一般社団法人 Japan Association for Human Resources in Industrial Product Manufacturing
工業製品製造技能人材機構

FY2026
SSW (ii) Evaluation Exam for Industrial Product Manufacturing

Overview Introduction Course (Metal surface treatment)

— Studying Using the “Study Reference Text” —

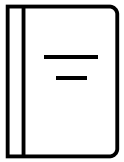
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Introduction

Target audience of this course: People in the manufacturing field with Specified Skilled Worker (i) status ⇒ aiming for (ii)

"Study Reference Text" for the Specified Skilled Worker (ii) Evaluation Exam

Japanese version



Translated version



Available on the My Page for JAIM member companies

In today's course, we will explain the practice questions in the above text.

Introduction

Total: 120 minutes	Program of This Course	Presenter
Approx. 15 minutes	**Introduction** Overview of the Specified Skilled Worker (ii) Evaluation Exam, notes when taking the exam, Japanese used on the exam, and notes for studying	AOTS
Approx. 105 minutes	**Lecture** Explanation of practice questions in the “Study Reference Text,” important keywords, related skills, and overall summary	Instructor

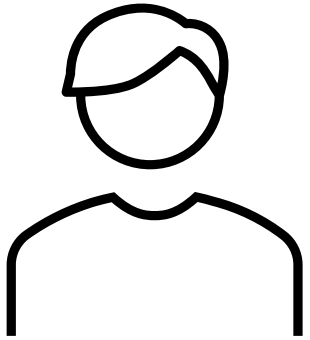
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* The above program times and time allocations are estimates. They vary slightly depending on the category and language of interpretation.

Profile of a Specified Skilled Worker (ii)

Can carry out highly specialized and technical work based on one's own judgment



Can bring together on-site workers and provide instruction and supervision

Has proficient skills based on practical work experience, etc.

Requirements to obtain status of residence for Industrial Product Manufacturing Specified Skilled Worker (ii) personnel

Meet all conditions in either of the following two routes

Specified Skilled Worker (ii) Evaluation Exam route	① Obtain Business Career Certification Grade 3 (either the Production Management Planning category or the Production Management Operation category)
	② Pass the Specified Skilled Worker (ii) Evaluation Exam for Industrial Product Manufacturing (either the Machining and Metal Processing category, the Electric and Electronic Equipment Assembly category, or the Metal Surface Treatment category)
	③ Have 3+ years of practical work experience at a manufacturing site of a company that has a base in Japan
Skills Test route	① Obtain Skills Test Grade 1
	② Have 3+ years of practical work experience at a manufacturing site of a company that has a base in Japan

Chapter 1: Exam Overview and How to Study

Exam Overview☞ “Study Reference Text” p. 1

Exam schedule	FY2026: Round 1: July 29, 2026 – August 1, 2026 (completed) Round 2: November 25, 2026 – November 28, 2026 (planned) Round 3: Around February 2027 (planned)		
Exam location	Test centers provided by Prometric Co., Ltd. (Domestic: throughout Japan)		
Administration format	CBT (Computer-Based Testing) format (practical test*) * Practical test: Questions that require reading content related to actual work processes and materials and choosing the correct answer		
Exam language	Japanese * Furigana provided for kanji		
Exam categories	3 categories (Machining and Metal Processing category / Electric and Electronic Equipment Assembly category / Metal Surface Treatment category)		
Exam level	Based on the level of the Skills Test Grade 1 exam		
Exam time	80 minutes	Number of questions	30 questions
Eligibility	· In principle, foreign nationals who are at least 17 years old on the exam date (at least 18 years old if they are Indonesian) and who intend to work in Japan if they pass the exam · Foreign nationals who have 3+ years of practical work experience at a manufacturing site of a company that has a base in Japan by the day before the exam * A “Work Experience Certificate” proving the above work experience must be submitted, and an eligibility confirmation number must be obtained		
Application	Prometric Specified Skilled Worker (ii) Evaluation Exam for Industrial Product Manufacturing Dedicated Page https://www.prometric-jp.com/ssw/test_list/archives/18		
Exam fee	15,000 yen		
Passing criteria	Correct answer rate of 60% or more		

Notes when taking the exam

☞ “Study Reference Text” p. 2

- Taking exam questions/answers out or sharing them is prohibited

- Security measures

- Response to misconduct

Notes for studying
☞ “Study Reference Text” p. 2

(1) Studying Japanese

① Improving Japanese reading comprehension

Reading comprehension texts for Japanese study, newspapers/magazines, online news, etc.

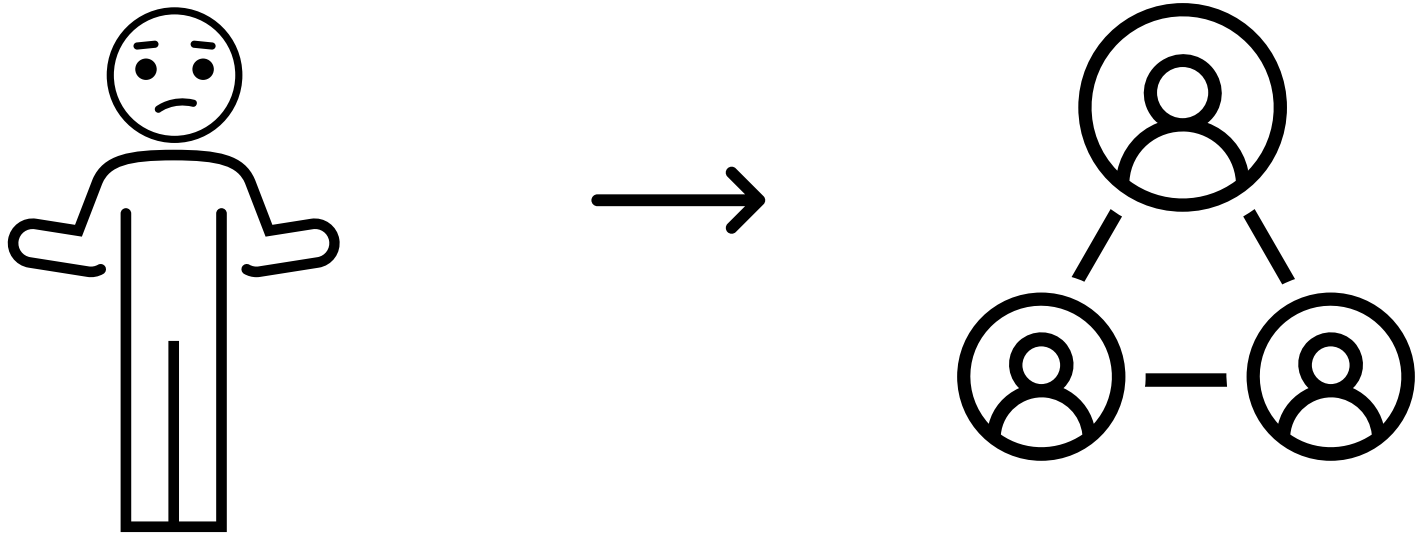
② Expanding specialized vocabulary

Creating your own specialized vocabulary list, etc.

