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

(Electric and electronic equipment assembly)

— Studying Using the “Study Reference Text” —

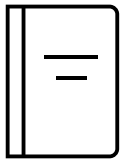
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Introduction

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

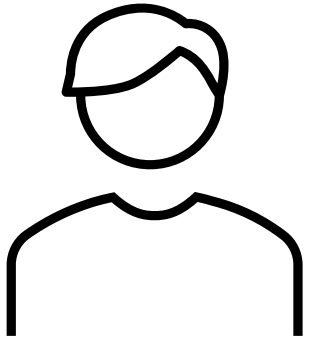
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Profile of a Specified Skilled Worker (ii)

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

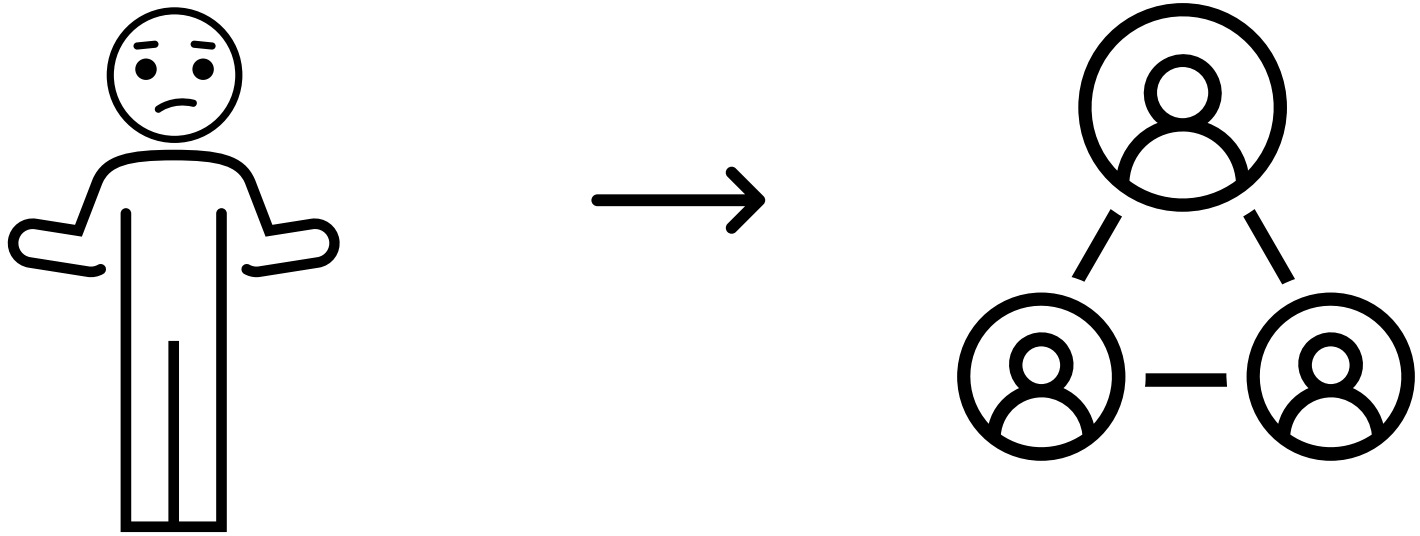
Creating your own specialized vocabulary list, etc.

③ Becoming familiar with the Japanese used on the exam

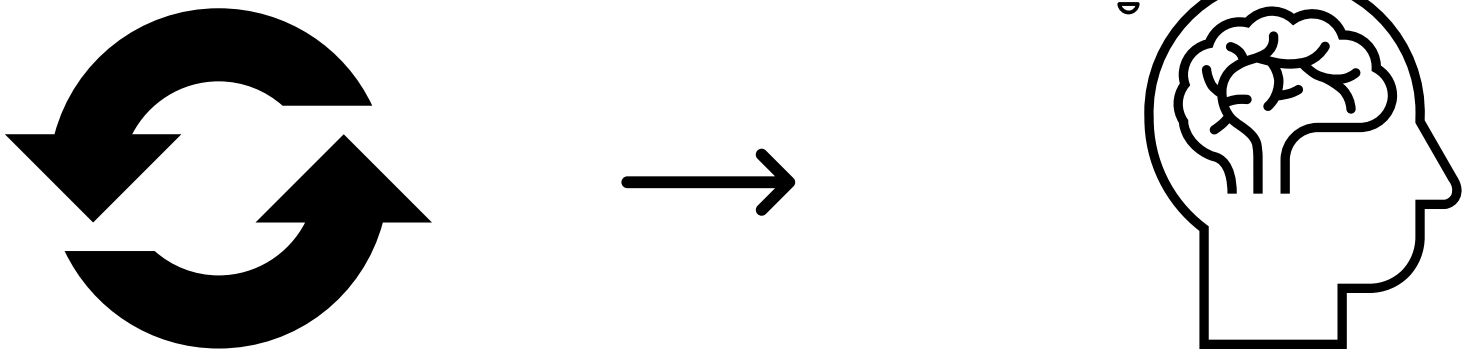
Getting plenty of exposure to exam questions, instructions, and answer choices

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

(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：瀬戸山 英嗣（Mr. Eiji Setoyama）

About the “Study Reference Text”

This textbook has about 40 practice questions.

Sixteen of those questions will be explained today.

They cover content considered important, but similar content will not necessarily appear on the exam.

A summary of each chapter is provided after the explanations of the practice questions, so please also use it as a reference for your studies.

Practice Question Topics

1. Meaning of 5S
2. Hazard Prediction at Work
3. QC Seven Tools / Pareto Chart
4. JIS Standards
5. Third-Angle Projection
6. JIS Graphical Symbols
7. Tools and How to Use Them
8. Reading a Micrometer
9. How to Cut Threads with a Tap
10. Lathe Machining Method
11. Current in DC Circuits
12. Current in AC Circuits
13. Actions After Completing Work
14. Sequence Circuits
15. Maintenance
16. Plastic Molding Method
17. Summary of Each Chapter

Practice Question 2-1
☞ “Study Reference Text” p. 6

[Practice Question 2-1]

■ Which of seiri, seiton, seiso, seiketsu, and shitsuke does each of the following describe?

① (　　) Clearly separate what is needed from what is not needed.

② (　　) Eliminate unnecessary searching time to increase work efficiency.

③ (　　) Find equipment abnormalities or problems (e.g., oil stains or loose parts) while removing dirt.

④ (　　) Maintain good conditions at all times and standardize procedures so that anyone can carry them out.

⑤ (　　) Voluntarily follow the established rules even when a leader is not present.

Explanation

☞ “Study Reference Text” p. 6

[**Explanation**]

①This describes sorting. (Seiri)

② This describes the purpose of setting-in-order. (Seiton)

③ Viewing cleaning as an inspection helps detect abnormalities early. (Seiso)

④ Standardization is important for maintaining a clean and orderly condition. (Seiketsu)

⑤ The goal is to make following the rules a habit and create a workplace where each person acts independently. (Shitsuke)

Supplementary Information [Meaning of 5S]

5S is an activity for improving the workplace environment at manufacturing sites, not a set of rules

The term 5S comes from the initial letters of the romanized Japanese words Seiri (Sorting), Seiton (Setting-in-Order), Seiketsu (Standardizing), Seiso (Shining), and Shitsuke (Sustaining the Discipline).



[Purpose]

- ○ Improving work efficiency and productivity
- ○ Improving safety
- ○ Employee ethics management

[Effects]

- ○ QCD benefits
- ○ Coordination with maintenance activities
- ○ Supporting IoT implementation

Practice Question 2-3

☞ “Study Reference Text” p. 19

Look at illustration B below and consider what hazards may be lurking.

A: Metal press work	B: Processing metal with a drill press	E: Cleaning a tank for metal degreasing work
The worker is performing metal press work. (Both the left and right switches are pressed simultaneously to operate the press.)	The worker is processing metal with a drill press.	The worker is cleaning a tank used for metal degreasing. The cleaning solution contains an organic solvent.
		

Explanation
☞ “Study Reference Text” p. 19



[Explanation]

① As the drill rotates and cuts the workpiece, chips and fragments may fly off.
② The worker is not wearing protective goggles, and chips, fragments, or dust may get in their eyes.
③ The worker is wearing cotton gloves that may be caught in the drill, injuring the worker’s hand.

Explanation partially revised

Supplementary Information: Precautions for Using a Drill Press and Cotton Gloves

[Precautions for using a drill press]

① Securely fasten the workpiece being processed.

② Wear protective goggles and work clothes to prevent injuries caused by cutting metal.

③ Wearing gloves when using a drill press is prohibited by law.

If the fingertips of the cotton gloves* fray and get tangled in the chips from processing, your fingers can get caught in an instant.

④ Ensure nobody approaches during the work.

⑤ The benchtop drill press in the photo is used on a workbench.



Gunte: Knitted work gloves made of cotton yarn. They are widely used for many types of work in Japan, but their use with a drill press is prohibited by law (Article 111, Ordinance on Industrial Safety and Health).

What is Kiken Yochi Training (**KYT**: Kiken Yochi Training)?

Participants look at illustrations or photos and discuss hazardous areas and points requiring caution. By exchanging opinions, participants broaden their perspective and become more sensitive to hazards, thereby improving their hazard prediction skills.

1. **Basics of hazard prediction:** It is important to maintain a mindset of always being aware of hazards.
2. **Automatic safe behavior :** Think in terms of “What if ...?”
3. **Ability to respond to changes and risks :** Detect the risks posed by small changes early.
4. **Improving safety awareness:** Sharing information about hazards improves the team’s safety awareness.

Practice Question 3-4

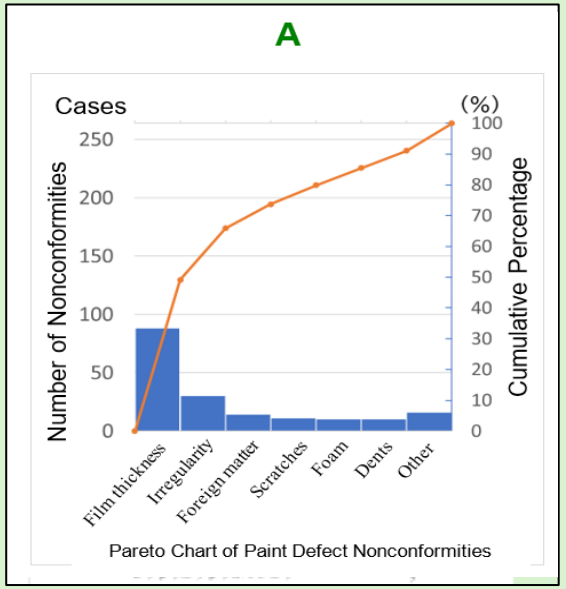
☞ "Study Reference Text" p. 45

Which of the Pareto charts from A to D correctly shows the number of nonconformities related to coating?

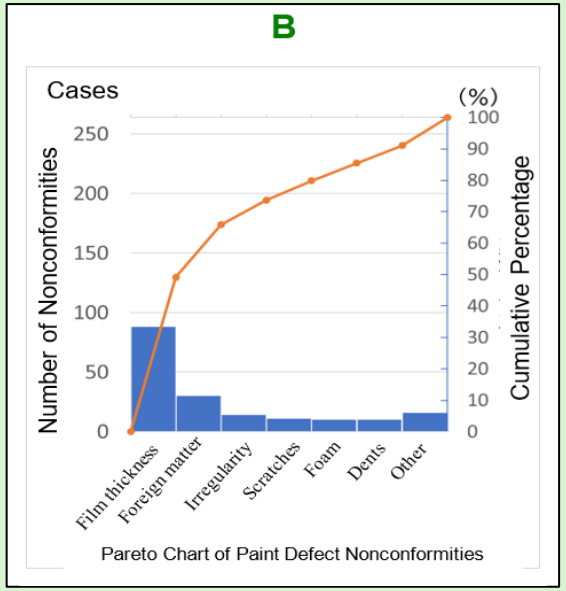
Type	Incidents	Cumulative incidents	Cumulative ratio %
Film thickness	88	88	49.2
Irregularity	30	118	65.9
Foreign matter	14	132	73.7
Scratches	11	143	79.9
Foam	10	153	85.5
Dents	10	163	91.1
Other	16	179	100.0

Pareto chart: A chart combining a bar graph with items arranged in descending order by number of incidents and a line graph showing the cumulative ratio

