試験問題　例

（CMfgT: Certified Manufacturing Technologist）

Ⅰ　Mathematical fundamentals

1: Mathematics

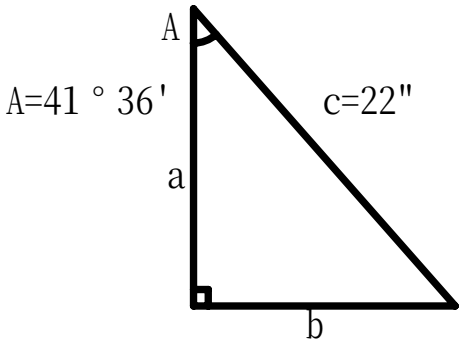
1－1　Given the following triangle, find side a.

A) 14.61 inches

B) 16.45 inches

C) 14.54 inches

D) 16.51 inches



1－2　What is the binary representation of the unsigned integer 182?

A) 11001001　　B) 10110110

C) 11100110　　D) 01101101

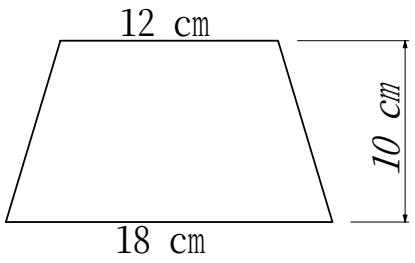
1－3　What is the area of this trapezoid ?

A) 120 cm²

B) 150 cm²

C) 216 cm²

D) 180 cm²



1－4　What is the binary representation of the unsigned integer 182?

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II Physics and Engineering Sciences

2: Units of Measure

2 – 1 Which of the following expresses 5 microinches?

A) .0005 inch B) .000005 inch

C) .00005 inch D) .005 inch

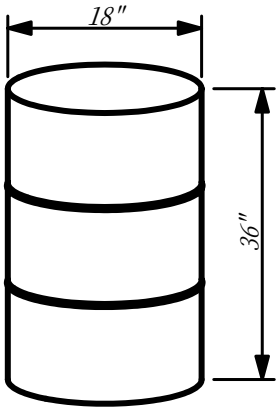
2 – 2 How many gallons of cutting oil will this barrel hold ?

A) 20.4

B) 91.6

C) 39.7

D) 8.8



2 – 3 How many cubic inches of displacement are in a 4.8 liter automotive engine?

A) 460 B) 293

C) 49.65 D) 351

3: Electricity / Electronics

3 – 1 Which transducer would be appropriate for electronically indicating the position of a sliding platform on a machine tool?

A) linear variable differential transformer B) accelerometer

C) load cell D) strain gage

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3 – 3 In the figure , what is the voltage drop across L2?

L1 = 8 ohms L2 = 20 ohms

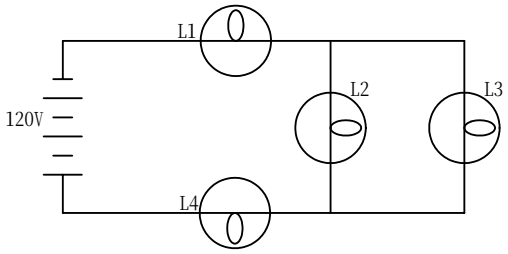
L3 = 30 ohms L4 = 10 ohms

A) 4.8v

B) 12.0v

C) 1.2v

D) 6.0v



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4: Statics

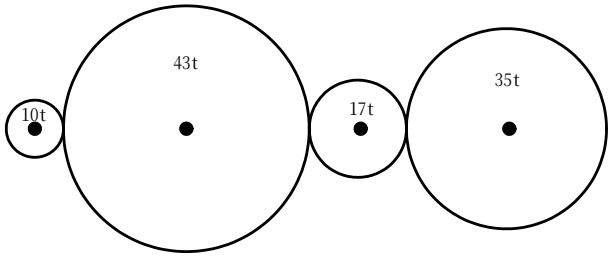
4 – 1 In this gear set the following conditions apply: the input torque is 20 lb.ft. and the speed is 100 rpm in a clockwise direction on the 10-toothed gear. What is the ideal output torque?