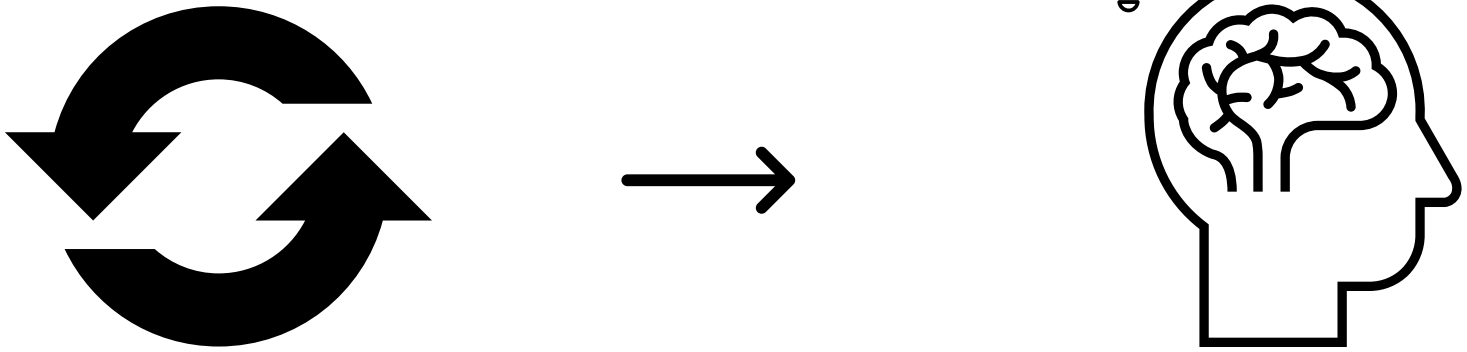
③ Becoming familiar with the Japanese used on the exam

Getting plenty of exposure to exam questions, instructions, and answer choices

(2) Ask supervisors and coworkers at the workplace



(3) Read repeatedly



(4) Read the question and answer choices carefully to the end.



Examples of question wording

Questions asking for the correct answer

Q. a~dの中から正しいものを選びなさい。

Q. Choose the correct statement from a–d.

Q. 以下の中から、正しいものを選べ。

Q. Choose the correct statement from the following.

Q. 次のうち、正しいものはどれか。

Q. Which of the following statements is correct?

Examples of question wording

Questions asking for the incorrect answer

Q. 次のうち、正しくないものはどれか。

Q. Which of the following statements is not correct?

Q. 次のうち、間違っているものはどれか。

Q. Which of the following statements is wrong?

Q. 次のうち、誤っているものはどれか。

Q. Which of the following statements is incorrect?

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イントロダクション

講師：滝本 淳（Mr. Atsushi Takimoto）

Table of Contents

Chapter	Theme	Practice Question	Explanation
Chapter 2	Health and Safety	2-3	KYT
Chapter 3	Quality Management	3-2	QCDS, PDCA, 4M, etc.
		3-3	Seven QC Tools
Chapter 9	Metal Surface Treatment	9-2	Difference Between Plating and Metal Surface Treatment
		9-3	Difference Between Plating and Metal Surface Treatment / Anodic Treatment
Chapter 4	Pollution Prevention	4-1	Wastewater Treatment
		4-3	About Pollution
Chapter 5	Measurement and Inspection	5-4	Plating Thickness Measurement
		5-7	Visual Inspection, Adhesion Testing, etc.
Chapter 6	Materials	6-2	Properties of Metals and Alloy Composition
		6-3	Corrosion
Chapter 7	General Chemistry	7-3	Oxidation and Reduction
		7-5	Hydrogen Ion Concentration and pH
Chapter 8	Electricity	8-2	Relationship Among Current, Voltage, Resistance, and Electric Power
		8-4	Resistance
Chapter 10	Plating	10-3	Plating Solution Management
		10-6	Hot-Dip Galvanizing
Chapter 11	Anodizing	11-2	Anodizing Thickness Measurement
		11-3	Quality and Properties of Anodizing
Chapter 12	Buff Polishing	12-2	Buff Polishing Procedure
		12-3	Buff Polishing Procedure

Practice Question 2-3 ☞ "Study Reference Text" p. 19

Look at the illustrations of the work below and consider KYT Round 1: "What hazards may be lurking?"

A. Metal press work is being performed. (The press operates when both the left and right switches are pressed.)



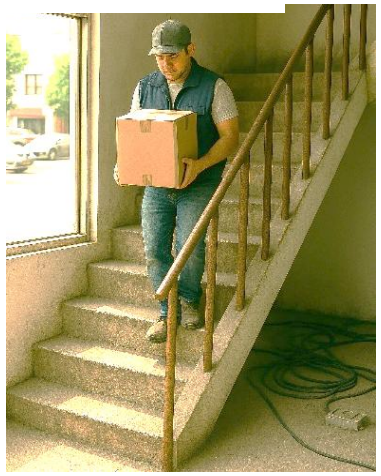
B. Metal is being processed with a drill press.



C. A person is walking on a road inside the premises.



D. A load is being carried down from the second floor.



E. A tank used for metal degreasing is being cleaned. The cleaning solution contains an organic solvent.



Explanation

A	①The right switch is taped in the ON position, so if the left switch is pressed by mistake while the right hand is inside, the hand may get caught. ②Because there is no entry prevention sensor, a hand may accidentally get caught. ③Because the back is open, another person may get caught if they approach.
B	①Because the drill is rotating, the workpiece may come into contact with it, causing fragments to fly off. ②Because safety glasses are not being worn, fragments or dust may get into the eyes. ③Because cotton work gloves are being worn, the drill may catch the gloves and injure the hand.
C	①Because the load blocks the forklift operator’s forward view, the forklift may collide with a truck or a person. ②Because the gutter cover is missing, a person or a wheel may fall into the gutter. ③Because the person has their hands in their pockets, they may be unable to support themselves in a fall and may be seriously injured.
D	①Because the load blocks the view of the feet, the person may miss a step on the stairs and fall. ②Because the person cannot hold the handrail, they may fall if they miss a step. ③The person may trip over a cable or protrusion and fall. ④If the load is heavy, it may cause lower back pain.
E	①Because protective equipment for organic solvents is not being worn, vaporized solvent may be inhaled. ②Because the ventilation fan is not running, vaporized organic solvent may accumulate in the room. ③Because the bucket lid is open, the organic solvent may spread throughout the room. ④Because the floor is wet, the worker may slip and fall.