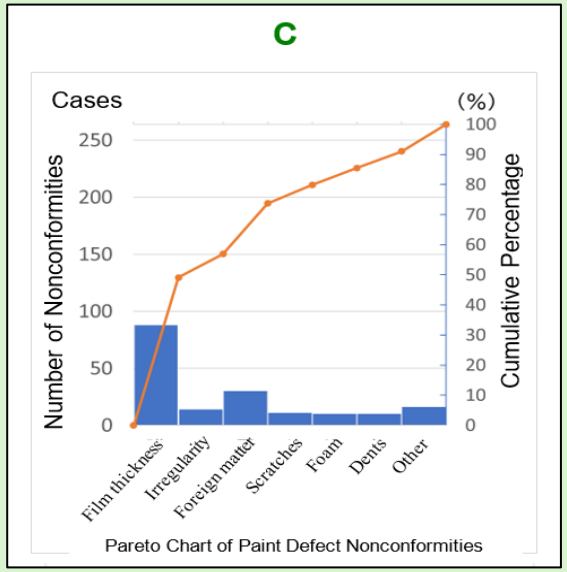
A



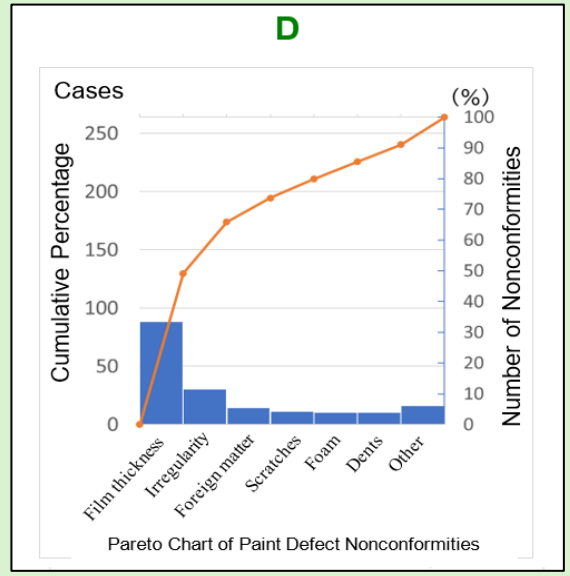
B



C



D



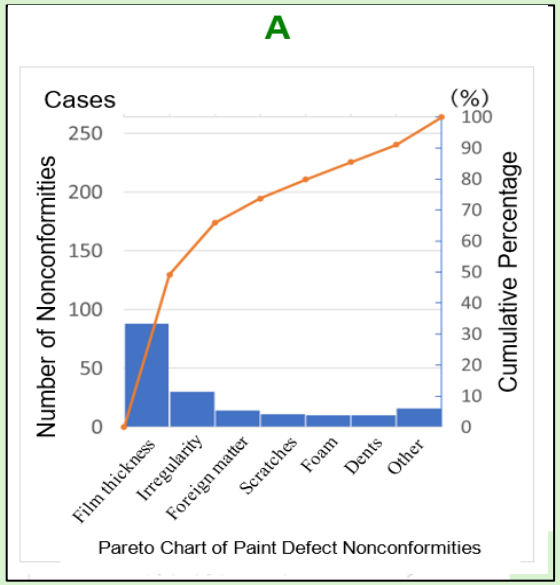
Explanation
☞ “Study Reference Text” p. 45

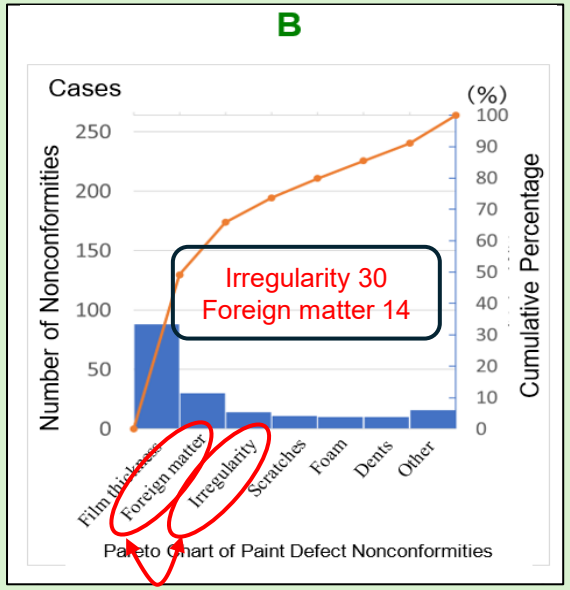
[Explanation]

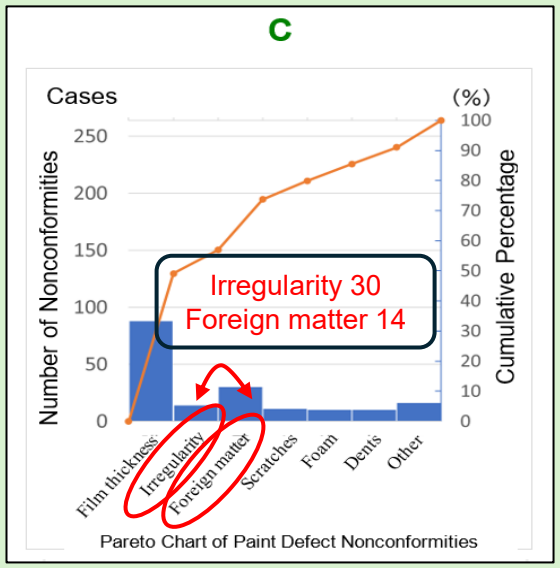
A. Shown correctly.
B. The order of foreign matter and irregularity is incorrect.
C. The type names for foreign matter and irregularity are reversed.
D. The names of the vertical axes for the right and left sides are reversed.

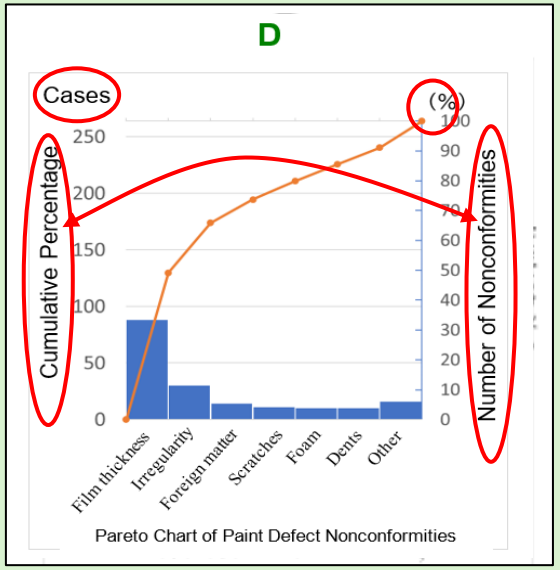
Answer: A

Pareto chart: A chart combining a bar graph with items arranged in descending order by number of incidents and a line graph showing the cumulative ratio





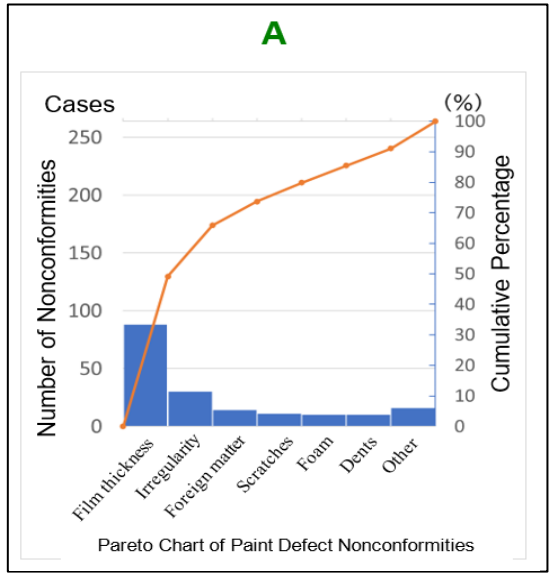




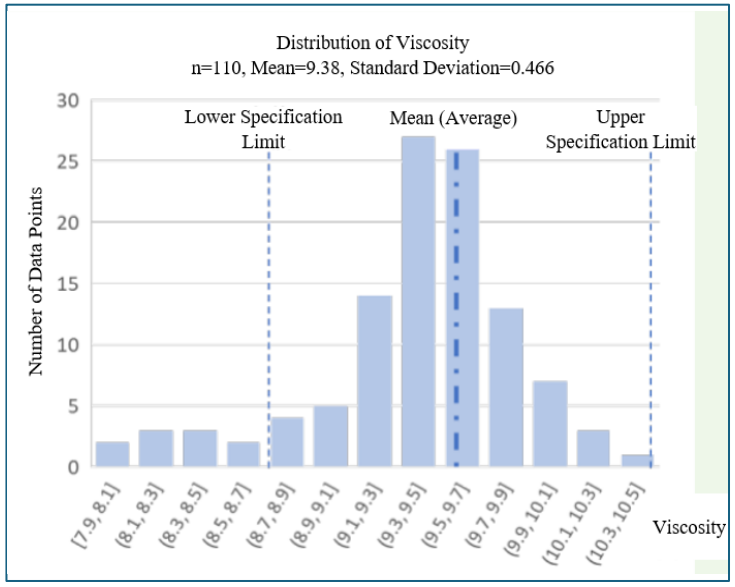
[Important]

Pareto chart: Look at the ratio of the whole for each item and determine the priority of defects, faults, improvement, etc.

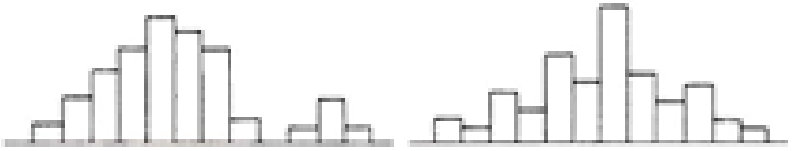
Histogram: A histogram shows at a glance the extent of variation and bias in the data distribution relative to the target value, and its shape can be used to investigate the causes of variation. For mass-produced products, statistical methods such as 3σ and 6σ are often used for quality control.



Pareto chart

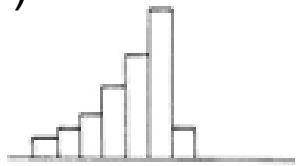


Histogram

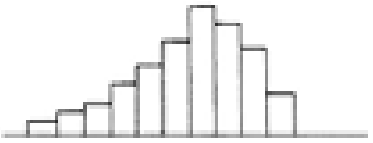


(a) Isolated island

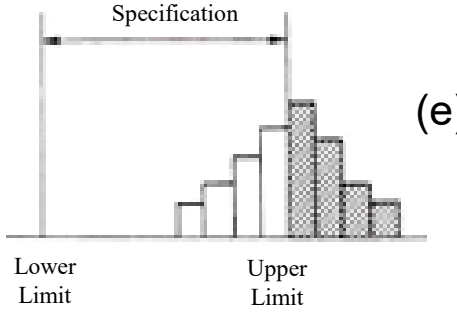
(b) Comb shape



(c) Cliff shape



(d) Skewed shape



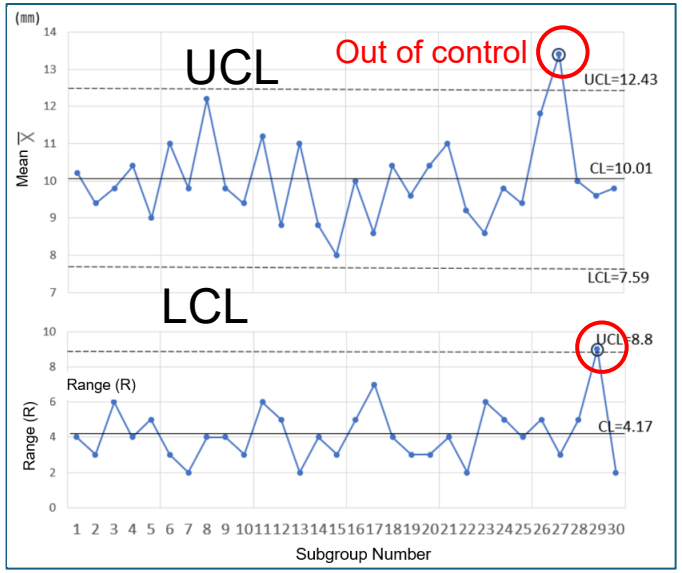
(e) Comparison with specifications

[Important]

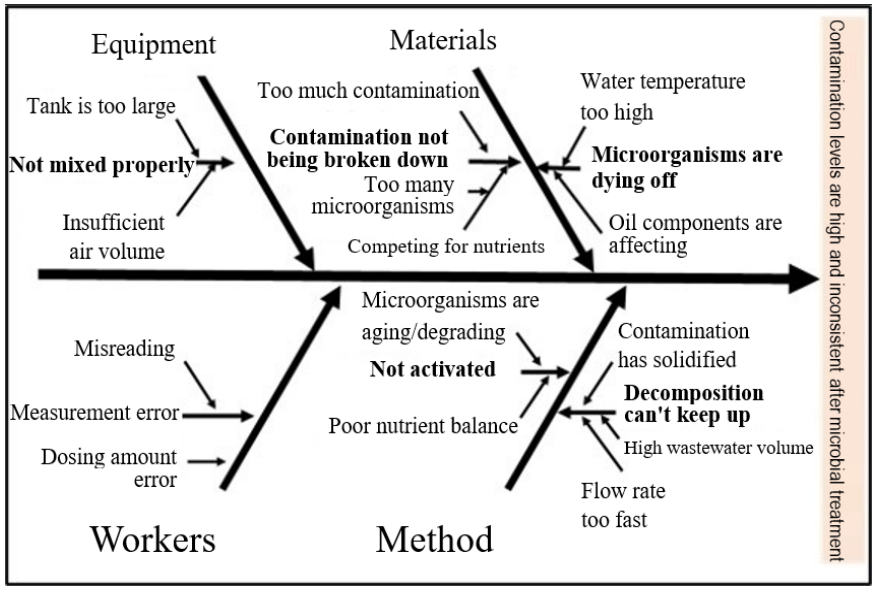
Control chart: Enables statistical detection of variation due to accidental (common) causes and variation due to abnormal (special) causes in processes.