A) 34.0 lb.ft

B) 5.7 lb.ft

C) 14.4 lb.ft

D) 70.0 lb.ft



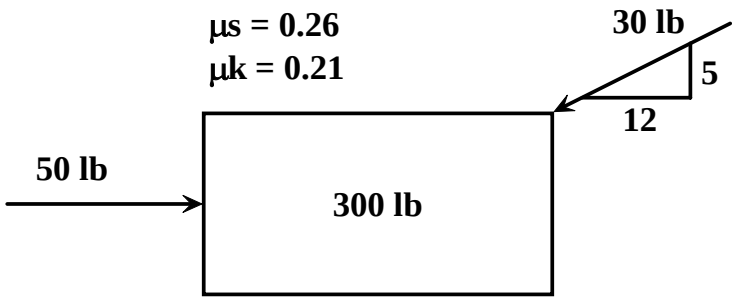
4 – 2 Find the magnitude of the frictional force acting on the 300 lb. block.

A) 69 lb

B) 21 lb

C) 90 lb

D) 81 lb



4－3 The law of conservation of momentum states that in an isolated system:

A) the kinetic energy before an interaction equals the kinetic energy after the interaction.

B) the velocity before an interaction equals the velocity after the interaction.

C) the total momentum before an interaction equals the total momentum after the interaction.

D) the total momentum before an interaction never equals the total momentum after the interaction.

5: Dynamics

5－1 A hollow cylinder is constructed from material that weighs I Ib/ft^3.
Thus, the cylinder's polar mass moment of inertia is 53.08 ft-lb-sec^2.
Find the cylinder's angular acceleration resulting from the applied couples.

A) 1.093 Rad/Sec^2 B) 10.814 Rad/Sec^2

C) 21.629 Rad/Sec^2 D) 35.652 Rad/Sec^2

5－2 A force applied over a period of time is called:

A) impulse. B) foot-pound.

C) momentum. D) inertia.

5－3 The 45,000 lb. airplane is showed to a stop, after touch down, by a constant braking force applied to the rear wheels. The speed of the airplane at touch down is 280 miles per hour and the deceleration is a constant 140 ft/sec^2. Find the magnitude of the reaction force (R_F) on the front wheel.

A) 38,571 lbs. B) 252,783 lbs.

C) 216,782 lbs. D) 180,560 lbs.

6: Strength of Materials

6－1 When an applied force stretches an object, the part is under:

A) torsion. B) shear.

C) tension. D) compression.

6－2 The ratio of the lateral strain on the element compared to the axial strain is called:

A) Poisson's ratio. B) Pascal's Law.

C) Boyle's Law. D) Hook's L

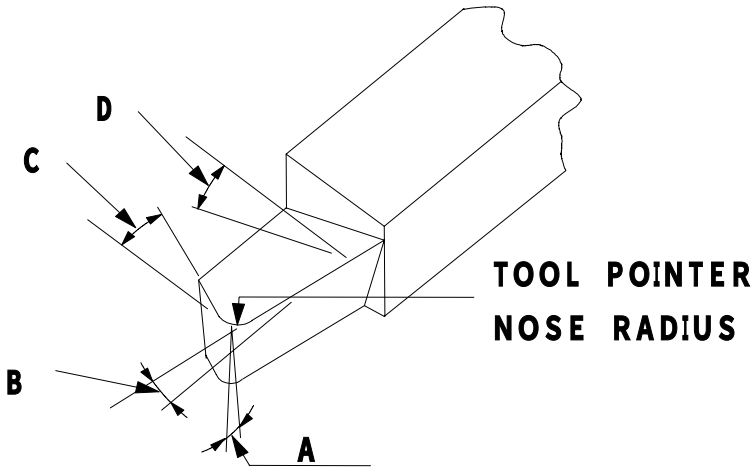
6－3 The connection below (Fig. 14) requires a 5/16 inch diameter brass rivet (maximum allowable shear stress 10,000 psi) and a 3/8 inch diameter steel rivet (maximum shear stress 15,000 psi). Considering only the shear capacity of the rivets, what is the maximum permissible load P?