Kiken Yochi Kunren (Kiken Yochi Training: KYT) [KYT 4-Round Method]

Safety First, Occupational Accidents, Electric Shock, Hazard Signs, Warning Signs

Practice Question 3-2

☞ "Study Reference Text" p. 34

■ Divide the following 20 terms into groups.

Safety, Sorting, Quality, C: Check, Setting-in-Order, Material/Parts, Method, Standardizing, D: Do, Shining, Operator, Delivery, A: Act, Actual Situation, Sustaining the Discipline, Actual Thing, P: Plan, Machine/Equipment, Cost, Actual Place

Table 3-3 Answers to the Practice Question

Group	Terms
QCDS	
Management Cycle	
4M	
Three Actuals Principle	
5S	

Explanation ☞ “Study Reference Text” p. 34

Group	Terms
QCDS	Quality, Cost, Delivery, Safety
Management Cycle	P: Plan, D: Do, C: Check, A: Act
4M	Operator, Machine/Equipment, Material/Parts, Method
Three Actuals Principle	Actual Place, Actual Thing, Actual Situation
5S	Sorting, Setting-in-Order, Shining, Standardizing, Sustaining the Discipline

Practice Question 3-3

☞ "Study Reference Text" p. 44

■ Which of the Seven QC Tools does each of the following describe?

① A method most useful for identifying items that should be addressed as priorities by classifying defects by type and ranking them from the highest to the lowest number of occurrences.

② A method that systematically organizes the factors (causes) of a result (characteristic) into large, medium, and small branches and visualizes them in the shape of a fishbone.

③ A method used to understand how collected data varies, that is, the shape of the data distribution.

④ A method suitable for understanding the relationship between two different variables, such as work time and defect rate or temperature and product characteristics.

⑤ A method that uses upper and lower control limits to monitor over time whether a process is stable or abnormal variation has occurred.

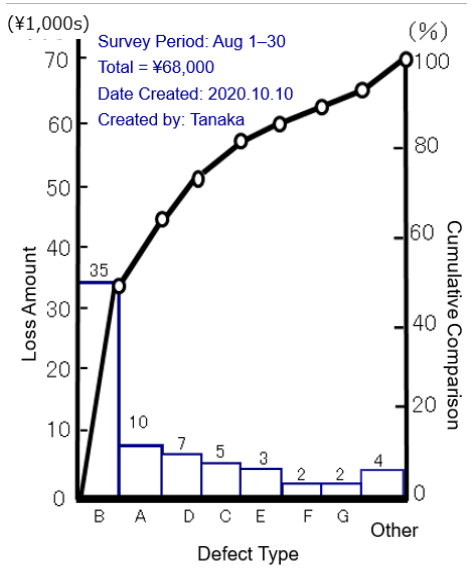
⑥ A simple form used to easily and accurately collect data in the workplace and record and tally items such as types of defects and locations where they occur.

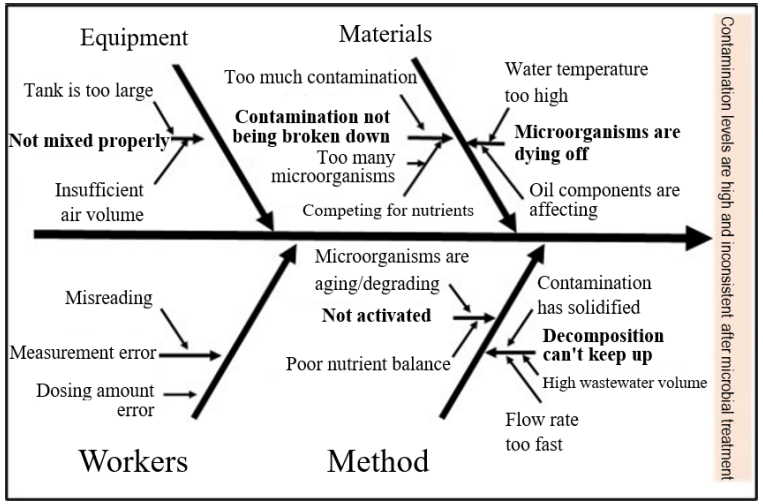
Chapter 3: Quality Management

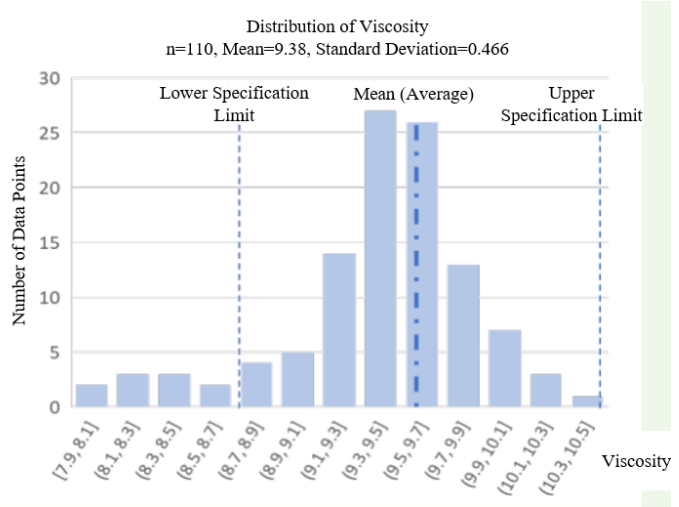
Explanation ☞ “Study Reference Text” p. 38–44

