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für metalltechnische Berufe

Lösungsbuch

TECHNISCHES ENGLISCH zur FACHKUNDE METALL

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Vorwort

Dss **Lösungsbuch Technisches Englisch für die Fachkunde Metall** dient zur Erarbeitung und Überprüfung der **Exercices** (Übungen) im Lehrbuch **Technisches Englisch für die Fachkunde Metall.**

Es enthält die **Fragen bzw. Aufgaben der Exercises** aus dem Lehrbuch und die dazu gehörenden **Antworten bzw. Lösungen.**

Die Antworten/Lösungen sind in Blau gedruckt und heben sich dadurch deutlich von den in Schwarz gedruckten Fragen/Aufgaben ab.

Die Exercises sind in derselben Reihenfolge und Kapitelnummerierung wie im Lehrbuch **Technisches Englisch für die Fachkunde Metall** angeordnet. Eine zusätzliche Seitenangabe lässt die jeweiligen Exercises im Lehrbuch rasch auffinden.

Nach jedem Kapitel bietet das **Lösungsbuch** eine Seite mit einer **Übungseinheit** (Test unit) zur Leistungsüberprüfung an.

Die **Übungseinheit** kann vom Lernenden als selbstgestellte Überprüfung seines Wissensstandes genutzt werden oder kann vom Lehrer durch Kopieren als Klassensatz zur Leistungsüberprüfung der Klasse verwendet werden.

Autorisierte Lehrkräfte können die Lösungen der Übungseinheiten auf der Website des Verlags Europa-Lehrmittel einsehen. Internetadresse: www.europa-lehrmittel.de

Sollten Sie Verbesserungsvorschläge zum **Lösungsbuch** haben, so freuen wir uns auf Ihre Zuschrift. Bitte senden Sie Ihre Hinweise und Vorschläge per E-Mail an: lektorat@europa-lehrmittel.de

Sommer 2021 Die Autoren, der Verlag

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Answers to the questions in the book TECHNISCHES ENGLISCH zur FACHKUNDE METALL

1 Measuring technique

1.1 Physical quantities and units

Exercises page 6

1. Working with words. Which words from the text are described here?

a) Every material has certain physical quantities, for example it has a special density.

b) In order to find out the correct diameter of a workpiece, you need to measure it with an instrument.

c) The speed of a car is also called velocity.

2. Define physical quantities in German by using the information from the text above.

Die an einem Objekt (z. B. bei einem bestimmten Werkstoff) messbaren Eigenschaften, Vorgänge oder Zustände werden physikalische Größen genannt.

3. Answer the following questions in English.

a) Which two elements does a physical quantity have? Find an example to explain it.

It consists of a numerical value and a unit.

For example: A workpiece has a *length l* of 330 mm:

330 represents the numerical value and **mm** the unit.

b) Which 7 base quantities does the International System of Units SI define?

The 7 base quantities defined by the International System of Units SI are length, mass, time, electric current, temperature, amount of substance and luminous intensity.

c) What is the difference between base quantities and derived quantities?

The base quantities cannot be transferred into another quantity, whereas the derived quantities can always be transferred back into the base quantities.

Exercises page 7

1. Write down the formula and explain the correct derived units. (Use your Metal Trades Handbook)

a) pressure p

$p = F : a$; Pressure p is defined as the effect of a force F applied to a surface a. The SI unit of pressure is Pascal (Pa), defined as a force of one Newton per square meter.

b) velocity v

$v = s : t$; Velocity v is defined as the distance s divided by time t. The SI unit for velocity is meter per second (m/s), defined as a distance measured in meter which is covered in the duration of one second.

c) density ϱ

$\varrho = m : V$; Density ϱ is defined as mass m per volume V. The SI unit for density is kilogram per cubic meter (kg/m^3), defined as a mass m measured in kilograms per volume V in cubic meters.

d) tension σ

$\sigma = F : S$; Tension σ is defined as a force F acting on a defined cross section S of a specimen in order to elongate him. The unit for tension in engineering is Newton per Millimeter N/mm^2.

e) electrical energy W

$W = P \cdot t$; Electrical energy W is defined as the electrical power P multiplied by the time t. The SI unit for electrical energy is Watt (W), defined as the power which gives rise to energy of one Joule in one second.

f) frequency f

$f = 1 : T$; Frequency f represents the number of occurrences of a repeating event per peroid time T. The SI unit for frequency is Hertz (Hz), defined as the rate of repetition per duration of one second.

