, welding, and cutting procedures.

The headquarters of the American Welding Society is in Miami, Florida. Currently, the organization serves over 70,000 members around the globe. It's dedicated to supporting thousands of experts in the industry comprising welders, fabricators, business leaders, sales and service teams, merchants, associations, scholars, educational institutions, and committee volunteers.

The American Welding Society joins welding communities from around the globe into a force that can collaborate by establishing a foundation of high-quality standards, enhanced learning, and rewarding growth.

AWS provides several certificate programs that acknowledge and record skills and the know-how in disciplines related to welding processes such as educators, welding engineers and manufacturers, and radiographic interpreters.

3. Заметите слова, выделенные курсивом, на правильные:

1. *Multiplication* is an operation inverse of subtraction.
2. The product is the result given by the operation of *addition*.
3. The part of the dividend which is left over is called the *divisor*.
4. *Division* is an operation inverse of addition.
5. The difference is the result of the operation of *multiplication*.
6. The quotient is the result of the operation of *subtraction*.
7. The sum is the result of the operation of *division*.
8. *Addition* is an operation inverse of multiplication.

4. Скажите по-английски:

1. $16 + 22 = 38$
2. $280 - 20 = 260$
3. $1345 + 15 = 1360$
4. $2017 - 1941 = 76$
5. $70 \times 3 = 210$
6. $48 : 8 = 6$
7. $3419 \times 2 = 6838$
8. $4200 : 2 = 2100$

5. Прочитайте и переведите предложения:

1. Albert Einstein is known all over the world as a brilliant physicist and the founder of the theory of relativity.
2. The four basic mathematical operations - addition, subtraction, multiplication, and division have application even in the most advanced mathematical theories.
3. Electronic calculators have made these (and other) operations simple to perform, but these devices can also create a dependency.
4. The order in which we add the numbers makes no difference.
5. If you have difficulties performing the basic operations for simple numbers, one way to improve your skills is to use flash cards.

6. The English system of measures is a collection of measures for length, volume, weight, area, etc. that have their roots in hundreds of years of history.
7. Weight is the measurement of how strongly gravity pulls an object toward Earth.
8. The main advantage of SI is that the rest of the world uses it so we can all communicate in the language of the metric system.
9. Some letters are called constants because they represent numbers with a fixed value that never changes.
10. . The invention of zero and our number system is one of the greatest achievements of the human race.
11. One disadvantage of the English system of measurement is that units within the system can vary from country to country.
12. The greater the mass the more force must be applied to move the object.

6. Выполните тест:

1)... 3 from 131.

- ☐ Divide
- ☒ Subtract
- ☐ Multiply

1) If you divide 4 ... 2, the answer is 2.

- ☐ in
- ☐ by
- ☐ into

2) The British variant of 234 900 is

- ☐ two hundred and thirty-four thousand nine hundred
- ☐ two hundred thirty-four thousand nine hundred
- ☐ two hundred thirty-four thousand ninety hundred

3) I have 174 people on my "Friends" list in this social network.

- ☐ one hundred seventy-four
- ☐ oh seven four
- ☐ one hundred and seventy-four

4) One inch is

- ☒ 10.6 cm
- ☐ 2.5 cm
- ☐ 1.3 km

5) I am not the kind of person who likes to ... sums.

- ☐ make
- ☐ do

- ☐ take
- 6) *Plus is a mathematical ...*
- ☐ symbol
- ☐ sign
- ☐ digit
- 7) *Do you know the ... table?*
- ☐ multiplying
- ☐ multi
- ☐ multiplication
- 8) *You need to ... more problems if you want to improve your mathematical skills.*
- ☐ do
- ☐ solve
- ☐ work out
- 9) *Now my favourite subject is*
- ☐ math
- ☐ maths
- ☐ mathematic

7. Выполните контрольную работу:

I. Translate the sentences into Russian:

1. If you want to read plans or drawings you have to know what do the basic welding symbols mean.
2. The main purpose of welding symbols is to tell to a welder where to weld, the joint type and how much filler material or metal should be used.
3. The American Welding Society (AWS) is responsible for creating the symbol standards.
4. The main advantage of SI system is that the whole world uses it so we can all communicate in the language of the metric system.
5. The four basic mathematical operations are addition, subtraction, multiplication, and division.
6. – What do the abbreviations CAW and PAW stand for? – They stand for ‘carbon arc welding’ and ‘plasma arc welding’.
7. Twenty-three minus ten equals thirteen.
8. If you divide 9 by three, the answer is three.
9. Add seven to eight and you will get fifteen.
10. Find the cube root of twenty-seven.