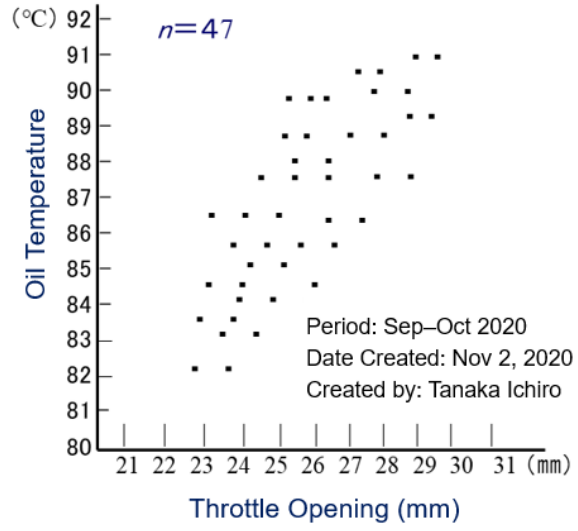
Explanation

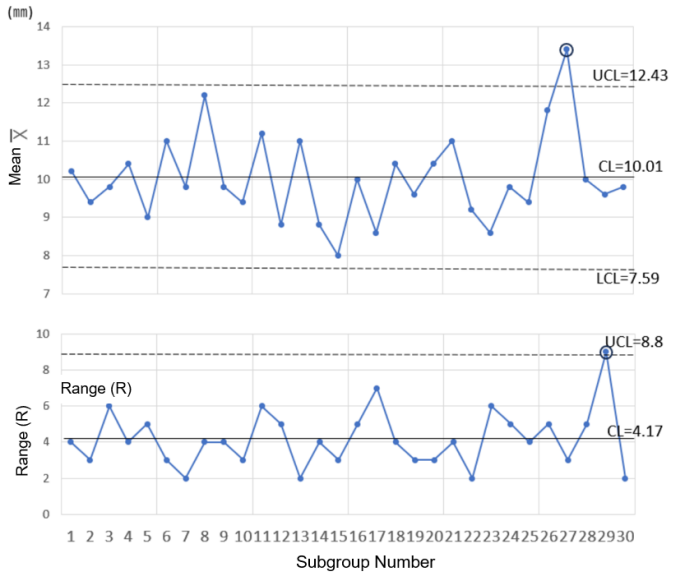
1. Pareto chart
2. Cause-and-effect diagram
3. Histogram
4. Scatter diagram
5. Control chart
6. Check sheet











Defect Item Checklist

	4/5	4/6	4/7	4/8
Crack	𝍸	///	𝍸	///
Pinhole	///		///	
Wrinkle	///	///	///	///
Scratch	/	/	𝍸	
Stain/Dirt	𝍸			///
Other	/	𝍸	𝍸	///

Quality First Customer Perspective Build Quality into the Process
Participation by All
Nonconforming Products, Quality Records, Seven QC Tools
Check Sheet, Pareto Chart, Graph,
Cause-and-Effect Diagram, Histogram, Control Chart, Scatter Diagram

Practice Question 9-2

☞ “Study Reference Text” p. 151

■ Choose the two incorrect statements from the following.

A. It is possible to plate insulating materials such as plastics.

B. Any metal can be anodized.

C. Plating is used in a wide variety of applications, such as automobiles, home appliances, and building materials.

D. CVD and PVD are used for semiconductors, electronic components, and similar products.

E. Thermal spraying is a method of forming a diffusion-penetration layer on the substrate surface.

Explanation
☞ “Study Reference Text” p. 151

Explanation

B. Metals that can be anodized are limited to aluminum, titanium, magnesium, and similar metals.

E. Thermal spraying is a method of coating the substrate surface with another substance.

Answer: B, E

Practice Question 9-3

☞ “Study Reference Text” p. 154

Choose the incorrect statement from the following.

A. Hot-dip plating is a method of forming a film by passing an electric current through the substrate in molten metal.

B. Dry plating includes methods such as vaporizing metal to form a film.

C. Both direct current and alternating current can be used in anodizing.

D. Color development and dyeing are possible in anodizing.

Explanation
☞ "Study Reference Text" p. 154

Explanation A. In hot-dip plating, the substrate is simply immersed in molten metal, and no electric current is passed.