A) 1,534 lbs

B) 1,657 lbs

C) 3,191 lbs

D) 767 lbs



7: Thermodynamics and Heat Transfer

7－1 Which of the following variables must be held constant when using Boyle's Law?

A) volume B) temperature

C) pressure D) cylinder diameter

7－2 The energy required to raise the temperature of a unit mass of material by one degree is the definition of:

A) specific heat. B) thermal conductivity.

C) thermal expansion. D) melting point.

8: Fluid Power

8－1 Which of the following is <u>not</u> a positive displacement pump?

A) impellor B) piston

C) gear D) vane

8－2 Standard atmospheric pressure at sea level is:

A) 24.6 in. Hg. B) 15.7 psi.

C) 86.0 cm Hg. D) 101.33 kPa.

Ⅲ : Materials

9: Material Properties

9－1 Which of the following tests would be used for accelerated aging for metal parts?

A) Fatigue B) Hardness

C) Notched-bar impact D) Fracture toughness test

9－2 Ductility is measured by determining the:

A) percent of elongation at fracture

B) energy absorbed per unit volume at yield stress.

C) energy absorbed per unit volume at fracture.

D) yield strain.

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10: Metals

10－1 When atoms from one kind of metal are randomly dispersed throughout another metal, it is called:

A) a solid solution. B) layering.

C) bonding. D) a dispersion colloid.

10－2 Which of the following is a plain low-carbon steel?

A) 1020 B) 4131

C) 1080 D) 4010

10－3 When metal is annealed, it is cooled:

A) quickly. B) with oil.

C) in a nitrogen atmosphere. D) slowly.

11: Composites

11－1 A material comprised of a combination of materials which has properties that exceed the properties of each ingredient acting alone and in which each ingredient is still recognizable with the naked eye after the combination is complete is called a/an:

A) composite. B) reinforced plastic.

C) alloy. D) laminate.

Ⅳ ： Product Design

12：Engineering Drawing

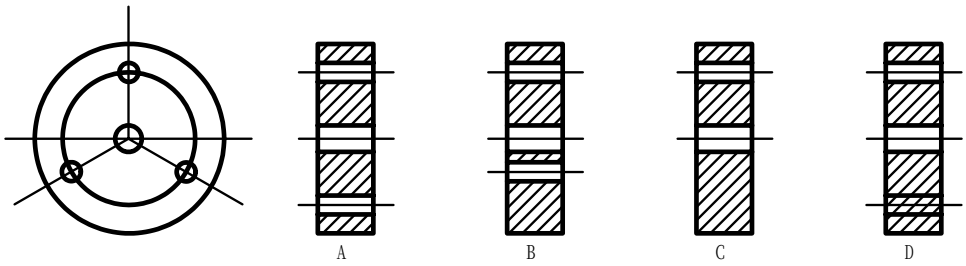
12－1 The most common method of projection using ANSI standard practices is commonly referred to as:

A) third angle projection. B) isometric projection.

C) first angle projection. D) oblique projection.

12－2 According to conventional practice, which is the preferred full section view ?

A) B B) D C) A D) C



12－3 The pitch of a screw thread is the:

A) distance between the peaks of two adjacent threads.

B) distance between the crest and the root of a thread.

C) measured distance over the top of the threads.

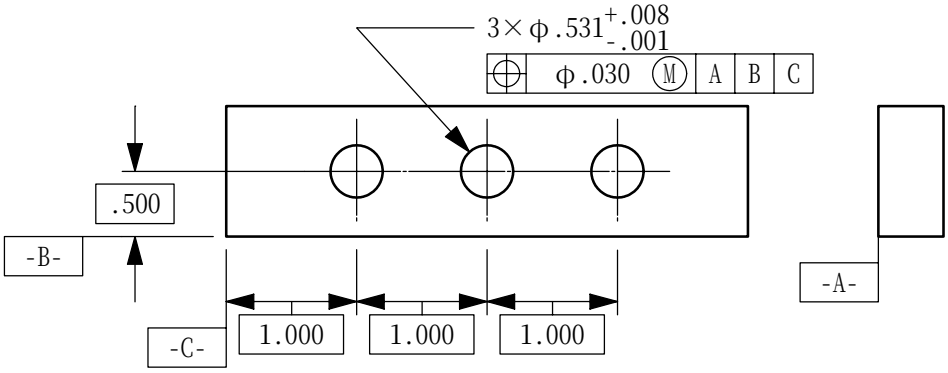
D) angle of the side walls of the thread.