II. Write these simple problems in English:

- | | | | | |
|----------------------|-----------------|------------------|-------------------|---------|
| 10) $6 \cdot 8 = 48$ | 2) $20 : 4 = 5$ | 3) $7 + 8 = 15$ | 4) $78 - 23 = 55$ | 5) 61% |
| 6) $4 \cdot 9 = 36$ | 7) $72 : 8 = 9$ | 8) $12 + 6 = 18$ | 9) $91 - 11 = 80$ | 10) 15% |

III. Translate the sentences into English:

1. Вы помните, что обозначает эта аббревиатура?
2. Прямой угол равняется 90 градусам.

3. Сварочные символы используются сварщиками, инженерами, контролерами и инспекторами.
4. В прошлом сварочные символы были простыми.
5. Минус – это пример математического знака.
6. Посмотрите на стрелочку с инструкцией «Варить здесь».

IV. Fill in the gaps:

words, equals, math operations, SMAW, dependency, approximately, constant, pipeline, equation, 141, numbers, times

1. Electronic calculators have made _____ simple to perform.
2. Calculators can create a _____.
3. The order in which we add the _____ makes no difference.
4. Mathematics uses numbers and symbols instead of _____ and punctuation.
5. A _____ has a fixed value that never changes.
6. I can't solve this _____.
7. – What is my task for today? – We must finish the _____.
8. – What is AWS number for 'shielded metal arc welding'? – It is _____.
9. – What is ISO number for 'gas tungsten arc welding'? – It is _____.
10. Two _____ eight is sixteen.
11. Sixty-one plus eleven _____ seventy-two.
12. π is _____ equal to 3.14.

ТЕМА VI. История сварки в России

1. Выучите слова и выражения. При необходимости проверьте транскрипцию.

1	ancient	древний
2	armour	доспехи, броня
3	(to) award	награда, награждать
4	to be in demand	быть востребованным
5	to believe	верить
6	blacksmith	кузнец
7	to discover	открывать, обнаруживать
8	to found founder	основывать основатель
9	honour honourable	честь почетный, уважаемый
10	impact	влияние, воздействие
11	to introduce	вводить, представлять
12	to make a breakthrough	сделать прорыв
13	contribution	вклад
14	to offer a job	предложить работу
15	to refuse	отказываться
16	to return	возвращаться
17	valuable	ценный

18	author	автор
19	exhibition	выставка
20	smelter	завод (металлургический)
21	to establish	устанавливать
22	consumable electrode	плавящийся электрод
23	to invent inventor	изобретать изобретатель
24	scientist	ученый

2. Прочитайте и переведите текст:

The first experiments that led to the discovery of welding (a process that joins metals by using high heat to melt parts together) were conducted in the early 19th century, simultaneously and independently, by Russian engineer Vasiliy Petrov, and English engineer Humphry Davy. They both discovered the electric arc, but while Davy's first arc was short-pulsed and lower in temperature, Petrov's one could hold longer and produce temperatures sufficient enough to melt metals.

In the early 19th century, Petrov's experiment was just pure science. However, in 1881, Russian engineer and inventor Nikolay Benardos, who worked under Pavel Yablochkov (inventor of the electric carbon arc lamp), discovered that an electric arc can be used for melting metals together – welding. In 1885, Benardos received a patent, and in 1888, the industrial use of the method began.