2. Convert the measurements from imperial units into metric units. (Use your Handbook)

a) 120 miles in km

120 · 1.609 km = 193.08 km

b) 3.300 ft in metres

3.300 · 0.3048 m = 1.00584 m

c) 1 ½ pints in litres

1.5 · 0.5683 l = 0.8525 l

d) 4.5 ounces in kilogram

4.5 · 0.02835 kg = 0.1276 kg

e) 1/8 inch in mm

0.125 · 25.4 mm = 3.175 mm

f) 22.5 pounds in kg

22.5 · 0.4536 kg = 10.2060 kg

3. Calculate the physical quantities by using SI-Units.

a) A compact disc (CD) has a diameter of 120 mm. Calculate the area in mm^2.
$A = \pi \cdot r^2$;
$A_{CD} = \pi \cdot (60\ mm)^2 = 11309.724\ mm^2$

b) The volume of a steel rod is 0.50 dm^3 and has a density of 7.85 kg/dm^3. Calculate the mass in kg.
$m = \varrho \cdot V$;
$m_{rod} = 7.85\ kg/dm^3 \cdot 0.50\ dm^3 = 3.925\ kg$

c) A turning tool moves 9.3 cm in a time of 3 seconds. Calculate the feed velocity in mm/s.
$v = m : t$; $v_{ftool} = 93\ mm : 3\ s = 31\ mm/s$

1.2 Fundamentals of measuring technique

Exercises page 8

1. Translate the following inspection aids and name the main group of these devices.

a) plug limit gauge
Grenzlehrdorn – Lehren (gauges)

b) prism block
Prisma – Hilfsmittel (auxiliary aids)

c) folding rule
Gliedermaßstab – Messtechnik (measuring devices)

d) micrometer
Bügelmessschraube – Messtechnik (measuring devices)

e) snap gauge
Rachenlehre – Lehren (gauges)

f) vernier calliper
Messschieber – Messtechnik (measuring devices)

2. Name the correct inspection aid to find out these measurements.

a) the diameter of a shaft of 22 mm
vernier calliper

b) the length of a rail of 1.80 m
folding rule

c) the angle of 120°
protractor

d) the bore of ∅ 20 mm
vernier calliper

e) the depth of 10 mm of a groove
vernier calliper

f) the radius R5
radius gauge

3. Answer the questions in English.

a) What are dimensional representatives?
Dimensional representatives are measuring devices allowing certain dimensions to be compared with a measuring scale.

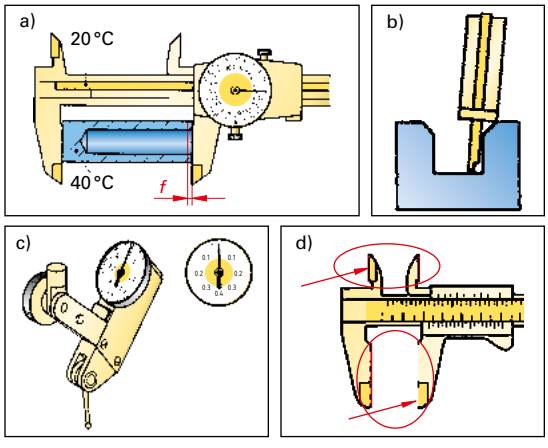
b) Which result do you get when you use a gauge? Give an example.
A gauge is used to check whether a dimension corresponds to the given standard. For example a plug limit gauge can be used to check whether the diameter of a hole is within specified limits and therefore accurate.

c) Which result do you get when you use an indicative measuring device? Give an example.
With an indicative measuring device, a numerical result is achieved. For example, when a shaft is measured with a vernier calliper.

d) When do you need an auxiliary aid? Give an example.
Auxiliary aids are used to fix objects in order to be able to measure them using measuring tools. For example to fix a shaft in a prism block and finally check it with a dial indicator.

Exercises page 9

1. Match the pictures a)–d) to the type of measuring error (1)–(4). Explain if it is a systematic or a random error.



Type of measuring error: (1) parallax error (2) wear of measuring surfaces (3) bad positioning of device (4) temperature too high

a) – 4 = systematic error
b) – 3 = random error
c) – 1 = random error
d) – 2 = systematic error

2. Make a list of six common measuring devices (e. g. steel rule, vernier calliper, gauge block, dial gauge protractor, etc.) and find out their type of inspection aid/range/accuracy. (Use a webpage of a company for measuring devices e. g. www.mitutoyo.com; www.mahr.de; www.hoffmann.de).