Cause-and-effect diagram: Diagram that clearly and systematically shows the relationships between potential causes affecting defects and other characteristic results.

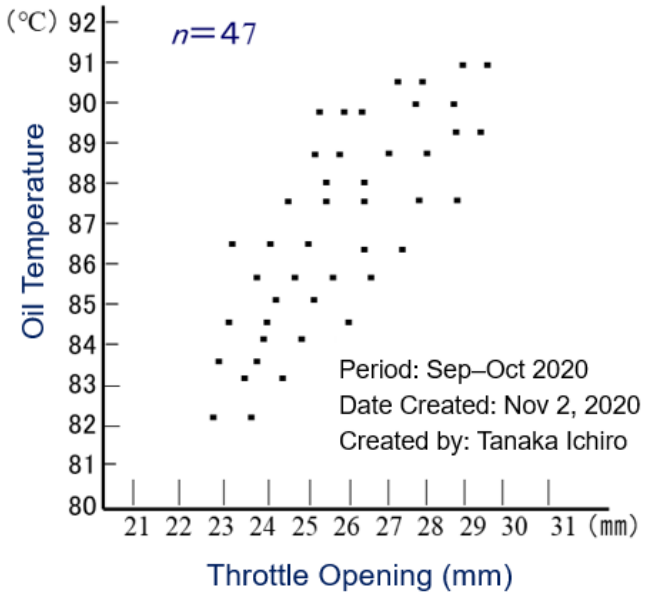
Scatter diagram: Diagram used to determine if there is a correlation between the amount of two types of data.



X-R control chart (mean and variation)



Cause-and-effect diagram (fishbone chart)



Example of a Scatter Diagram

Supplementary Information: QC Seven Tools

[Important]

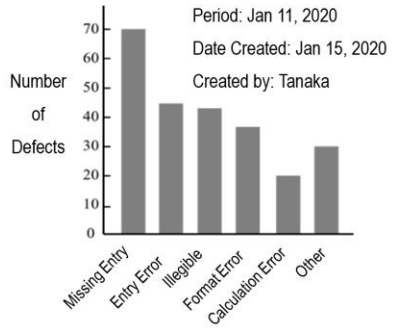
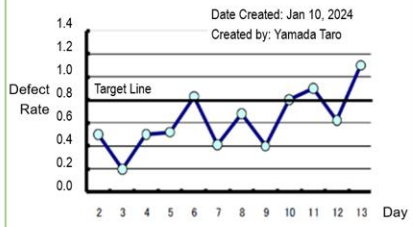
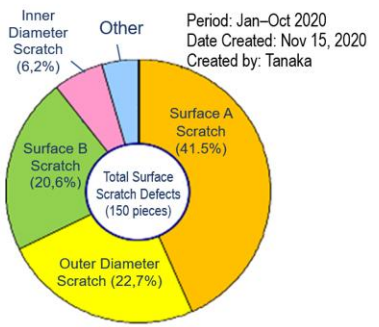
Check sheet : Diagram used to assess multiple items and see the balance and characteristics.

Graph : Tool for visualizing data. E.g., pie chart, bar graph, line graph

Defect item check sheet

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

Example of a check sheet

Bar graph	Line graph	Pie chart
Compares the size and quantity of each element.	Shows changes in control items over time.	Compares the proportion of each element in the whole.
		
Bar Graph of "Production Daily Report Defects"	Line Graph of "December Package Defects"	Pie Chart of "Occurrence Status of Surface Scratch Defects"

Explanations and examples of each graph

Practice Question 4-2

☞ “Study Reference Text” p. 59

■ Choose the statement from among A to D that is incorrect.

A. Adopting JIS standards enables product standardization.

B. Adopting JIS standards can reduce product costs.

C. There is no problem exporting products overseas as long as they comply with JIS standards.

D. When a product’s quality is certified to conform to JIS standards, the JIS mark can be displayed.

■ Explanation

A. Correct

B. Correct

C. Incorrect: JIS is a domestic standard, so exported products must comply with the standards of the destination country or international standards such as ISO and IEC.

D. Correct

Answer: C

Standardization through JIS

Ensuring product compatibility and interface consistency (bolts, nuts, USB cables)

Standardizing terminology, symbols, units of measurement, design methods, testing and evaluation methods, and production methods

Cost reduction through JIS

Improving production efficiency through parts standardization and reducing costs through mass production, etc.

Certification and display of the JIS mark

Certification of product reliability and safety. The mark can be displayed after certification is obtained.

Differences between JIS and ISO/IEC

· ISO/IEC standards are used worldwide. JIS applies only in Japan.

· Many JIS standards are based on ISO standards (product and management standards).

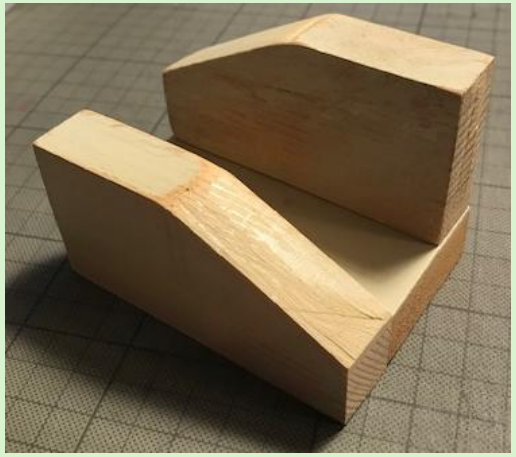
· There are also JIS-specific standards. Therefore, products must comply with the standards of the destination country.

Practice Question 5-2

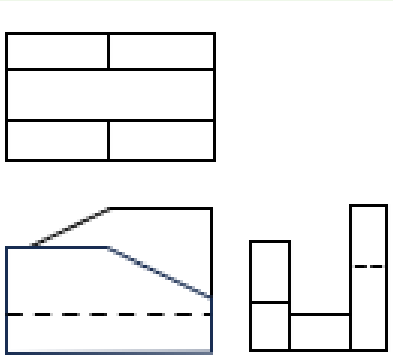
☞ "Study Reference Text" p. 64

- Choose the diagram from among A to D that shows the third-angle projection of the solid figure below.

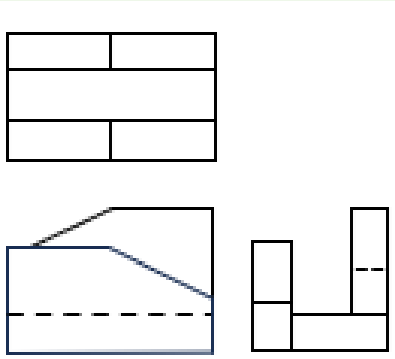




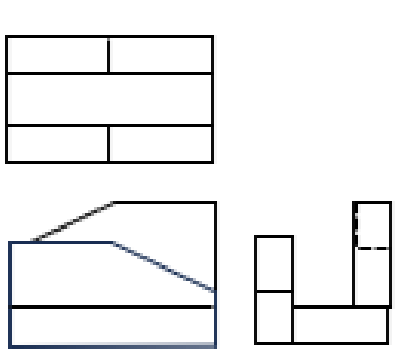
A



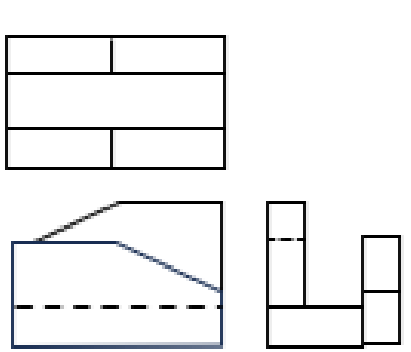
B



C



D



Explanation

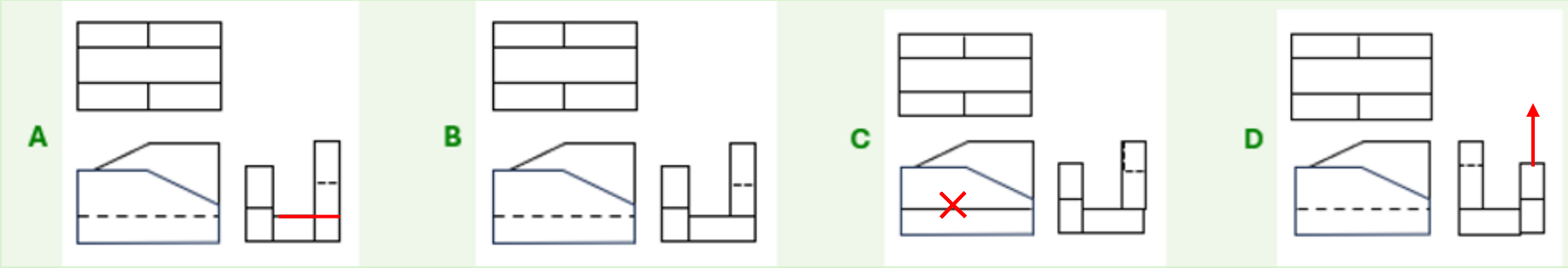
The top view is the same for all four, so compare the front and side views.

A. The back plate resting on the bottom plate in the front view differs from the drawing.
B. Correct projection.

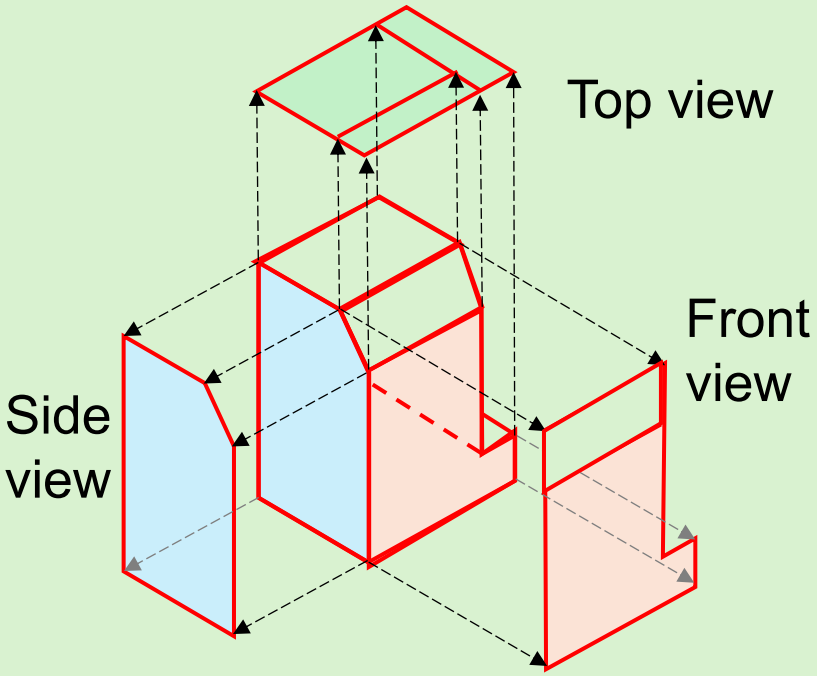
C. The front plate not resting on the bottom plate in the front view differs from the drawing.

D. The back part is higher in the front view but lower in the side view, so this projection is incorrect.

Answer: B



Supplementary Information: Third-angle Projection



[Technical drawing]

Drafting standards: The standards in Japan are the JIS standards, which are roughly the same as the ISO standards

Projection method **Third-angle projection** Stereographic drawing (stereograph) ⇔ Projection drawing
As seen Mutual conversion

Graphic method: Basic figure (ref. textbook)

Electrical drawings: Graphic symbols (ref. textbook)
Circuit diagrams (sequences, ladders: how to write and read)

Electrical materials: Learn the types and characteristics of conductive materials, insulation materials, and magnetic materials

Projection methods and graphic methods are the same in JIS and ISO.

Supplementary Information: Work Is Based on Drawings

- **Drafting methods are universal:**

  Drafting and graphic methods: JIS standards are largely harmonized with the international ISO/IEC standards

- The textbook shows only some examples of graphic methods; learn the other methods as well

- **Assembly work is based on drawings:**

  In electrical and electronic assembly work, a correct understanding of assembly drawings and exploded views is essential

- **Parts machining is also based on drawings:**

  In electrical parts machining, instructions are given in part drawings and machining drawings appropriate to the work

Practice Question 5-3

☞ "Study Reference Text" p. 74

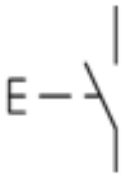
■ Which of the following electrical circuit symbols represents a device that can interrupt load current but not overcurrent? Choose one from A to D.