At the same time, another Russian engineer, Nikolay Slavyanov, suggested using metal electrodes instead of carbon ones, which allowed for the welding of metals with very high melting points. As an example, Slavyanov created his famous “glass”, a cylinder comprised of eight metals with high melting points that were welded together.

Paton was a pioneer researcher of joining and welding technology. He carried out research on the fundamentals of welding, how to calculate the strength of welded structures, and the mechanization of welding processes. He supervised the development of automatic submerged arc welding. During World War II Paton supervised the design and production of equipment and technology for automated welding of special steels for tanks, bombs, and other military hardware.

3. Выполните тест:

1. In ancient Russia, ... were in demand and their work was very valuable.

- engineers
- scientists
- blacksmiths
- carpenters

2. Blacksmiths could make ...

- tools
- books
- armour
- horse shoes
- clocks
- decorations

3. ... were widely used metals.

- aluminium
- copper
- zinc
- gold
- silver

4. In 1802 Vasily Petrov ...

- introduced arc welding with consumable arc electrodes, invented a new alloy and demonstrated the first welding machine
- studied and described the use of an electric arc for melting metals
- invented carbon arc welding

5. In 1882 Nikolay Benardos ...

- invented carbon arc welding. It was the first practical arc welding method.
- studied and described the use of an electric arc for melting metals.
- introduced arc welding with consumable arc electrodes, invented a new alloy and demonstrated the first welding machine.

6. In 1888 Nikolay Slavyanov ...

- studied and described the use of an electric arc for melting metals.
- introduced arc welding with consumable arc electrodes, invented a new alloy and demonstrated the first welding machine.
- invented carbon arc welding. It was the first practical arc welding method.

7. In 1893, Slavyanov showed his welding equipment at the World Exhibition in ...

- London
- Chicago
- New York
- Washington

8. A special ... after Slavyanov was established by the Academy of Sciences.

9. Slavyanov had a project of a technological ...

- plant
- factory
- smelter
- station

10. Russian engineers made a ... in welding.

- breakthrough
- breakdown

- breakfast
- breakwater

4. Выполните контрольную работу:

1. Match the words to make up the expressions:

- | | |
|-----------------------------|-------------------------|
| 1. to make a | a) future |
| 2. to offer a | b) welding technologies |
| 3. to discover a | c) phenomenon |
| 4. to be in | d) blacksmithing |
| 5. horse | e) job |
| 6. to have an impact on the | f) electrode |
| 7. honourable | g) demand |
| 8. consumable | h) Sciences |
| 9. to patent | i) shoes |
| 10. to be interested in | j) great contribution |
| 11. the Academy of | k) an invention |
| 12. the founders of | l) profession |

II. Translate the sentences into Russian:

1. It was very honourable to be a blacksmith in ancient Russia: they made armour, tools, decorations.
2. V. Petrov studied the use of an electric arc and made basics for electric arc welding.
3. N. Benardos was interested in blacksmithing in his childhood that had a big impact on his future.
4. N. Slavyanov showed his welding equipment at the World Exhibition in Chicago.
5. The construction of the first all-welded bridge in the world under Paton's supervision began in 1940 but the war stopped the project.
6. During World War II Paton supervised the production of special steels for tanks T-34, bombs and other military equipment.

III. Translate the sentences into English:

1. В древней России кузнецы были востребованы, и их работа была очень ценной.
2. Русский физик В. Петров открыл феномен электрической дуги.
3. Русский ученый Н. Бенардос изобрел углеродистую дуговую сварку.
4. Русский изобретатель и ученый Н. Славянов представил дуговую сварку плавящимися электродами.
5. Н. Славянов изобрел новый сплав и продемонстрировал первый в мире сварочный аппарат.
6. После войны более 100 мостов было сконструировано под руководством профессора Е. Патона.