13 : Geometric Dimensioning and Tolerancing

13－1 On the drawing below , what will be the total tolerance allowed for the horizontal location of the hole farthest form datum C? (Assume the hole is at maximum material condition.)

A) +.030 B) -.001

C) +.090 D) +.008



13－2 Generally speaking, the appropriate percentage of the workpiece locational tolerance applied to a jig or fixture is:

A) 10 to 20 percent. B) 20 to 50 percent.

C) 5 to 10 percent. D) 85 to 95 percent.

１３－３ If a hole's diameter is 0.05 mm greater than its specified size at maximum material condition, what amount of bonus tolerance may be added to the hole's positional tolerance?

A) 0.000 mm　　B) 0.100 mm

C) 0.050 mm　　D) 0.025 mm

14 : Computer-aided Design

１４－１ Which of the following commands would be used to proportionally increase or decrease the size of an object on a CAD display without changing the dimensions of that object?

A) explode　　B) zoom

C) scale　　D) window

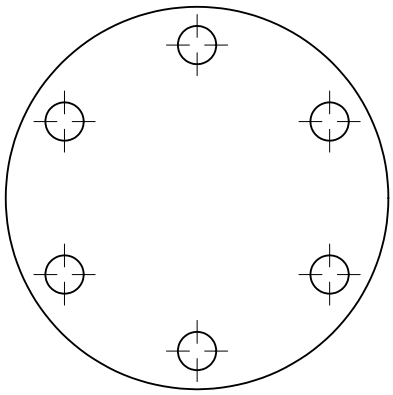
１４－２ Which CAD editing technique would be best to create six evenly spaced holes in the part shown in the following illustration ?

A）copy

B）offset

C）circular array

D）angular displacement



１４－３ Stereolithography is a technique which can be used to:

A) create two-color plates for high volume offset printing.

B) apply graphic images to contoured surfaces.

C) enhance the display of CAD solid models by generating 3D Holographic images.

D）rapidly generate physical prototypes of piece parts directly from 3D CAD data.

15 : Product Design Tools

15－1 Which of the following engineering analysis methods would be most appropriate for modeling the heat distribution in an engine exhaust manifold?

A) finite element analysis
B) logic and simulation analysis
C) kinematic analysis
D) closed-form solution analysis

15－2 A manufacturing engineer should view the design specifications for a product as:

A) representing the best possible specifications for all concerned regardless of production difficulties.
B) final and not open to any changes.
C) being equal to the process capability.
D) important but changeable if necessary to make production easier and economical.

15－3 In a Group Technology classification system, which of the following would most likely be found in the same part family?

A) Engine flywheel, brake drum, cast iron pulley
B) Engine flywheel, crankshaft, engine block
C) Brake drum, brake pads, brake cylinder
D) Cast iron pulley, woodruff key, drive belt

V : Manufacturing Processes

16 : Cutting Tool Technology

16－1 The tool life of a machine turning a 1-inch diameter bar of steel at 284 rpm is 10 minutes. When the cutting speed is reduced to 232 rpm, the tool life is 60 minutes. If the speed were reduced to 150 rpm, using Taylor's tool life equation, the expected tool life would be approximately:

A) 287 minutes.
B) 5 minutes.
C) 20 minutes.
D) 219 minutes.

16－2 The angle labeled "A" depicted in the illustration (Fig. 15) of a single point cutting tool is a:

A) rake angle. B) nose angle.

C) end angle. D) relief angle

17 : Machining

17－1 On a lathe, a parting tool is typically mounted on the:

A) tailstock B) quill

C) head stock D) cross-slide.