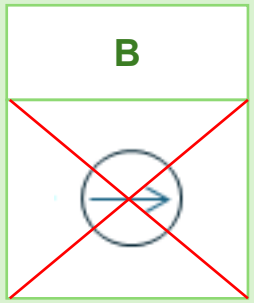
(The graphical symbol for B in the textbook is incorrect)

Choices	A	B	C	D
Graphical symbol				

Explanation
☞ "Study Reference Text" p. 74

Explanation

Choices	A	B	C	D
Graphical symbol				



Incorrect graphical symbol for B

A. A molded-case circuit breaker can interrupt both load current and overcurrent.

B. This is a push-button switch.

C. An electromagnetic contactor can interrupt load current but cannot interrupt overcurrent.

D. Control contacts cannot interrupt either load current or overcurrent.

Answer: C The incorrect graphical symbol for B in the textbook question ⟶ is the symbol for positive operation of a switch (ref. Table 5-4)

Supplementary Information:
Other Graphic Methods and Graphical Symbols

Graphic methods

Flange (ref. Fig. 5-4)

Circle, arc (ref. Fig. 5-5)

Threaded hole (ref. Fig. 5-6)

Finishing (ref. Fig. 5-7)

Other

Partial sectional view

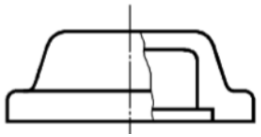
Simplified representation of hole locations

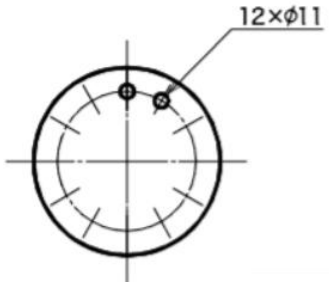
Flat surface machining

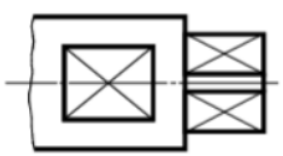
Keyway, elongated hole

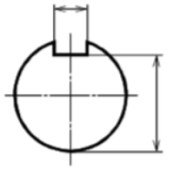
Pneumatic symbols

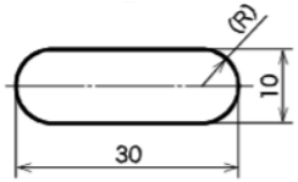
(omitted)









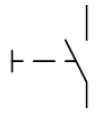
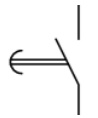
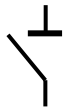
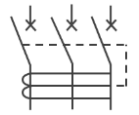
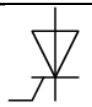
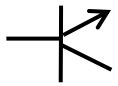


Graphical symbol

⌀	Diameter of a circle or arc
S⌀	Diameter of a sphere
SR	Radius of a sphere
⌒	Arc length
□	Side of a square
C	45° chamfer
t	Thickness

S: sphere

Electrical graphical symbols

	Manual switch
	Time-delay closing switch
	Load-break switch
	Disconnector
	Earth leakage circuit breaker
	Thyristor
	PNP transistor

Current interrupting capability of wiring devices

Name	Letter symbol	Load current	Overcurrent	Short-circuit current
Molded-case circuit breaker	MCB	○	○	○
Electromagnetic switch	MS	○	○	×
Electromagnetic contactor	MS	○	×	×
Thermal relay	TH	—	○	×
Fuse	F	—	○	○
Make/Break contact switch		×	×	×
Push-button switch		×	×	×

Positive operation of a switch

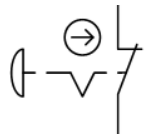
(ref. textbook p. 74)

Graphical symbol 

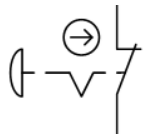
Mechanism that forcibly separates contacts even if contact welding occurs



Alarm switch



Emergency stop switch



Limit switch

Practice Question 6-1

☞ “Study Reference Text” p. 89

■ Choose the statement from among A to D that correctly describes the use of the following tools.

A. A spanner is used to tighten hexagon socket head bolts.

B. A tap is a tool used to cut external threads.

C. Burrs created when drilling holes are removed with a file.

D. Solder is used to secure metals to each other or electronic components to a printed circuit board and connect them electrically.

Explanation
☞ “Study Reference Text” p. 89

Explanation

A. Hexagon socket head bolts are tightened with a hex wrench.

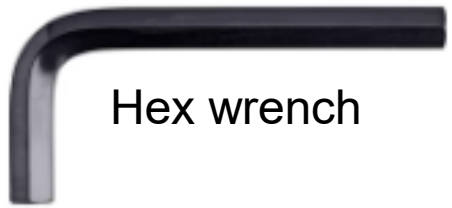
B. A tap is a tool used to cut internal threads.

C. Burrs are removed with a deburring tool or a larger drill.

D. Solder is used to secure wires to device terminals and electronic components to printed circuit boards and connect them electrically.

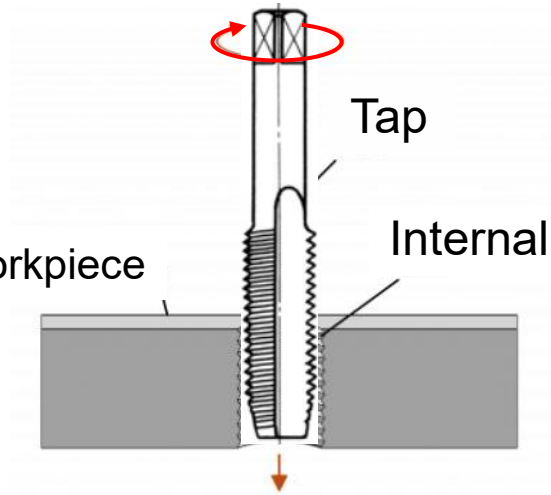
Answer: D

Supplementary Information









Tap (internal thread cutting)



Die (external thread cutting)

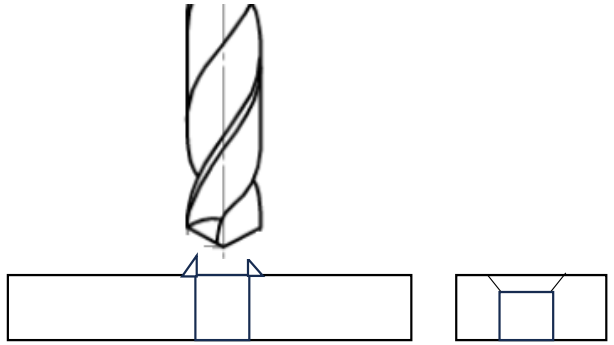
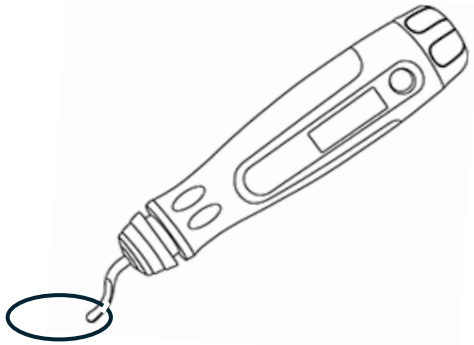


Fig. 7-2 How to Remove Burrs

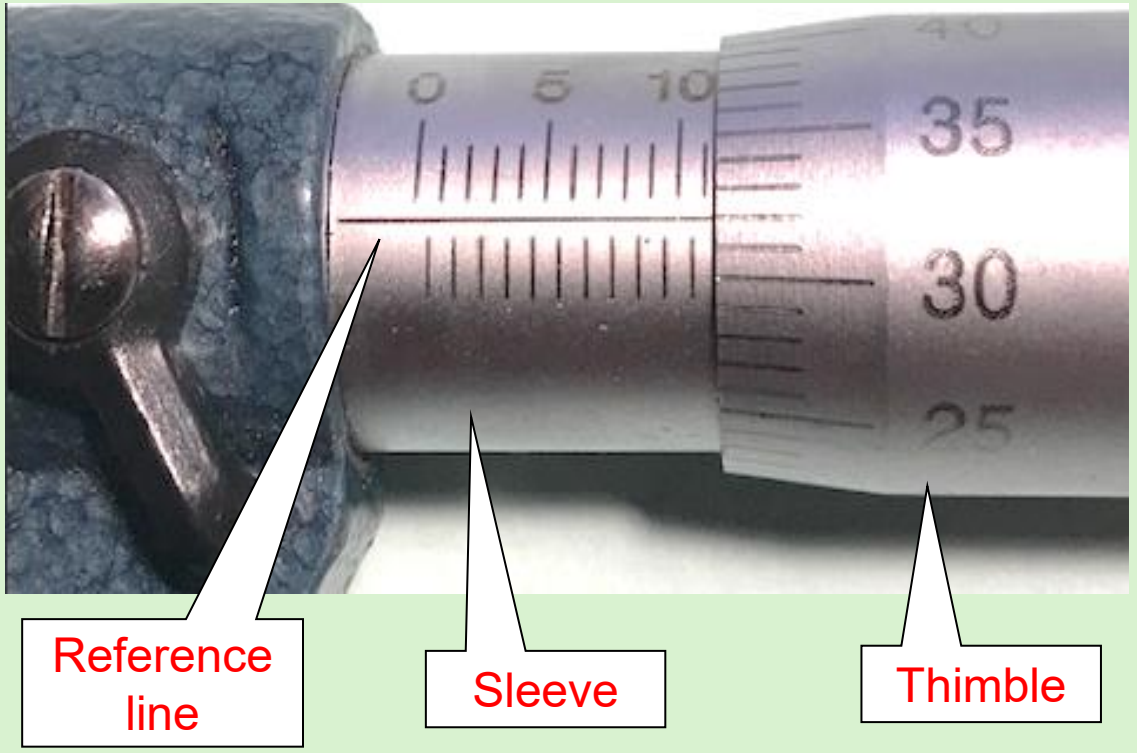


Deburring tool

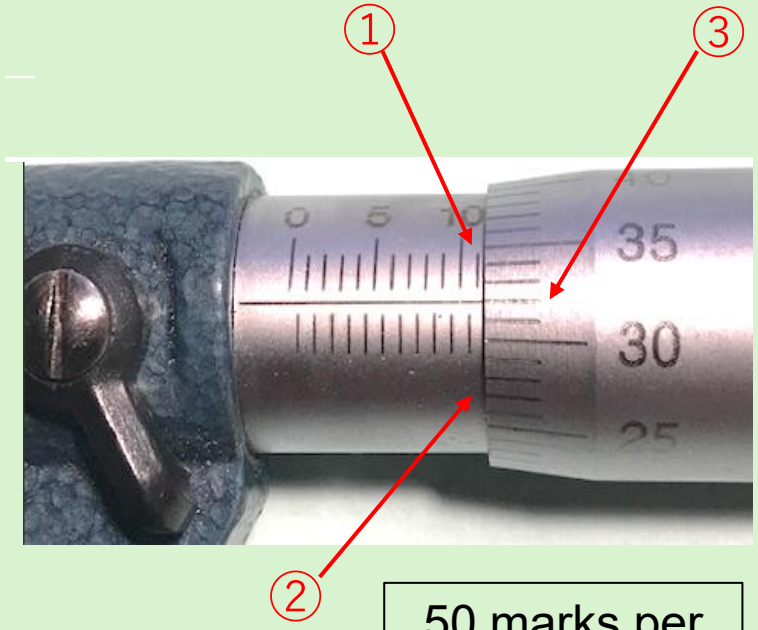
Practice Question 6-3

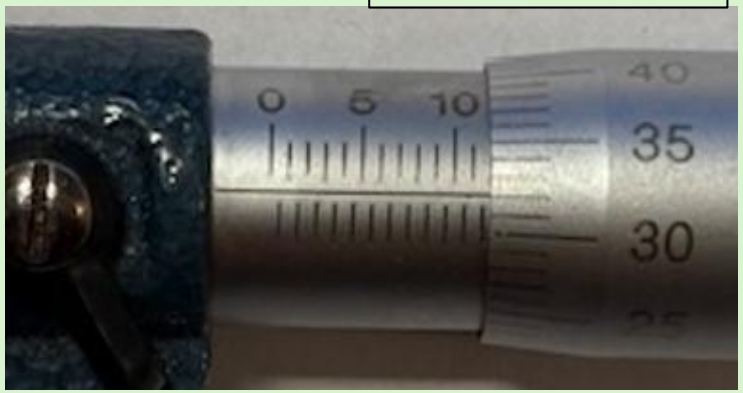
☞ "Study Reference Text" p. 97

- What is the reading of the micrometer below?



Explanation ☞ “Study Reference Text” p. 97





[Explanation]

- The thimble has 50 marks per revolution, and the spindle moves 0.5 mm per revolution.
- The reading precision is 0.5 mm/50 = 0.01 mm.
- The marks below the reference line are spaced 0.5 mm apart.
- Read the largest mark shown on the sleeve.
- The marks on the sleeve go up to 11 (①).
- You cannot see the mark on the sleeve below the reference line (②).
- The reading on the thimble is 32 (③).