IV. Fill in the gaps:

inventions, bridge, vehicles, gold and copper, awarded, carbon, breakthrough, pneumonia, founder, tunnel, smelter, patriot
--

1. In ancient Russia _____ were widely used metals.
2. Benardos was an author of 200 _____ and projects.
3. _____ arc welding became popular during the late 1890s and early 1900s.
4. Slavyanov had a project of a technological _____.
5. Slavyanov had great ideas, but he died because of _____.
6. Slavyanov was a _____: he was offered a job in the USA, but he refused and returned to Russia.
7. A special medal after Slavyanov is _____ for the best works in the sphere of welding.
8. The place for a bridge was so beautiful that Paton

gave up the idea of making a _____. 9. To remember Paton, the _____ was named after the great scientist and welder. 10. The bridge is extremely strong: many _____ drive the bridge per day. 11. Paton is the _____ of Electric Welding Institute in Kiev. 12. Russian engineers made a _____ in welding.

ТЕМА 7. История сварки в англоязычных странах

1. Выучите слова и выражения. При необходимости проверьте транскрипцию.

1	(to) advance	продвигать, продвижение
2	clay	глина
3	lime	известь
4	non-profit	некоммерческий
5	aim, goal	цель
6	to appear disappear	появляться исчезать
7	allied	смежный, похожий
8	motor shaft	вал (двигателя)
9	rear axle	задний мост (ось)
10	extruding	метод опрессовки
11	coated/covered	покрытый, с покрытием
12	thin coating	тонкое покрытие
13	chemist	химик
14	suitable	подходящий, соответствующий
15	to provide	обеспечивать
16	stable	стабильный
17	to produce	производить
18	armament	вооружение
19	rod	прут
20	various/different types	различные виды
21	part	часть, деталь
22	widely used	широко используемый
23	century	век, столетие

2. Прочитайте и переведите текст:

From the History of Welding

Welding is a technique used for joining metallic parts usually through the application of heat. This technique was discovered during efforts to manipulate iron into useful shapes. Welded blades were developed in the first millennium AD, the most famous being those produced by Arab armourers at Damascus, Syria. The process of carburization of iron to produce hard steel was known at this time, but the resultant steel was very brittle. The welding technique - which involved interlayering relatively soft and tough iron with high-carbon material, followed by hammer forging - produced a strong, tough blade.

In modern times the improvement in iron-making techniques, especially the introduction of cast iron, restricted welding to the blacksmith and the jeweler. Other joining techniques, such as fastening by bolts or rivets, were widely applied to new products, from bridges and railway engines to kitchen utensils.

Modern fusion welding processes are an outgrowth of the need to obtain a continuous joint on large steel plates. Rivetting had been shown to have disadvantages, especially for an enclosed container such as a boiler. Gas welding, arc welding, and resistance welding all appeared at the end of the 19th century. The first real attempt to adopt welding processes on a wide scale was made during World War I. By 1916 the oxyacetylene process was well developed, and the welding techniques employed then are still used. The main improvements since then have been in equipment and safety.

Arc welding, using a consumable electrode, was also introduced in this period, but the bare wires initially used produced brittle welds. A solution was found by wrapping the bare wire with asbestos and an entwined aluminum wire. The modern electrode, introduced in 1907, consists of a bare wire with a complex coating of minerals and metals. Arc welding was not universally used until World War II, when the urgent need for rapid means of construction for shipping, power plants, transportation, and structures spurred the necessary development work.

Resistance welding, invented in 1877 by Elihu Thomson, was accepted long before arc welding for spot and seam joining of sheet. Butt welding for chain making and joining bars and rods was developed during the 1920s. In the 1940s the tungsten-inert gas process, using a nonconsumable tungsten electrode to perform fusion welds, was introduced. In 1948 a new gas - shielded process utilized a wire electrode that was consumed in the weld. More recently, electron-beam welding, laser welding, and several solid- phase processes such as diffusion bonding, friction welding, and ultrasonic joining have been developed.

3. Соотнесите следующие утверждения с абзацами:

1. Application of welding techniques is decreasing nowadays.
2. Welding originated from the attempts to shape metal into useful forms.
3. Resistance welding is one of the earliest types of joining metals.
4. Industrial development in the 1950-s expedited (ускорять) the advance of welding technologies.