Answer: A

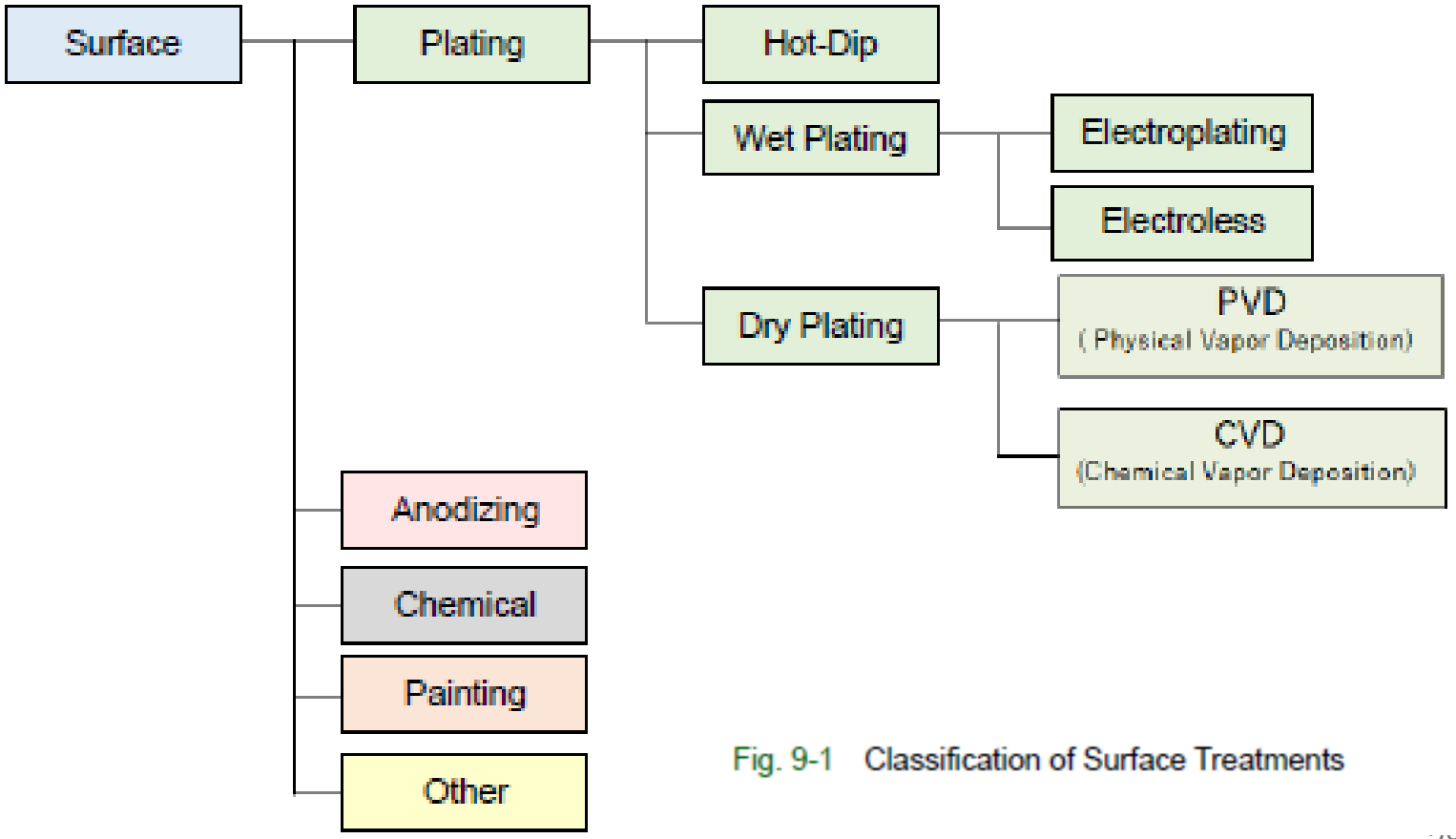


Fig. 9-1 Classification of Surface Treatments

Chapter 9: Metal Surface Treatment Keywords

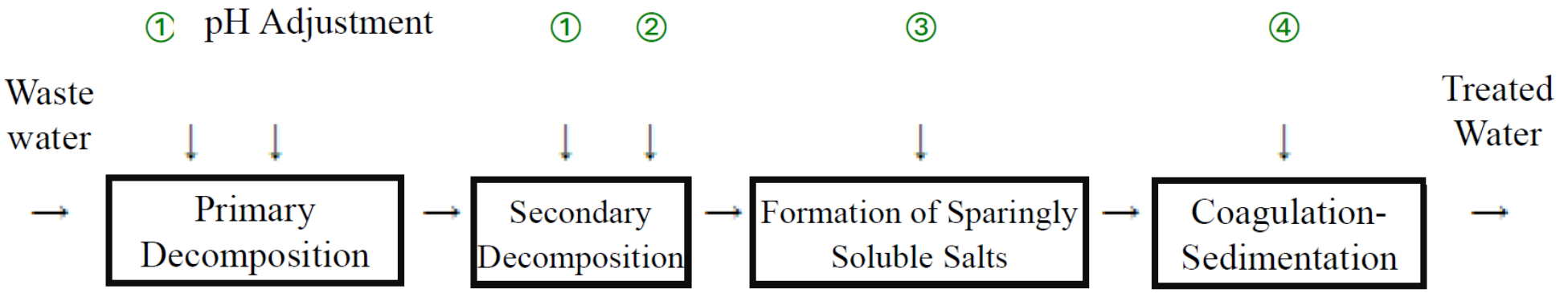
☞ “Study Reference Text” p. 148

Treatment Method	Substrate	Film Formed		Functions Provided
		Type	Film Thickness	
Plating	Metals (Steel, Copper, Aluminum Alloys, etc.), Resins, etc.	Metals (Zinc, Chromium, Nickel, Gold, Tin, etc.)	Approx. 0.1–150 μm	Corrosion Resistance, Wear Resistance, Conductivity, Decorative Properties
Anodizing	Aluminum, Titanium, Magnesium	Oxide Film (Alumina, etc.)	Approx. 1–150 μm	Corrosion Resistance, Wear Resistance, Insulating Properties, Dyeability, Catalytic Properties
Chemical Conversion Treatment	Metals (Steel, Galvanized Steel Sheet, Stainless Steel, Aluminum, etc.)	Compound Film (Phosphate, Chromium Oxide Film, etc.)	Approx. 0.01–20 μm	Corrosion Resistance, Lubricity, Paint Pretreatment
Painting	Metals (Steel, Stainless Steel, Aluminum, etc.), Resins, Wood, etc.	Resin Film	Approx. 15–150 μm	Corrosion Resistance, Water Resistance, Weather Resistance, Decorative Properties, Thermal Insulation
Thermal Spraying	Metals (Steel, Stainless Steel, Aluminum, etc.), Ceramics, Resins, etc.	Metals (Zinc, Aluminum, etc.), Ceramics (Alumina), Cermets, Resins, etc.	Approx. 0.1–several mm	Corrosion Resistance, Wear Resistance, Thermal Insulation, Conductivity, Insulating Properties
Surface Heat Treatment (Quenching, Thermal Diffusion Treatment)	Steel, Cast Iron, Stainless Steel, etc.	The Microstructure and Chemical Composition of the Substrate Surface Change	Approx. 0.01–several mm (Hardened Layer Depth)	Wear Resistance, Fatigue Resistance, Corrosion Resistance
Etching	Metals (Steel, Copper, Aluminum, etc.), Silicon, Glass, Resins, etc.	The Shape of the Substrate Surface Changes	Several nm–Several Hundred μm (Etching Thickness)	Oxide Film Removal, Cleaning, Antireflective Decoration, Microstructure Formation

Practice Question 4-1

☞ "Study Reference Text" p. 55

- The figure below shows the cyanide wastewater treatment flow using alkaline chlorination–Prussian blue treatment. Choose the correct combination of chemicals to be added. Select one chemical from the choices for each of ① to ④.



A. NaOH Sodium Hydroxide **B.** NaClO Sodium Hypochlorite

C. Cl_2 Chlorine Gas **D.** H_2SO_4 Sulfuric Acid **E.** PAC Polyaluminum Chloride

F. $Al_2(SO_4)_3$ Aluminum Sulfate **G.** $FeSO_4 \cdot 7H_2O$ Iron(II) Sulfate Heptahydrate

Explanation

① Cyanide is decomposed by the alkaline chlorination method (a water treatment method that oxidatively decomposes cyanide using an oxidizing agent such as sodium hypochlorite under alkaline conditions).

Answer: B

② Sodium hypochlorite is added again, and the pH is adjusted with sulfuric acid.

Answer: D

③ Cyanide compounds are reliably removed by the Prussian Blue Method, in which cyanide complexes, such as iron complexes, that are difficult to decompose by the alkaline chlorination method are converted into sparingly soluble salts by adding an iron salt and then removed by coagulation-sedimentation.

Answer: G

④ A polymer coagulant (PAC) is used to reliably form a precipitate and remove it.

Answer: E

Wastewater Treatment: Coagulation-Sedimentation Method
Alkaline Chlorination Method Prussian Blue Method

Practice Question 4-3

☞ "Study Reference Text" p. 60

- Choose the correct statement about pollution.

A. Pollution causes harm to human health or the living environment and is generated by production activities at factories.

B. Odorous substances generated by production activities at factories and other facilities are not a problem because they spread through the air.

C. Noise generated at factories and construction sites is not a problem during the daytime.

D. Factory wastewater is not a problem even if it seeps into the soil, as long as it does not spread.

Explanation

Pollution causes harm to human health or the living environment. There are seven types of pollution generated by production activities at factories.

Answer: A

☞ “Study Reference Text” p. 50

Basic Act on the Environment, Seven Types of Pollution (Water Pollution, Air Pollution, Soil Contamination, Noise, Vibration, Land Subsidence, Offensive Odors)



Environmental Management System (ISO 14001) Reduce, Recycle, Reuse RoHS Directive, REACH Regulation

Practice Question 5-4

☞ "Study Reference Text" p. 73

■ Choose A if the statement is correct and B if it is incorrect.

① (　　) An X-ray fluorescence coating thickness gauge is used to measure plating thickness.

② (　　) The mean film thickness of Sample F is 11 μm. Round to the nearest whole number.

Unit: μm

Sample	①	②	③	④	⑤	Mean
F	10	12	15	11	9	

③ (　　) When 1.6 g of plating (density: 8.0 g/cm³) is deposited on both sides of a 100 cm^2 substrate, the film thickness is 20 μm.