The dimension is 11 + 32 × 0.01 = **11.32** (mm)

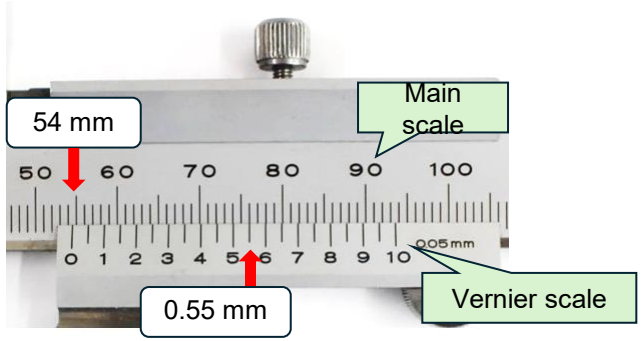
If the mark below the sleeve reference line is visible:
The dimension is 11.5 + 32 × 0.01 = **11.82** (mm)

Supplementary Information: How to Read Other Measuring Instruments

(1) Precision of measuring instruments

Vernier caliper: **0.05** mm
Micrometer: **0.01** mm
Dial gauge: **0.01–0.001** mm
Scale: **0.5** mm

(2) Vernier caliper



(3) Dial gauge



How to use
Align the **reference point**

Sum of the small hand and **the large hand**
If pushing from the reference point, rotate right
Holding method

(4) Digital gauges

- Digital caliper
- Digital micrometer
- Digital dial gauge
- Digital height gauge
- Digital indicator











Practice Question 7-1

☞ “Study Reference Text” p. 109

- Choose the statement from among A to D that is incorrect in tapping work.

  A: You can use a drill press to hold the tap vertically.

  B: When the tap is too hard to turn, use force to turn it.

  C: Pilot holes for tapping should be in the dimensions specified in JIS standards.

  D: Tapping is the process of cutting internal threads.

Explanation ☞ “Study Reference Text” p. 109

[Explanation]

A. **Correct**. Setting up is crucial in tapping, and you should press down to ensure the tap is inserted vertically. Doing this manually requires experience, and it is easier to do using a drill press.
Use a drill press with a tapping function, or attach a specialized tool such as a tapper.

B. **Incorrect**. The tap becomes heavy when engaged, and so the tap should be repeatedly turned one turn forward and one half turn back, preventing excessive cutting. Forcing it to turn when it is too difficult to turn can easily break the tap. Apply oil and turn it back and forth repeatedly to cut the thread.

C. **Correct**. The dimensions for pilot holes in tapping are specified in JIS B1004.

D. **Correct**. Tapping is used to cut internal threads, while dies are used to cut external threads.

Answer: B

In manufacturing, tapping is mainly performed by machines such as tapping drill presses rather than manually.



Practice Question 7-2

☞ “Study Reference Text” p. 114

- Choose the incorrect statement about lathes from among A to D.

  A. A lathe machines the workpiece while rotating it.

  B. Thread cutting can be performed on a lathe.

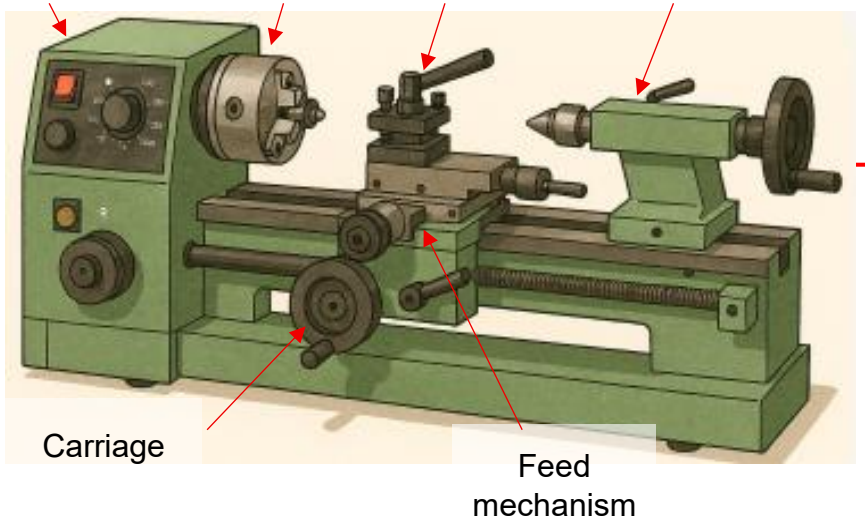
  C. A machining drawing for a lathe should be drawn with the machined surface on the left.

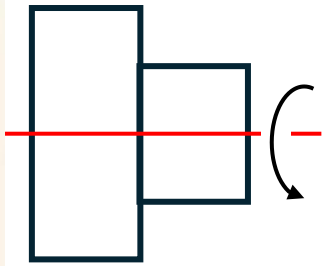
  D. The rotational speed of a lathe should be adjusted according to the material.

Explanation ☞ "Study Reference Text" p. 114

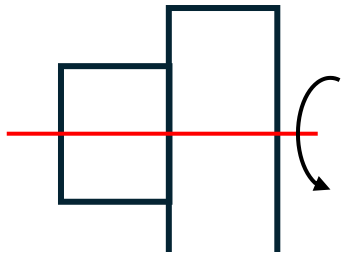
As shown in the figure, a lathe has the chuck on the left, and the cutting tool is applied from the right for machining. Therefore, the machining drawing should be drawn so that machining can be easily performed from the right (see figure below).

Answer: C





Correct machining direction



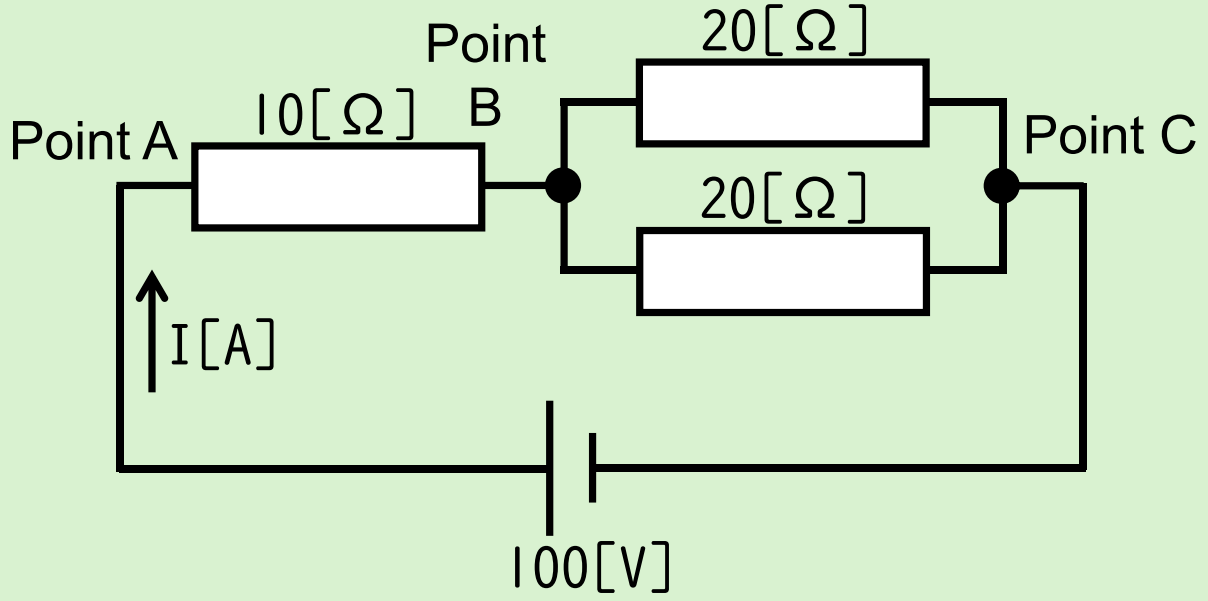
Incorrect machining direction

Cutting speed
(Speed at which the tool cuts the workpiece per minute)
$V = \pi Dn/1000$ [m/min]

Practice Question 8-2

☞ "Study Reference Text" p. 139

■ Choose the correct current flowing in the diagram below from among A to D.

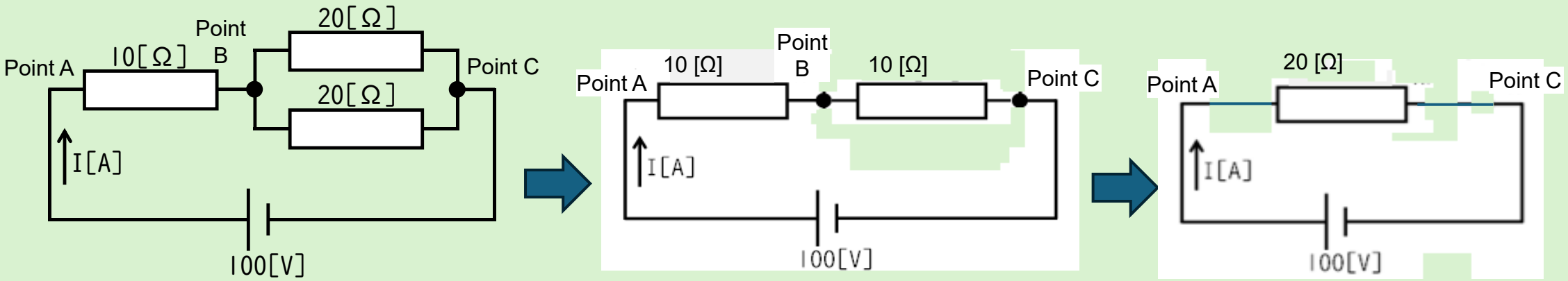


Choices

A. 2[A]　B. 5[A]　C. 10[A]　D. 20[A]

Explanation

☞ “Study Reference Text” p. 139



[Explanation]

The combined resistance of the parallel section between points B and C in the parallel part is 10 [Ω], which is in series with the resistance of 10 [Ω] between points A and B (upper middle diagram), and so the overall resistance between points A and C is 20 [Ω] (upper right diagram). Connected to 100 [V], the current value would be

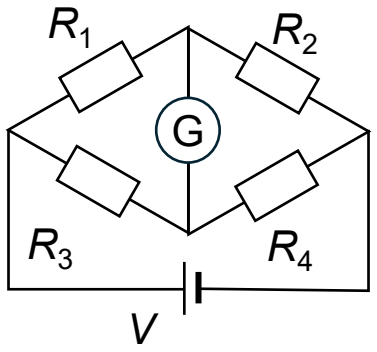
$$100\ [\mathrm{V}] \div 20\ [\Omega] = \mathbf{5}\ [\mathrm{A}]$$

and the correct answer is B.

Answer: B

Supplementary Information: Other Main Circuits

(1)

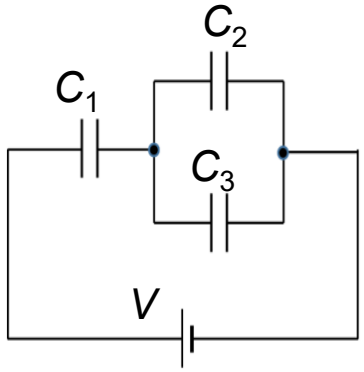


Bridge circuit

$R_1 \cdot R_4 = R_2 \cdot R_3$

The galvanometer reads 0 under balanced conditions

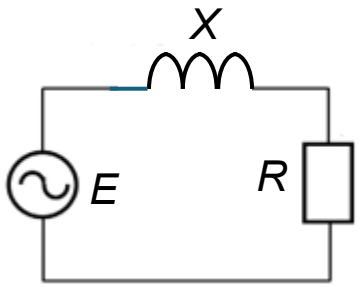
(2)



Electrostatic capacitance circuit

$$C = \frac{C_1+(C_2+C_3)}{C_1(C_2+C_3)}$$

(3)

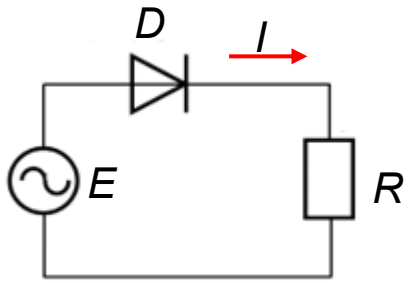


AC circuit

$Z = R+jX$
$= \sqrt{(R^2+X^2)}$

$X = X_L + X_C$
$= j\omega L + 1/j\omega C$

(4)



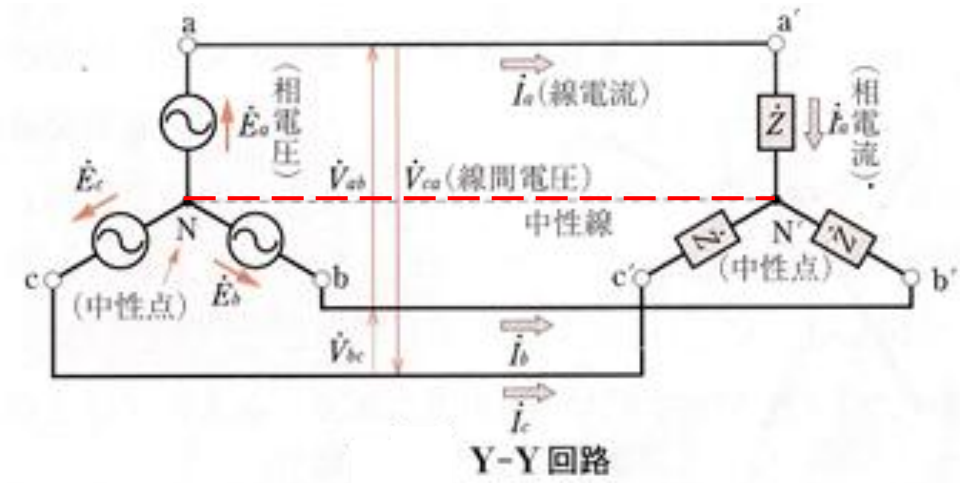
Rectifier circuit

(Half-wave rectification)