4. Согласиться или не согласиться с утверждениями:

1. Only heat is used for joining metallic parts in welding.
2. The process of carburization of iron is rather new.
3. The blacksmith and the jeweler continue to use welding techniques in their work.
4. Welding is the only technique of joining metallic parts.
5. The modern electrode consists of a bare wire with asbestos.
6. Arc welding was not used after World War II.
7. Diffusion bonding and friction welding are solid-phase processes.
8. Rivetting is now widely used for producing an enclosed container such as a boiler.

5. Ответьте на вопросы:

1. What is welding?
2. How was welding discovered?
3. Who were the first welders?
4. What did the first welding technique for making blades involve?
5. Did the improvement in iron-making techniques conduce to the development of welding?
6. Is it efficient to apply riveting for making boilers?

7. When did gas, arc and resistance welding appear?
8. What was the quality of the welds produced by the arc welding using bare wires like?
9. What does the coating of the modern electrode consist of?
10. What are the years 1877, 1916, and 1948 remarkable for in terms of welding?

6. Прочитайте и переведите предложения:

1. Арабских оружейников, изготавливавших кованые клинки, можно считать первыми сварщиками.
2. Появление методов сварки плавлением было обусловлено необходимостью производства изделий из крупнолистовой стали.
3. Впервые сварка стала использоваться в массовом производстве во время первой мировой войны.
4. Вторая мировая война ускорила внедрение электродуговой сварки.
5. Современный сварочный электрод имеет сложное покрытие, состоящее из композитных материалов.
6. Помимо сварки, клепка и болтовые соединения являются основными методами соединения металлов.

7. Выполните тест:

1. In 1800, Sir Humphry Davy produced ...

- acetylene
- advance welding
- an arc between two carbon electrodes
- a coated metal electrode
- in America and in Europe
- produced
- the first US patent
- use with low-pressure
- was introduced by

2. In 1836, Edmund Davy discovered ...

- acetylene
- advance welding
- an arc between two carbon electrodes
- a coated metal electrode
- in America and in Europe
- produced
- the first US patent
- use with low-pressure
- was introduced by

3. In 1890, Charles L.Coffin got ... for an arc welding process.

- acetylene
- advance welding

- an arc between two carbon electrodes
- a coated metal electrode
- in America and in Europe
- produced
- the first US patent
- use with low-pressure
- was introduced by

4. In 1900 A. P. Strohmenger introduced ... in Great Britain.

- acetylene
- advance welding
- an arc between two carbon electrodes
- a coated metal electrode
- in America and in Europe
- produced
- the first US patent
- use with low-pressure
- was introduced by

5. In about 1900, a torch suitable for ... acetylene was developed.

- acetylene
- advance welding
- an arc between two carbon electrodes
- a coated metal electrode
- in America and in Europe
- produced
- the first US patent
- use with low-pressure
- was introduced by

6. ..., many companies appeared to produce welding machines.

- acetylene
- advance welding
- an arc between two carbon electrodes
- a coated metal electrode
- in America and in Europe
- produced
- the first US patent
- use with low-pressure
- was introduced by

7. In 1919, the American Welding Society was founded to

- acetylene
- advance welding
- an arc between two carbon electrodes
- a coated metal electrode

- in America and in Europe
- produced
- the first US patent
- use with low-pressure
- was introduced by

8. In 1920, automatic welding ... the General Electric Company.

- acetylene
- advance welding
- an arc between two carbon electrodes
- a coated metal electrode
- in America and in Europe
- produced
- the first US patent
- use with low-pressure
- was introduced by

9. In 1929, the Lincoln Electric Company ... extruded electrode rods.

- acetylene
- advance welding
- an arc between two carbon electrodes
- a coated metal electrode
- in America and in Europe
- produced
- the first US patent
- use with low-pressure
- was introduced by

10. In 1930 ... were widely used.

- acetylene
- advance welding
- an arc between two carbon electrodes
- covered electrodes
- in America and in Europe
- produced
- the first US patent
- use with low-pressure
- was introduced by

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