Explanation
☞ **"Study Reference Text" p. 73**

Explanation

① **Answer: A**

② (10 + 12 + 15 + 11 + 9) ÷ 5 = 11.4, rounded to 11

Answer: A

③ Film thickness = 1.6 g ÷ 100 cm^2 ÷ 8 g/cm^3 ÷ 2 (both sides) × 10,000 = 10 μm

Answer: B

Practice Question 5-7

☞ “Study Reference Text” p. 83

Choose A if the statement is correct and B if it is incorrect.

① (　　) Visual inspection is performed at an illuminance of 500 lux or less.

② (　　) Color matching is performed using only measuring instruments.

③ (　　) A tape peel test is one type of plating adhesion test.

④ (　　) In a cross-cut adhesion test for a coating, cuts reaching the substrate are made with a utility knife to evaluate adhesion.

⑤ (　　) A falling sand abrasion test is one type of wear resistance test.

Explanation ☞ “Study Reference Text” p. 83

Explanation

① Depending on the type of inspection, it is performed at an illuminance of 500 lux or more.

Answer: B

② Color matching is also performed visually.

Answer: B

③ Correct.

Answer: A

④ Correct.

Answer: A

⑤ Correct.

Answer: A

Measurement of Solutions (How to Read the Scale)

Electrical Measurement (Voltage and Current)

Visual Inspection, Film Thickness Measurement, Corrosion

Resistance Test

Practice Question 6-2 ☞ "Study Reference Text" p. 91

① Choose one correct statement about metal materials from choices A to D.

A. When zinc is dissolved in hydrochloric acid, chlorine gas is generated.

B. For the same volume, aluminum is heavier than iron.

C. Ionization tendency differs depending on the metal.

D. Electric current flows more easily through aluminum than through copper.

② Choose one incorrect statement about metal alloys from choices A to D.

A. Aluminum die-casting material ADC12 is an alloy with silicon and iron added.

B. Bronze is an alloy of copper and tin.

C. Steel is an alloy composed mainly of iron and is an inexpensive basic material with excellent mechanical and physical properties.

D. Because zinc alloys have a low melting point, they are used for die casting and hot-dip galvanizing.

Explanation

① A. When zinc is dissolved in hydrochloric acid, hydrogen is generated.

B. Iron has a specific gravity of 7.8 and aluminum 2.7, so aluminum has a lower specific gravity.

C. Ionization tendency differs depending on the metal and corresponds to susceptibility to corrosion.

D. Copper has lower electrical conductivity and allows electric current to flow more easily.

Answer: C

② A. Aluminum die-casting alloy ADC12 is an alloy with silicon and copper added.

B. Bronze is copper with tin added.

C. Steel is a relatively inexpensive material with excellent physical properties.

D. Zinc has a low melting point and is used for die casting and hot-dip galvanizing.

Answer: A

Practice Question 6-3 ☞ "Study Reference Text" p. 98

① Choose one incorrect statement about corrosion from choices A to D.

A. Aluminum combines with oxygen in the air to form a strong natural oxide film.

B. Steel is easily corroded by humidity and sea salt grains.

C. Zinc is a metal that is more prone to corrosion than iron.

D. Aluminum materials must be stored away from dust and condensation to prevent corrosion.

② Choose one correct statement about corrosion from choices A to D.

A. Aluminum materials have excellent corrosion resistance and will not corrode even when stored outdoors.

B. Steel is not corroded by sea salt grains.

C. Aluminum combines with oxygen in the air to form a thin oxide film.

D. Chemical conversion treatment is a method to prevent metal corrosion.

Explanation ☞
"Study Reference Text" p. 99

Explanation ①

A. Aluminum is an active metal and combines with oxygen in the air to form a thin natural oxide film. The natural oxide film is weak and corrodes easily if damaged.
B. Steel is easily corroded by humidity (moisture) and sea salt grains (sodium chloride).
C. Zinc is a metal that is softer and more easily damaged than iron.
D. The oxide film on aluminum materials is stable but is easily affected by external factors. To prevent corrosion, aluminum materials must be stored away from dust and condensation.

Answer: A

②

A. Aluminum materials have excellent corrosion resistance but are susceptible to corrosion from wind and rain when stored outdoors.
B. Steel is corroded by the salt in sea salt grains.
C. Aluminum combines with oxygen in the air to form a thin oxide layer (Al_2O_3).
D. Chemical conversion treatment is often used to prevent corrosion of aluminum, but it is not effective for all metals.

Answer: C

Density, Melting Point of Metals, Electrical

Conductivity of Metals

Corrosion of Iron (Steel), Corrosion of Copper,

Corrosion and Corrosion Protection of Aluminum,

Corrosion of Zinc Materials Used for Jigs

Practice Question 7-3

☞ "Study Reference Text" p. 111

- Choose one incorrect statement from the following four statements about oxidation and reduction.

  A. When an iron plate is placed in a copper sulfate solution, copper is deposited on the surface of the iron plate.

  B. Oxidation means that a substance combines with hydrogen.

  C. In anodizing, aluminum is oxidized to form an anodic oxide film.

  D. When a zinc plate is placed in a copper sulfate solution, the zinc is oxidized and dissolves.

Explanation

A. When an iron plate is placed in a copper sulfate solution, the surface of the iron plate is oxidized, and copper ions are reduced by the iron, causing metallic copper to be deposited.

B. Oxidation usually refers to a substance combining with oxygen (oxidation of metals in the narrow sense). In plating (electrochemistry), ‘oxidation and reduction’ means the loss of electrons (oxidation in the broad sense).

C. Correct.

D. When a zinc plate is placed in a copper sulfate solution, the zinc is oxidized and dissolves. Copper is deposited on the surface of the zinc plate.

Answer: B

Practice Question 7-5 ☞ "Study Reference Text" p. 118

- Choose one incorrect statement from the following four statements about pH.

A. Mixing equal amounts of pH 4 and pH 6 solutions does not result in pH 5.

B. An aqueous solution that turns pH test paper blue is acidic.

C. A solution with a pH greater than 7 is alkaline.

D. There are fixed, benchtop, and handheld pH meters.

Explanation

A. Because pH 4 and pH 6 solutions differ greatly in hydrogen ion concentration (by about two orders of magnitude), mixing equal amounts of the solutions does not result in an intermediate pH value. Correct.

B. An aqueous solution that turns pH test paper blue is alkaline. Incorrect.

C. Correct.

D. Various types of pH meters, including fixed, benchtop, and handheld types, are manufactured. Correct.

Answer: B

☞ “Study Reference Text” p. 103–127

Acids and Bases, Dissolution, Precipitation, Neutralization, Oxidation and Reduction, Gases pH, Wettability, Ionization Tendency

Practice Question 8-2 ☞ "Study Reference Text" p. 134

- Choose A if the statement is correct and B if it is incorrect.