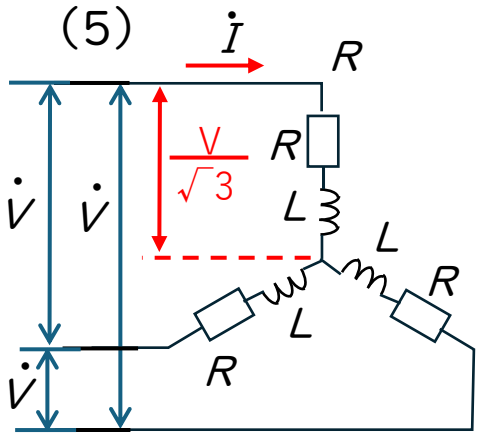
Supplementary Information: Three-phase circuit

三相交流回路
- Y-Y 回路
- Δ-Δ回路
- Y-Δ回路
- Δ-Y 回路

(例)　Y-Y 回路



Y-Y 回路



Three-phase circuit

$P = \sqrt{3} VI \cos\theta$

$\dot{V}, \dot{I}$: Line voltage, line current

*Current and power calculations are performed using a single-phase circuit including the neutral line (red dashed line)

Y結線では、線電圧 $\dot{V} = \sqrt{3}$ 相電圧 $= \sqrt{3}\dot{E}$

線電流 $\dot{I}$ ＝相電流 $\dot{I} = \dot{E}/Z$

インピーダンス $Z = \sqrt{(R^2 + (\omega L)^2)}$

三相電力 ＝3×(単相電力)＝3×($I \times V/\sqrt{3}$) $\cos\theta$

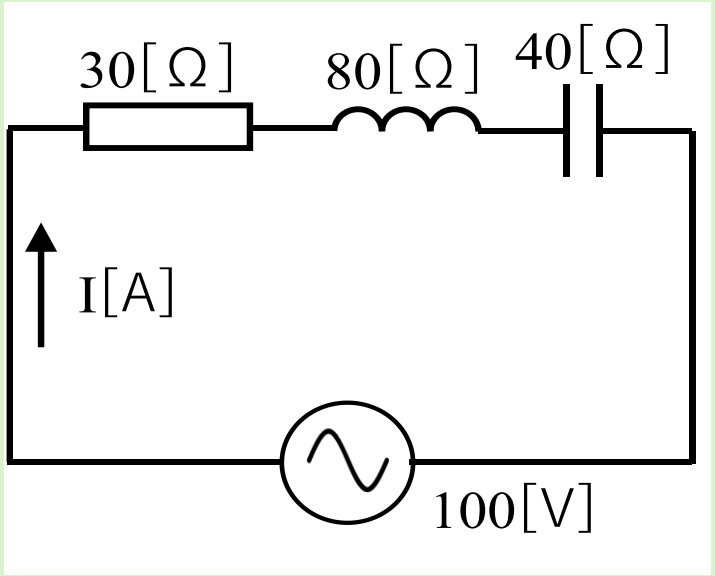
$= \sqrt{3}\, V I \cos\theta$

$\cos\theta$ は力率、θ は相電圧と相電流の位相差

Practice Question 8-4

☞ "Study Reference Text" p. 143

- Choose the correct current flowing in the following AC circuit from among A to D.



A. 0.8[A] **B.** 1.5[A] **C.** 2.0[A] **D.** 2.8[A]

Explanation

☞ “Study Reference Text” p. 143

In an AC circuit, always calculate the impedance.

The impedance Z of a series circuit with a resistor, coil, and capacitor can be calculated using the following formula: $Z=\sqrt{R^2+(j\omega L+1/j\omega C)^2}$

$$= \sqrt{30^2 + (80 - 40)^2} = 50 \ [\Omega]$$

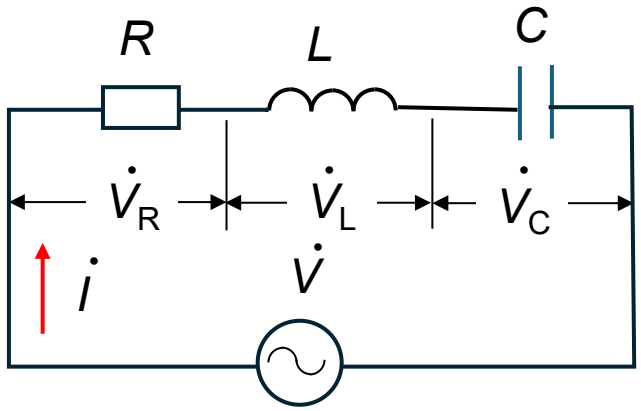
From this, the current is determined by Ohm’s law

$$I = \frac{100}{Z} = \frac{100}{50} = 2.0 \ [\mathrm{A}]$$

Therefore, the correct answer is C.

Answer: C

Impedance of a series circuit of R, L, and C



(1) $\dot{V}_R = \dot{I} \cdot R$

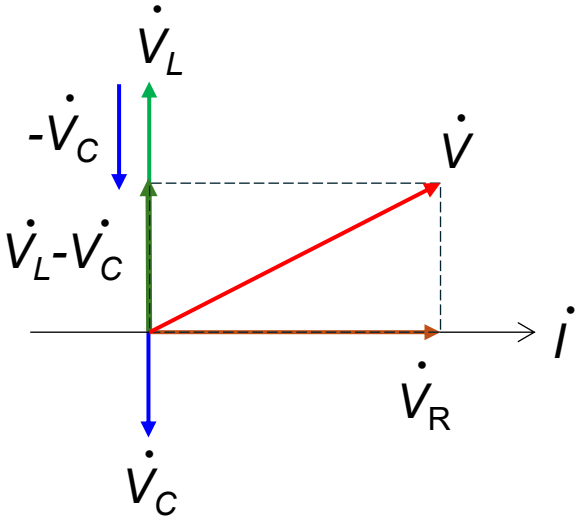
$\dot{V}_L = \dot{I} \cdot j\omega L = \dot{I} \cdot X_L$

$\dot{V}_C = \dot{I} \cdot \frac{1}{j\omega C} = \dot{I} \cdot X_C$

$\dot{V} = \dot{V}_R + \dot{V}_L + \dot{V}_C$

$= \sqrt{V_R^2 + (V_L - V_C)^2}$

$= \dot{I} \cdot \sqrt{R^2 + (X_L - X_C)^2}$



(2) The impedance Z of the circuit is

$$Z = \frac{\dot{V}}{\dot{I}} = \sqrt{R^2 + (X_L - X_C)^2}$$

Practice Question 9-4

☞ “Study Reference Text” p. 167

■ Choose the incorrect statement about actions after completing work from among A to D.

A. After completing work, tools, used parts, etc. must be returned from the workbench to their storage locations.

B. After completing work, the work area must be left as it is with tools, etc. left out, and the worker must leave quickly so that the next worker can start work as soon as possible.

C. After completing work, the workbench, floor, etc. must be thoroughly cleaned and kept clean.

D. After completing work, the work procedure manual used must be returned to its storage location.

Explanation
☞ **“Study Reference Text” p. 167**

① After completing work, return the tools, parts, work procedure manuals, etc. used in the work to their respective storage locations. Then clean the workbench so that the next worker can work comfortably. **A, C, and D** are correct.

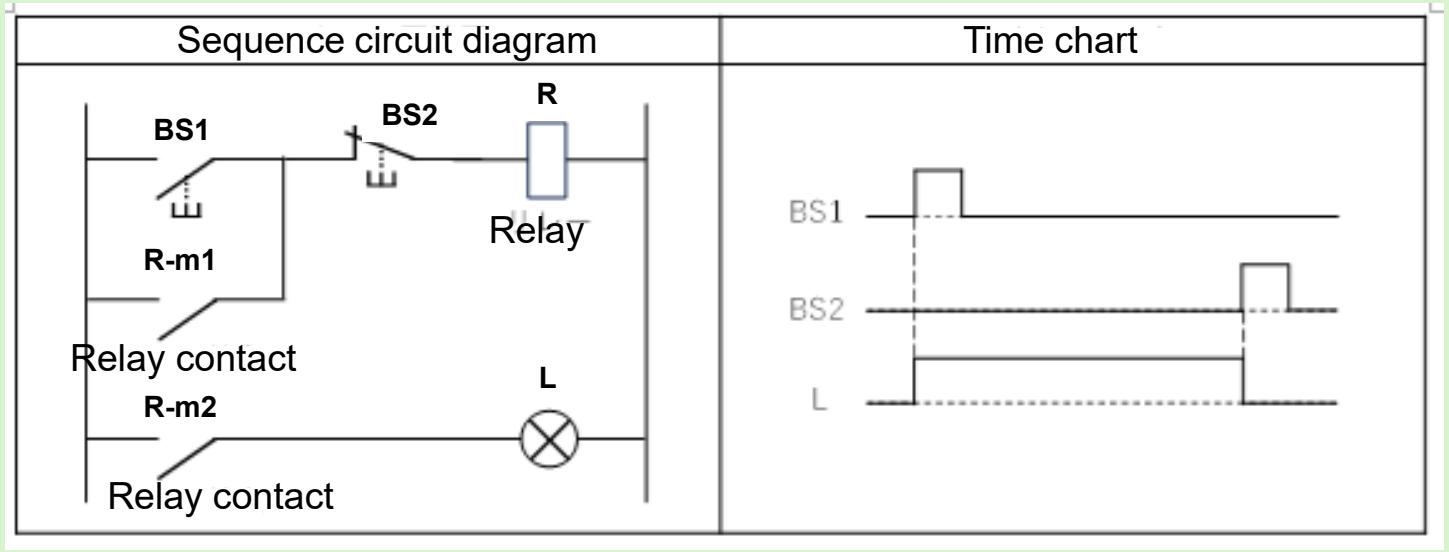
② After completing work, it is important to leave the area quickly for the next worker. However, even then, tools and parts must be put away. It is not known whether the next worker will use the same tools.
If the workbench is dirty, it also poses an injury risk, so it must be kept clean. **B** is incorrect.

Answer: B

Practice Question 10-1

☞ "Study Reference Text" p. 188

■ Choose the statement from among A to D that correctly describes the action of the sequence circuit diagram below.



Choices

A. When BS1 is pressed, only R-m1 turns ON, and L does not light up.

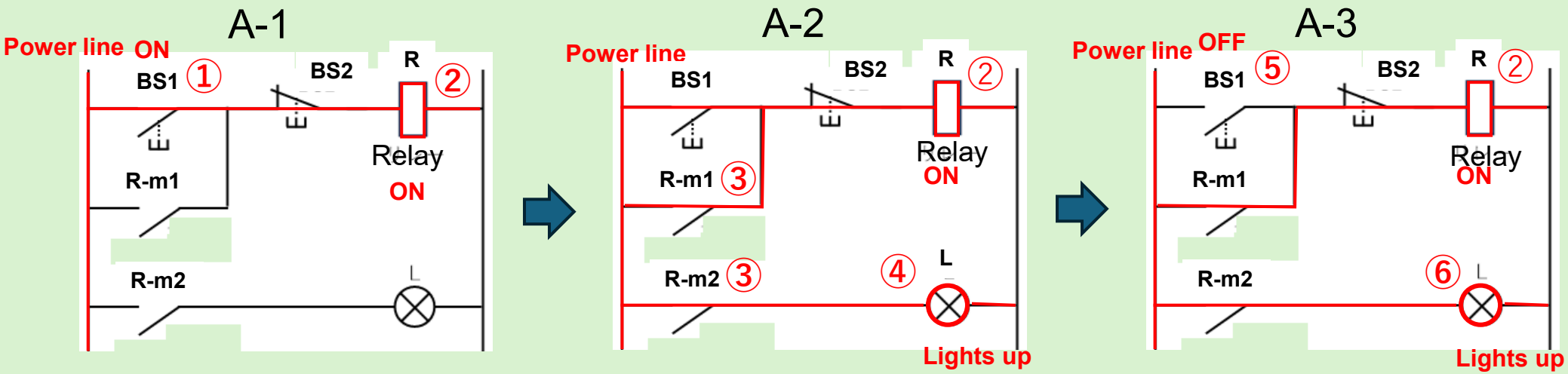
B. When BS2 is pressed, R-m2 turns ON, and L lights up.