17－2 A 3.5" diameter bar is to be reduced to 3.25" in two cuts on a lathe by using:

A) 125" and .0625" depths of cut

B) .200" and .050" depths of cut

C) .125" and .125" depths of cut

D) .100" and .025" depths of cut

17－3 A drilling machine consisting of two or more independent, light duty, single spindle machines mounted on a common base is a:

A) turret drill. B) radial drill.

C) gang drill. D) gun drill.

18 : Metal Forming

18－1 Which of the following characteristics are associated with the cold-working of steel?

A) high strength, high hardness, low ductility

B) high strength, high hardness, high ductility

C) high strength, low hardness, low ductility

D) low strength, low hardness, low ductility

18－2 Which of the following would tend to decrease the chance of material fracture along a bend?

A) Bending the axis line in same direction as material grain lines

B) Bending the axis line perpendicular to material grain lines

C) Corner setting

E) Bending the radius less than one material thickness

19 : Sheet Metalworking

19－1 A die which performs a series of fundamental sheet metal operations at Two or more stations during each press stroke is commonly referred to as a :

A) progressive die B) simultaneous die

C) compound die D) combination die

19－2 The force needed to pierce a 2 inch diameter hole in .125 inch thick steel having a shear strength of 60,000 psi is approximately:

A) 188,496 lb B) 4,712 lb

C) 47,124 lb D) 23,562 lb

20 : Plastics Processes

20－1 Injection molding is used mainly to mold:

A) thermoplastic materials. B) plastisol materials.

C) composite materials. D) elastomer materials.

20－2 A typical example of attribute data collected on a product during an injection molding process is data related:

A) burns on the product. B) length of the product.

C) time taken to mold the product. D) weight of the product.

20－3 A plastics manufacturing firm for certain products wishes to choose only one type of thermoplastic material for its injection molding, rotational molding, themofoming and reinforced plastic molding processes.
Which type of material would be suitable for the above applications?

A) polysulfone B) polyethylene

C) polycarbonate D) polyurethane

VI : Production Systems

21 : Traditional Production Planning and Control

21－1 In a Materials Requirements Planning system, what data source is used to determine the raw materials and component parts needed to produce a given item listed in the master schedule?

A) part rating sheet B) Item master file

C) Assembly drawings D) Bill of materials

21－2 What is the primary function of MRPII planning?

A) processing data acquisition for SPC

B) scheduling the machine repair program

C) maintaining and controlling information in the CAD database

D) controlling scheduling and material procurement

22: Process Engineering

22－1 The main difference between a jig and a fixture is:

A) jigs use a greater percentage of the workpiece tolerance.

B) fixtures are for large parts.

C) fixtures are less costly.

D) jigs guide the cutting tool.

22－2 Which one of the following allows the greatest flexibility in an assembly system?

A) Robotic assembly operations.

B) Special machines for assembly operation.

C) Manual assembly operations.

D) Automated assembly operations within a computer-integrated manufacturing system.

22－3 Which is the best approach for a maintenance program in a highly automated manufacturing facility?

A) corrective maintenance B) contingency maintenance

C) annual maintenance D) preventative maintenance

Ⅶ : Automated System and Control

23 : Computer application / Automation

23－1 Which of the following techniques would be the best method for determining the average of a column of ten numbers in a spreadsheet? Assume all functions exist for a specific spreadsheet.

A) @SUM(b2..b11)/@COUNT{b2..b11}

B) c2 = @SUM(b2+b3+b4+b5+b6+b7+b8+b9+b10+b11)
c3 = 10
c4 = c2/c3

C) (b2+b3+b4+b5+b6+b7+b8+b9+b10+b11)/10

D) @AVG(b2..b11)

24 : Manufacturing Networks

24－1 The type of system where a central host computer is used for the sending of part programs to the computer controller(s) of two or more machine tools is best known as:

A) networked numerical control.
B) computer numerical control.
C) distributed numerical control.
D) direct numerical control.

25 : Computer Numerical Control Machining

25－1 Which of the following best describes the Z axis on a CNC milling machine feeding into a work piece while the X and Y axis are moving?