① ( ) When an electric current flows through a wire, a magnetic field is generated parallel to the wire.

② ( ) The Right-Hand Screw Rule describes the relationship between the directions of electric current and the magnetic field.

Explanation ☞ "Study Reference Text" p. 134

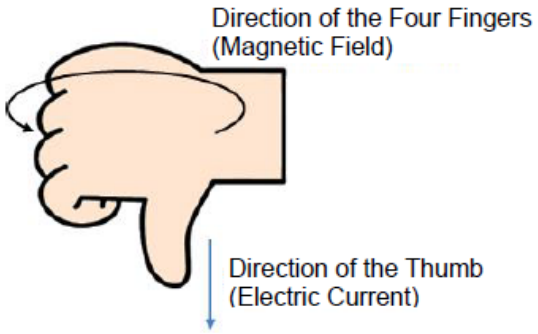
Explanation

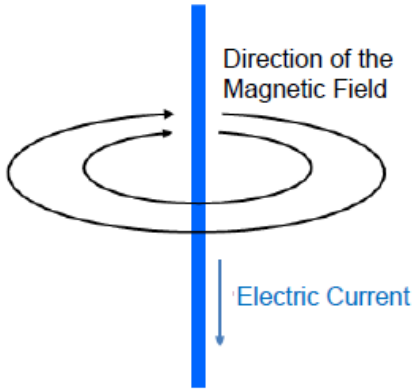
① A magnetic field forms in a doughnut shape around the wire.

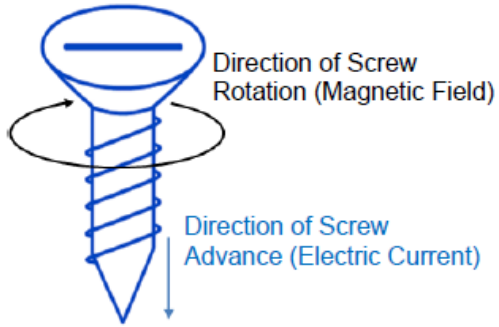
Answer: B

② Correct.

Answer: A







Practice Question 8-4 ☞ "Study Reference Text" p. 141

- Choose A if the statement is correct and B if it is incorrect.

① ( ) In Fig. 8-9, when R_1 = 10 Ω and R_2 = 5 Ω, the combined resistance R is 15 Ω.

② ( ) In Fig. 8-9, when R_1 = 10 Ω and R_2 = 500 mΩ, the combined resistance R is 15 Ω.

③ ( ) In Fig. 8-9, when R_1 = 70 mΩ and R_2 = 80 mΩ, the combined resistance R is 150 mΩ.

④ ( ) In Fig. 8-10, when R_1 = 2 Ω and R_2 = 2 Ω, the combined resistance R is 4 Ω.

⑤ ( ) In Fig. 8-10, when R_1 = 8 Ω and R_2 = 2 Ω, the combined resistance R is 1.6 Ω.

⑥ ( ) In Fig. 8-11, when R_1 = 1 Ω, R_2 = 3 Ω, R_3 = 2 Ω, and R_4 = 2 Ω, the combined resistance R is 5 Ω.

⑦ ( ) In Figure 8-11, when R_1 = 10 Ω, R_2 = 3 Ω, R_3 = 2 Ω, R_4 = 8 Ω, the combined resistance R is 17.6 Ω.

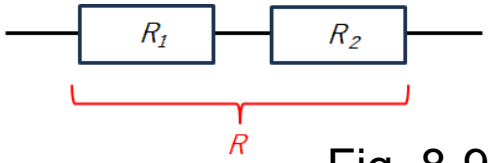


Fig. 8-9

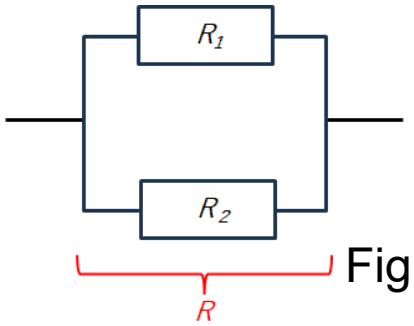


Fig. 8-10

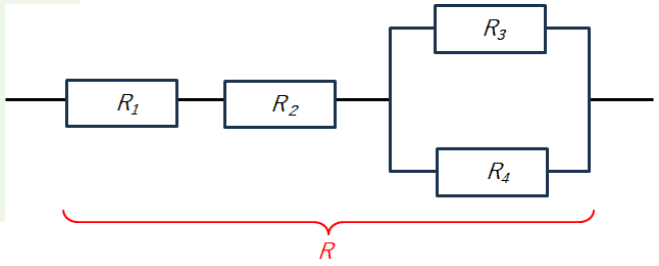


Fig. 8-11

Explanation

① R = R1 + R2 = 10 + 5 = 15 Ω.

Answer: A

② R = R1 + R2 = 10 + 0.5 = 10.5 Ω.

Answer: B

③ R = R1 + R2 = 70 + 80 = 150 mΩ.

Answer: A

④ R = (R1 × R2) / (R1 + R2) = (2 × 2) / (2 + 2) = 4 / 4 = 1 Ω.

Answer: B

⑤ R = (R1 × R2) / (R1 + R2) = (8 × 2) / (8 + 2) = 16 / 10 = 1.6 Ω.

Answer: A

⑥ R = R1 + R2 + (R3 × R4) / (R3 + R4) = 1 + 3 + (2 × 2) / (2 + 2) = 5 Ω.

Answer: A

⑦ R = R1 + R2 + (R3 × R4) / (R3 + R4) = 10 + 3 + (2 × 8) / (2 + 8) = 14.6 Ω.

Answer: B

$$R = R_1 + R_2$$

$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} \Rightarrow R = \frac{R_1 \times R_2}{R_1 + R_2}$$

Equivalent Resistance in a Parallel Circuit

$$R = R_1 + R_2 + \frac{R_3 \times R_4}{R_3 + R_4}$$

Right-Hand Rule

Ohm’s Law, Series Connection, Parallel Connection, Electric Power

Fleming’s Rule, Kirchhoff’s Laws

Practice Question 10-3 ☞ "Study Reference Text" p. 176

■ Choose the two incorrect statements from the following.