C. When BS1 is pressed, L lights up and does not go out even when BS1 is released.

D. When BS1 is pressed, L lights up and does not go out even when BS2 is pressed.

Explanation

☞ “Study Reference Text” p. 188



① When push-button switch BS1 is pressed, power is supplied to relay R
② Relay R is excited

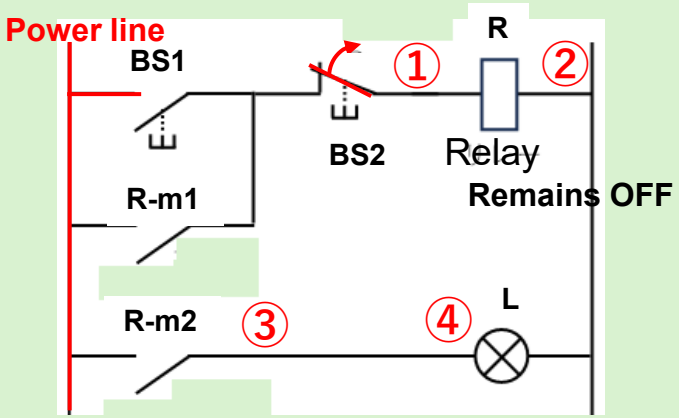
When relay R is excited:
③ relay contacts R-m1 and R-m2 close instantly
④ When R-m2 closes, lamp L lights up.
The statement that L does not light up is incorrect.
A. (Incorrect)

⑤ Next, when BS1 is released, the contact opens, but the relay remains excited via R-m1 (②)
⑥ The lamp does not go out and remains lit

Explanation

☞ “Study Reference Text” p. 188

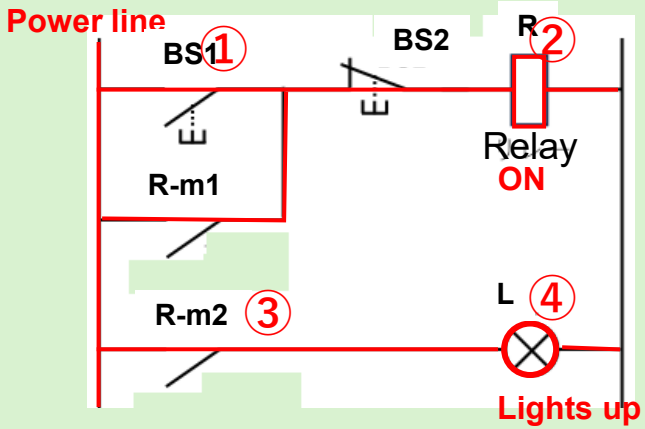
B



① When BS2 is pressed, the circuit opens and no current flows through relay R
② Relay R is not excited
③ Therefore, contact R-m2 does not close and lamp L does not light up. The statement that it lights up is incorrect.

B. (Incorrect)

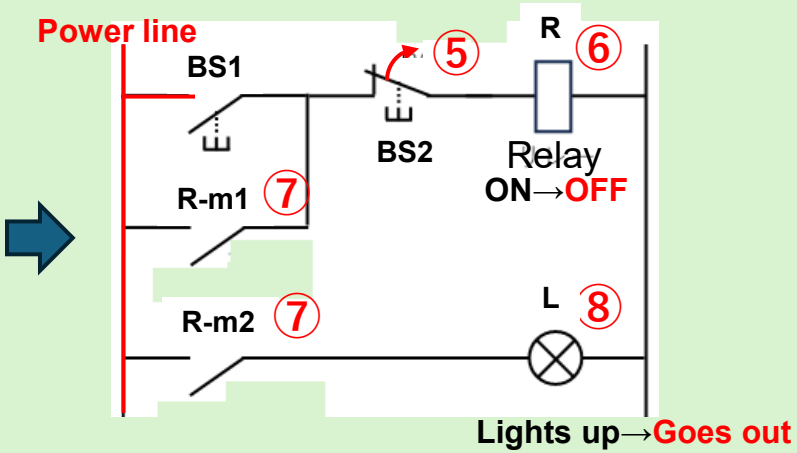
D-1



① When BS1 is pressed
② Relay R is excited
③ R-m1 and R-m2 close
④ Lamp L lights up

(Same as A)

D-2



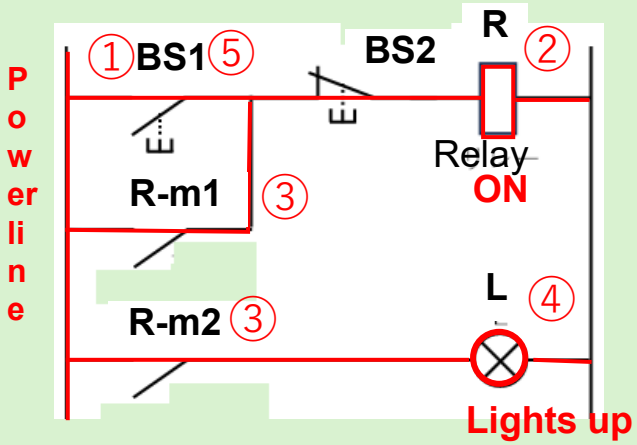
⑤ When BS2 is pressed in this state,
⑥ relay is de-excited
⑦ R-m1 and R-m2 turn OFF
⑧ Lamp L goes out.
The statement that it does not go out is incorrect.

D. (Incorrect)

Explanation

☞ “Study Reference Text” p. 188

C



① When BS1 is pressed, ② relay R is activated

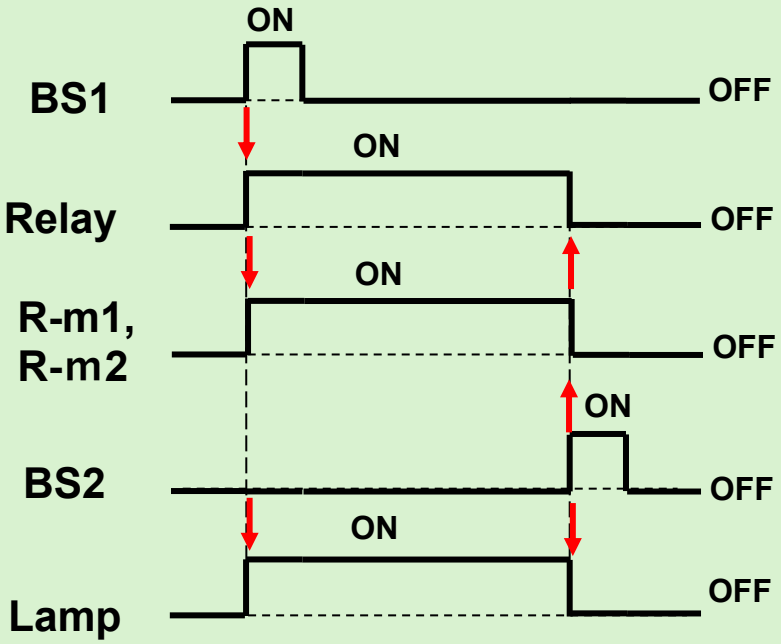
③ R-m1 and R-m2 turn ON

④ L lights up

⑤ Even when BS1 is released in this state, R-m2 remains closed, so relay R remains excited and lamp L remains lit

C. Correct

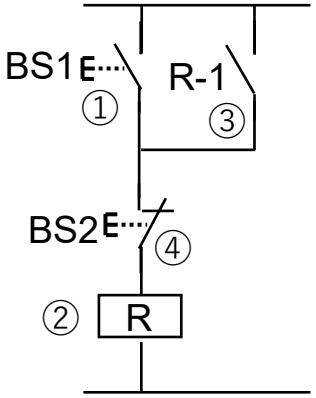
Self-holding circuit



Time chart

[Various Circuits (1)]

Point: The order of operations in sequence control is written from left to right and top to bottom.



Self-holding circuit

Same as Practice Question A

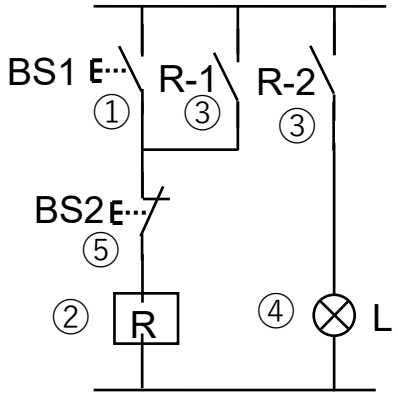
① BS1 turns ON

② Relay R is excited

③ Relay contact R-1 turns ON

Excitation continues even when BS1 turns OFF

④ Reset by BS2



Lamp lighting circuit

Same as Practice Question A

① BS1 turns ON

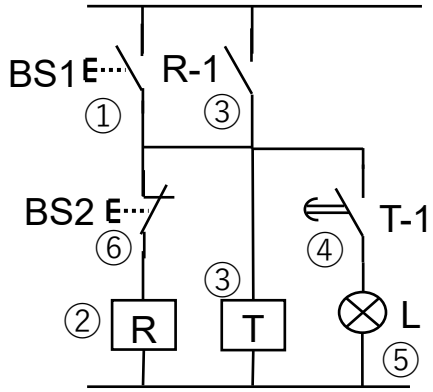
② Relay R is excited

③ Contacts R-1 and R-2 turn ON

④ The lamp lights up

Excitation and lighting continue even when BS1 turns OFF

⑤ Reset by BS2



Timer circuit

Lights up after a delay by the timer

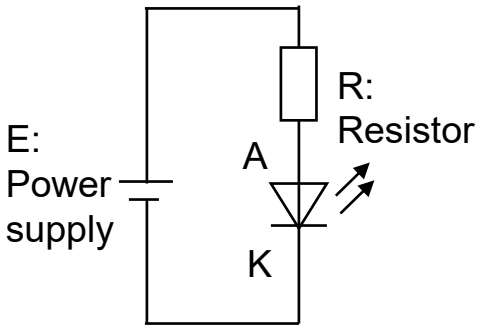
① BS1 turns ON ② Relay R is excited

③ Relay contact R-1 turns ON, and timer T starts

④ Timer contact T-1 turns ON, and ⑤ the lamp lights up. Excitation and lighting continue even when BS1 turns OFF

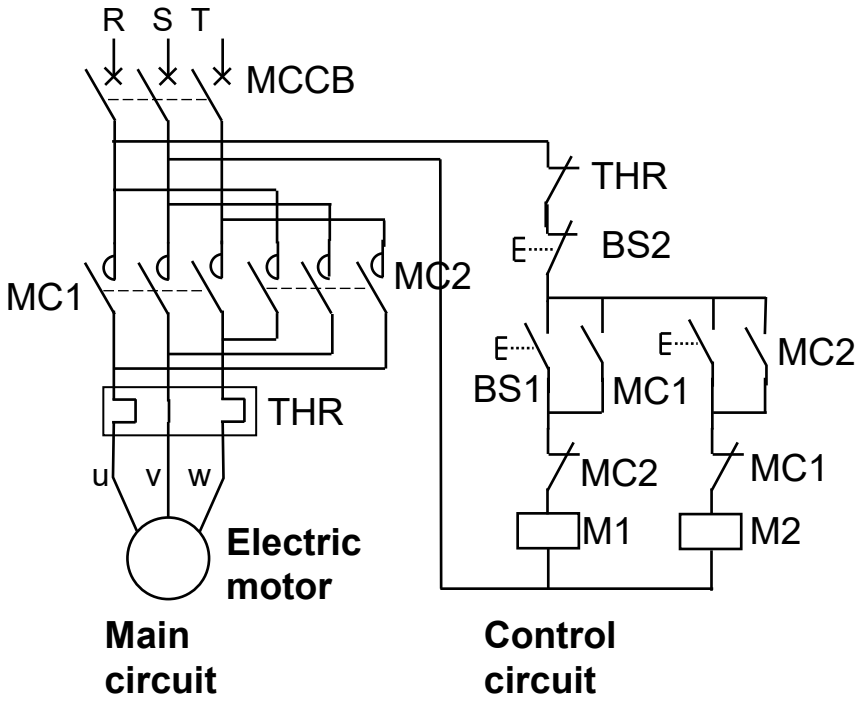
⑥ Reset by BS2

[Various Circuits (2)]



LED lighting circuit

An LED has polarity. Connect A (anode) to the positive voltage side and K (cathode) to the negative voltage side, and always insert current-limiting resistor R to prevent the maximum current from being exceeded.



Forward and reverse rotation control circuit for motor

MCCB: Molded-case circuit breaker

MC: Magnetic Contactor

THR: Thermal relay

Forward and reverse rotation control circuit for motor

① Press push-button switch BS1 in the control circuit.

② Relay M1 is excited, and contact MC1 turns ON.

③ The MC1 contacts in the self-holding circuit and main circuit close, and the electric motor rotates.