A) point to point
B) incremental positioning
C) absolute positioning
D) contouring

25－2 The "Z" axis on an N/C machine is generally the:

A) spindle axis.
B) minor axis.
C) major axis.
D) cross slide axis.

26 : Programmable Logic Controllers

26－1 A proximity switch transmits a signal to which PLC module?

A) Analog B) PID

C) Input D) High speed counter

26－2 In ladder logic code this symbol ---| |--- represents a(n):

A) test bit symbol B) timer symbol.

C) output symbol D) examine on symbol.

27 : Robotics

27－1 What are the four basic industrial robot configurations available?

A) polar, cartesian, cylindrical, and jointed-arm.

B) precision, sensor, polar, and cylindrical.

C) cylindrical, horizontal, precision, and jointed-arm.

D)horizontal, vertical, cylindrical, and jointed-arm

27－2 Which type of robotic power system should be selected for extremely quick and accurate assembly of small components?

A) pneumatic B) mechanical

C) electrical D) hydraulic

28 : Automated Material Handling and Identification

28－1 A bar code can be read from either left to right or right to left. The symbology feature that allows for this is its:

A) aspect ratio. B) code length.

C) check character. D) start/stop character.

28－2 The X dimension of a bar code refers to the:

A) height of the bar code. B) width of the widest element. .

C) width of the narrowest element. D) length of the bar code.

Ⅷ : Quality

29 : Statistical Methods for Quality Control

29－1 Based on the normal distribution curve, how many parts in 1,000 would fall outside the limits of a six-sigma range?

A) 27 parts B) 3 parts

C) 6 parts D) 30 parts

29－2 If variation in a process is normally distributed and a process dimension has a bilateral tolerance of plus or minus three standard deviations, what would the expected percentage of bad parts be?

A) .02 % B) .27 %

C) 0.0 % D) 1.02 %

29－3 A steering joint angle in excess of 12 degrees might cause steering failure in the Weld.

The mean was estimated to be 9.25 degrees and, the standard deviation at 1.03 degrees. Given that the data approximates a normal distribution, calculate the "Z" value of the Joint angle of 12 degrees.

A) -2.67 B) -2.40

C) 2.67 D) .02

30 : Dimensional Metrology

30－1 A metric micrometer would read in

A) millimeters. B) kilometers.

C) centimeters. D) decimeters.

30－2 Comparison of a dimension with some standard to see if it is larger or smaller is:

A) checking. B) gaging.

C) measuring. D) profiling.

Ⅸ : Manufacturing Management

31 : Management Introduction

31－1 Which of the following is a graphic technique used to analyze cause-and-effect relationships?

A) Pareto diagram
B) Histogram
C) Fishbone diagram
D) PERT/CPM chart

31－2 Legally, who has the ultimate responsibility for the ethical behavior of individuals in a manufacturing organization?

A) the individuals themselves
B) the government
C) the owners of the company
D) management executives

32 : Labor, Safety and Human Factors

32－1 When designing a manual assembly operation, which of the following would <u>not</u> contribute to repetitive motion injuries?

A) inadequate lighting
B) poor tooling design
C) improper workstation height
D) excessive component weights

32－2 The Occupational Safety and Health Act (OSHA) places the legal obligation to comply on:

A) supervisors.
B) manufacturers in interstate commerce.
C) employers.
D) every employee.

32－3 If a manufacturing plant had 20 injuries and job-related illnesses during a period in which all employees worked a total of 800,000 hours, what would be the plant's total injury-illness rate based upon OSHA's current factor of hours worked per year by 100 employees?

A) 15.0
B) 5.2
C) 5.0
D) 10.4

33 : Engineering Economics

33－1 Which of the following would be the most appropriate application of Value Engineering Analysis?

A) Material substitution to satisfy customer

B) Limiting work-in-process inventories

C) Assessing the value of an existing CNC machine

D) Calculating engineering indirect labor costs

33－2 Which of the following product design methods is most dependent on open communication and a team approach?

A) Simultaneous Engineering B) Value Analysis Engineering

C) Group Technology D) Phased Product Development

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END