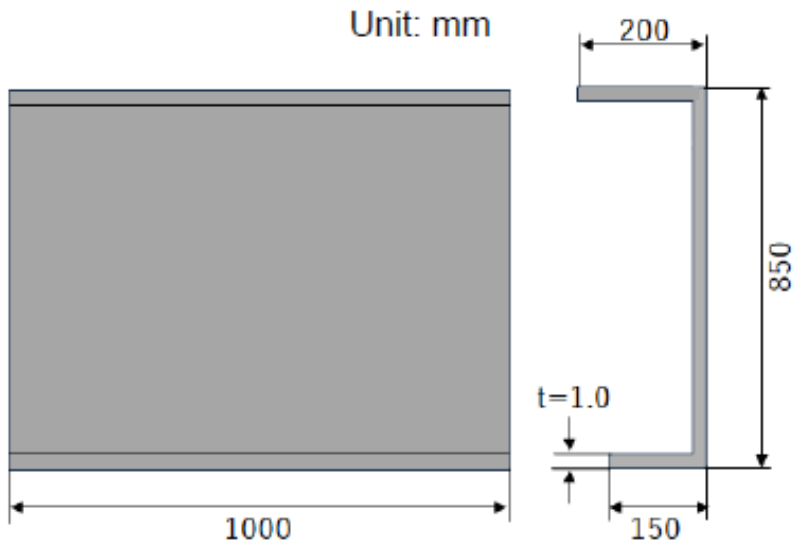
A. The anode used for electroplating must be soluble in the plating solution.

B. Stirring is important to achieve a consistent plating solution concentration and temperature.

C. Titanium has excellent corrosion resistance and can be used in jigs for plating or for anodizing.

D. Barrel plating is used to plate bolts, nuts, and electronic parts.

E. The surface area of the part shown in the following drawing is 2 m^2. However, the cross-sectional area of the product is not taken into consideration.



Explanation

A. Sometimes an insoluble anode that does not dissolve is used.

E. Surface area = (150 + 850 + 200) × 1000 × 2 = 1200 × 1000 × 2 = 2400000 mm^2 = 2.4 m^2

Answer: A, E

Practice Question 10-6 ☞ "Study Reference Text" p. 191

- Choose A if the statement is correct and B if it is incorrect.

① ( ) In hot-dip plating, an alloy layer forms between the substrate and the plating layer.

② ( ) Flux treatment prevents the substrate from rusting and promotes alloying between the substrate and zinc.

③ ( )When a 2 t zinc plating bath is heated from 400°C to 450°C, if the specific heat of zinc is 0.377 kJ/(kg·K), the required amount of heat is 37,700 kJ.

Explanation ☞ “Study Reference Text” p. 191

Explanation

① Correct.

Answer: A

② Correct.

Answer: A

③ 0.377 × 2000 × 50 = 37700 kJ

Answer: A

Chapter 10: Plating Keywords

☞ “Study Reference Text” p. 103–127

Treatment Process, Equipment, Control, Defects, Area (Calculation), Current, Voltage

Electroless Plating, Hot-Dip Plating

Chapter 11: Aluminum Anodizing

Practice Question 11-2

☞ "Study Reference Text" p. 206

- The following table shows the thickness of anodized film measured with a film thickness meter.

  Choose the description that is incorrect based on JIS H 8601.

	Measurement results (μm)					Mean film thickness (μm)
A	4.9	4.5	5.3	5.0	4.9	4.9
B	6.3	6.2	5.6	3.9	6.5	5.7
C	14.0	14.5	14.9	15.5	15.1	14.8
D	14.6	14.8	15.2	15.1	15.3	15.0

A. Does not meet grade AA5.

B. Meets grade AA5.

C. Does not meet grade AA15.

D. Meets grade AA15.

Explanation ☞ "Study Reference Text" p. 206

Explanation

• The mean film thickness must be equal to or greater than the grade value.

• At least 80% of the mean film thickness. At least 12 μm for 15 μm and at least 4 μm for 5 μm.

A and C have mean film thicknesses below the standard value. Correct.

D meets the standard. For B, the mean film thickness is 5.7 μm, which is within the standard, but there is a value of 3.9 μm that is outside the standard.

Answer: B

	Measurement results (μm)					Mean film thickness (μm)
A	4.9	4.5	5.3	5.0	4.9	4.9
B	6.3	6.2	5.6	3.9	6.5	5.7
C	14.0	14.5	14.9	15.5	15.1	14.8
D	14.6	14.8	15.2	15.1	15.3	15.0

Practice Question 11-3

☞ “Study Reference Text” p. 209

■ Choose one correct statement from the following four statements about anodizing.

A. Only the direct current method is used for anodizing aluminum materials.

B. The quality of anodizing is specified in JIS H 8601.

C. Aluminum alloy castings cannot be anodized.

D. Hard anodizing is often performed without sealing, but this does not affect corrosion resistance.

Explanation

A. For anodizing aluminum materials, not only direct current but also AC superposition may be used for coloring purposes.

B. The quality of anodizing is specified in JIS H 8601. Correct.

C. Aluminum alloy castings require special treatment such as smut treatment, but they can be anodized.

D. Even hard anodic oxide films do not have good corrosion resistance unless sealing is performed. When corrosion resistance is required, sealing is performed.

Answer: B

Work Procedures, Evaluation

Sealing Treatment, Coloring Treatment

Corrosion Resistance Test, Wear Resistance Test, Lightfastness Test

Practice Question 12-2 ☞ "Study Reference Text" p. 224

- Choose the two incorrect statements from the following.

A. In buff polishing, the material surface is first finished to a mirror finish, and then rough polishing is performed.

B. In buff polishing, softer buffs and finer abrasives are used as the process progresses.

C. Sisal buffs have strong polishing power and are suitable for deburring and removing deep scratches.

D. Green buffing compound is made of silica and is mainly used for rough polishing.

E. There are various types of buff polishing equipment, including floor-mounted and handheld types.

Explanation

A. Mirror finishing is performed as the final finishing step.

D. Green buffing compound is made of chromium oxide and is used from finish polishing through mirror finishing.

Answer: A, D

Practice Question 12-3

☞ "Study Reference Text" p. 229

- Choose the two incorrect statements from the following.

A. In buff polishing, pressing too hard makes burning more likely to occur.

B. In buff polishing, any buff or abrasive may be used.

C. In buff polishing, it is acceptable to proceed to the next process while leaving coarse scratches.

D. In buff polishing, it is important to polish at a rotational speed suitable for the material.

E. In buff polishing, it is important to apply the buff properly, including at the proper angle.

Explanation ☞ “Study Reference Text” p. 229

Explanation

B. In buff polishing, it is important to use buffs and abrasives suitable for the material and purpose.

C. If coarse scratches remain when proceeding to the next process, they will not disappear even after finishing, so it is important not to leave coarse scratches.

Answer: B, C

Buff Polishing Process Precautions for Buff Polishing

Buff Polishing Defects: Burning, Unevenness, Poor Gloss

Buffing Stoppage

Summary

1. Because surface treatment involves handling hazardous substances, particular attention must be paid to health and safety.

2. Chapter 9 was covered in the first half of the lecture, so please make sure you understand the overview of each treatment method.

3. In plating and anodizing, the surface area of the item being treated is a key factor in the quality of the finish, so please review how to calculate the area.

4. In plating and anodizing, management of the treatment solution is also important for proper operation.

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