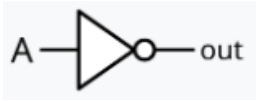
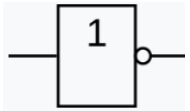
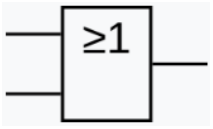
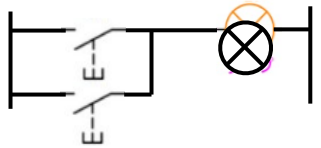
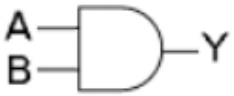
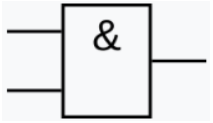
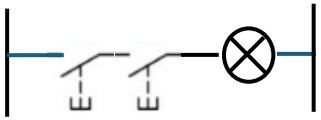
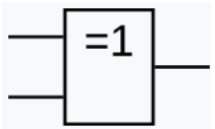
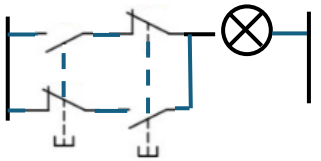
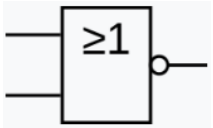
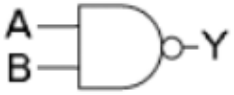
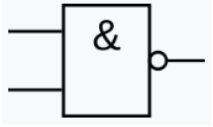
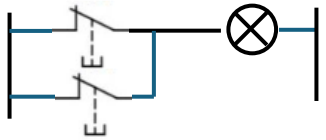
④ When BS2 is pressed or the thermal relay operates, the self-holding circuit is reset and the motor stops.

⑤ For reverse operation, press M2. MC2 operates, the R and S phases of the main circuit are switched, and the motor rotates in reverse.

⑥ Forward and reverse operations are interlocked to prevent simultaneous operation.

Chapter 10: Electrical/Electronic Applications

Supplementary Information: Logic Expressions, Circuit Symbols, and Truth Tables for Logic Circuits

Logic	Logic expression	Circuit symbol	JIS circuit symbol	Truth table	Relay circuit
NOT Logical negation	$\overline{A}$			**A** | **0** | **1** out | **1** | **0**	
OR Logical OR	A+B			**A** | **0** | **0** | **1** | **1** B | 0 | 1 | 0 | 1 Y | 0 | 1 | 1 | 1	
AND Logical AND	A・B			**A** | **0** | **0** | **1** | **1** B | 0 | 1 | 0 | 1 Y | 0 | 0 | 0 | 1	
XOR Exclusive OR	A + B			**A** | **0** | **0** | **1** | **1** B | 0 | 1 | 0 | 1 Y | 0 | 1 | 1 | 0	
NOR	$\overline{A+B}$			**A** | **0** | **0** | **1** | **1** B | 0 | 1 | 0 | 1 Y | 1 | 0 | 0 | 0	
NAND	$\overline{A \cdot B}$			**A** | **0** | **0** | **1** | **1** B | 0 | 1 | 0 | 1 Y | 1 | 1 | 1 | 0	

Practice Question 11-1

☞ “Study Reference Text” p. 204

■ Choose the incorrect statement from among A to D.

A. Hoshu means “protecting and inspecting equipment to prevent failures.”

B. Preventive maintenance is widely used in Japan.

C. Planned maintenance is effective in semiconductor factories where line stoppages have a major impact.

D. Predictive maintenance involves less unnecessary parts replacement than preventive maintenance.

Explanation

☞ “Study Reference Text” p. 204

Inspecting equipment to prevent failures, as described in A, is hozen.

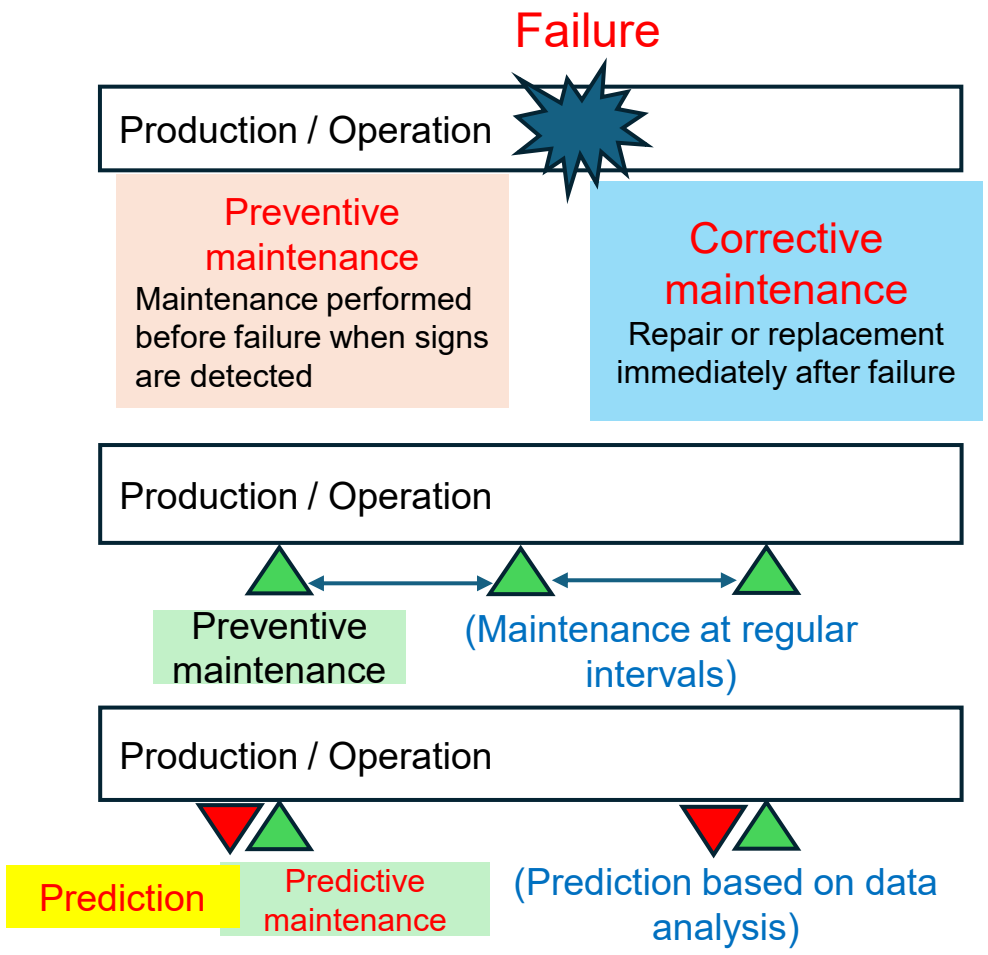
A is incorrect.

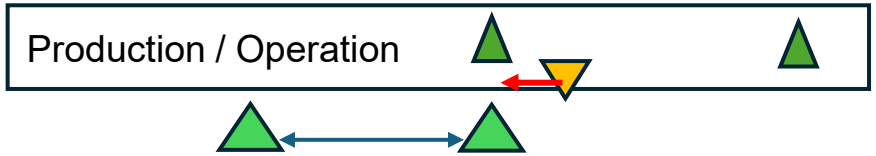
B, C, and D are correct.

Answer: A

Chapter 11: Inspection, Maintenance, Packaging, and Molding

Supplementary Information: Preventive Maintenance





Planned maintenance
Maintenance in which machinery and parts are serviced and replaced in a planned manner before the end of their service life

Possibility of unnecessary parts replacement because equipment is shut down all at once for statutory inspections, at semiconductor factories, etc.

Advantages and disadvantages of preventive maintenance

- ○ Prevention of sudden stoppages due to equipment failure
- ○ Longer equipment service life
- ○ Improved safety
- × Requires a continuous equipment monitoring system

Practice Question 11-2

☞ “Study Reference Text” p. 212

■ Choose the correct statement from among A to D.

A. Thermoplastic resin can be reused by reheating.

B. Molds for plastic molding can be used for different products.

C. The draft angle for removing a molded product is provided at the gate.

D. Molds may be reused, so they should be stored near the equipment.

Explanation

☞ “Study Reference Text” p. 212

A. **(Correct)** It softens when reheated, so it can be reused.

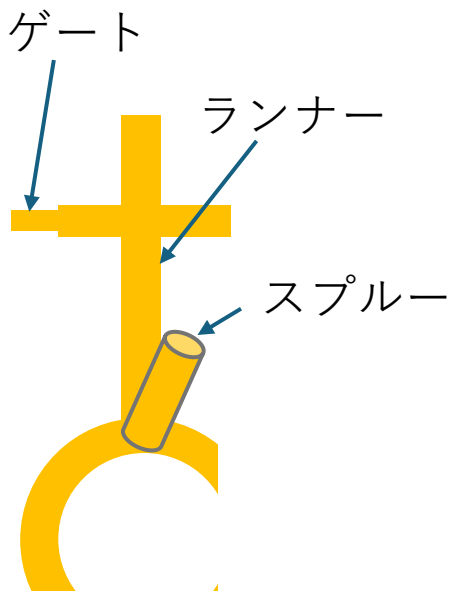
B. **(Incorrect)** Molds require precise design for injection speed, injection volume, etc., and cannot be shared among different products.

C. **(Incorrect)** The draft angle is provided on the sprue at the injection inlet, not at the gate.

D. **(Incorrect)** Molds are precision parts, so they should be protected with an oil film to prevent rusting and stored in a humidity-controlled warehouse or similar location.

Answer: A




ゲート
ランナー
スプルー

Summary of Each Chapter

Chapter 2: Health and Safety

- In Japan, many initiatives are undertaken to protect worker safety, ranging from laws (Industrial Safety and Health Act, etc.) and company rules to employees' daily activities and awareness.
- Kiken yochi training (KYT) and sorting, setting-in-order, standardizing, cleaning, and sustaining the discipline (5S) are important.
- Pay attention to safety signs, warning labels, and other items that differ from those used in your country.

Chapter 3: Quality Management

- Companies place great importance on quality. Thoroughly understand the purpose and effects of quality management, management cycles such as PDCA, and the significance of improving efficiency and quality through standardization.
- Quality management using evaluation methods such as the QC Seven Tools (Pareto charts, histograms, etc.) is also widely used. Understand these thoroughly.

Summary of Each Chapter

Chapter 4: Laws and Standards related to Electricity

- Laws and regulations, including requirements for the PSE mark, govern the safe use of electrical products and equipment.
- JIS standards are almost the same as ISO/IEC standards, but their applicability to exported products must be confirmed.

Chapter 5: Technical Drawing

- Projection methods, representation methods, graphical symbols, electrical graphical symbols, etc. used in technical drawing are almost the same as those in ISO/IEC standards. Some JIS standards are unique to Japan.
- In Japan, work instructions are basically given using drawings. Basic knowledge of drawings is essential.

Chapter 6: Instruments/Tools

- Pay attention to identifying instruments, tools, and measuring instruments from photographs and understanding their applications and use, particularly readings of vernier calipers, micrometers, and dial gauges, and tester connections.

Summary of Each Chapter

Chapter 7: Machining/Finishing

- Correctly understand the methods and procedures for machining, drilling, thread cutting (tapping), chamfering, finishing, etc.
- Understand how to use machine tools (drill presses, lathes, milling machines, NC machines, and machining centers) and their applications according to the shape to be machined. Calculate cutting speed.

Chapter 8: Basic Electrical/Electronic Theory

- Be able to apply the basic laws of electrical circuits (Ohm's law, Kirchhoff's laws, and bridge circuits) and calculate resistance in DC and AC circuits, impedance, electrostatic capacitance, and current and power in three-phase AC circuits.
- Understand the principles of semiconductors and how to use diodes, rectifier circuits, and LED circuits.

Summary of Each Chapter

Chapter 9: Electrical/Electronic Work

- Use of measuring instruments; current measurement
- Preparation for assembly work; clothing; seiri, seiton, and kataduke
- Soldering (printed circuit boards, SMD, terminals): work methods and procedures

Chapter 10: Electrical/Electronic Applications

- Understand sequence circuits, logical operations, logic circuits, truth tables, etc.
- Understand control graphical symbols, passive components, and control devices.
- Understand self-holding circuits, motor drive circuits, LED circuits, and lamp lighting circuits.
- Understand the characteristics of electrical equipment (induction motors, transformers, circuit breakers), solar cells, etc.

Summary of Each Chapter

Chapter 11: Inspection, Maintenance, Packaging, and Molding

- Understand the types and details of various inspections, including assembly inspection, parts inspection, and printed circuit board inspection.
- Understand the difference between hozen and hoshu, types of maintenance, corrective action, and the effects of preventive maintenance.
- Industrial packaging, logistics quality, IC packaging methods, handling precaution labels
- Understand plastic injection molding methods, thermoplastic materials, molds, their structures, and defects.
- Understand types of printed circuit boards and etching defects.

Summary

This is the end of the explanation of study methods and main practice questions to use as reference for your studies.

Use the questions to thoroughly check that the content is correctly understood.

In addition to the practice questions, supplementary explanations are provided on points considered important, points considered difficult to understand, and content unique to Japan.

As mentioned at the beginning, this textbook does not cover everything; however, with the hope that these materials will help you deepen your knowledge and pass the exam, I will conclude my lecture. Thank you very much.

References

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Graphical symbols for diagrams - Part 2, Part 7, etc. (JIS C 0617)

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Industrial Safety and Health Act Industrial Safety and Health Act | e-Gov law and ordinance search

Ordinance on Industrial Safety and Health Ordinance on Industrial Safety and Health | e-Gov law and ordinance search

Electrical equipment technical standards and their interpretation Electrical equipment technical standards and their interpretation

Electrical Appliance and Material Safety Act Electrical Appliance and Material Safety Act | e-Gov law and ordinance search

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Design and fabrication of control panels (Japan Science and Engineering Publishing Association) ISBN978-4-89019-200-7



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