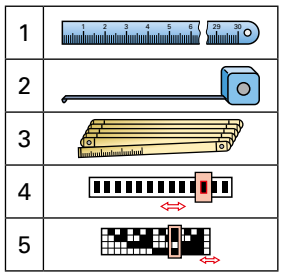
Measuring device	Type of inspection aid	Measuring Range	Accuracy
steel rule	dimensional representative	150–1000 mm	0.5/1 mm
vernier calliper	indicative measuring device	150 mm	0.01/0.2 mm
protractor	indicative measuring device	180°	0.1°/0.5°
micrometer	indicative measuring device	0–300 mm	0.005/0.01 mm
plug limit gauge	gauge	0.5–500 mm	0.01 mm/0.02 mm
dial indicator	indicative measuring device	50 µm–100 µm	0.001 mm
folding meter	dimensional representative	2000 mm	0.5/1 mm

1.3 Length Measuring Instruments

Exercises page 10

1. Match the correct expression of the following measuring devices to the pictures at the right.

a) absolute scale
b) flexible steel rule
c) tape rule
d) folding rule
e) impulse scale



a) – 5
b) – 1
c) – 2
d) – 3
e) – 4

2. Answer the following questions in English.

a) What is the difference between measuring instruments and gauges?
Measuring instruments provide a numerical value for the quantity, size, weight, distance or capacity of an object, whereas gauges are geometrical representations of certain dimensions or forms.

b) Why do straight edges and engineer's squares have lapped test blades?
Lapped test blades guarantee a high grade of flatness. Thus they enable the naked eye to realize different tiny light gaps between the blade and the tested object. These light gaps reveal inaccuracies concerning straightness and flatness of the workpiece.

c) What can you check with straight edges?
Straight edges are used to check the straightness and flatness of an object`s surfaces.

d) What is the light gap method?
The test blades are laid upon the surface of the object to be tested. If any tiny light gaps between the blade and the tested object are visible, they reveal inaccuracies in the surface.

e) Mention 3 different types of gauges and choose a certain measurement of a workpiece which can be checked by them.
Plug gauge – internal diameter of bores
Snap gauge – external diameter of cylindrical objects
Gauge block – external dimension of any three-dimensional object.

Exercises page 11

1. Find the correct answer of the questions and tick it in the table below.

a) A tolerance is a …	clearance between a shaft/mating bore	measurement error	variation in manufacturing ✓
b) Which of the following statement of plug gauges is true (only 1)?	The Go side is smaller than the No Go side of the plug gauge. ✓	Only slight pressure is needed to slide the Go member into the bore.	The No Go member is designated with the minimum limit size.
c) Which of the following statements of snap gauges is true (only 1)?	The Go member should fail to slide into the bore.	The Go member is marked in red.	The Go member doesn't represent the minimum limit size. ✓

2. Create a stack of gauge blocks and write down the combination of blocks.

a) 42.123 mm
1.003
1.020
1.100
9.000
30.000

b) 74.357 mm
1.000
1.007
1.050
1.300
70.000

c) 81.685 mm
1.005
1.080
1.600
8.000
70.000

1.4 Vernier calliper

Exercises page 12

1. Some of the following six statements are wrong. Find these statements and correct them.

a) A vernier calliper is the least frequently used measuring device in the workshop.
⇒ Wrong
A vernier calliper is the **most** frequently used measuring device in the workshop.

b) A calliper can measure diameters of bores and shafts, the width and thickness of a part.
⇒ Correct

c) There are three different types of callipers: manual, digital and CNC callipers.
⇒ Wrong
There are **two** different types of callipers: manual and digital.

d) With the aid of a 1/20 nonius a measuring of 0.02 mm is possible.
⇒ Wrong
With the aid of a 1/20 nonius an accuracy of **0.05 mm** is possible.

e) Measurements of 0.001 inch, 0.01, 0.02 and 0.05 mm are also possible.
⇒ Correct

f) Digital callipers are easier to read, cheaper and more often used nowadays.
⇒ Wrong
Digital callipers are easier to read and more often used nowadays, but **not** cheaper.

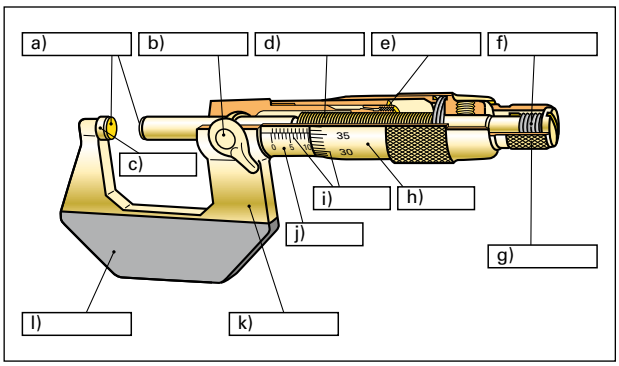
2. Translate the example of reading a mechanical calliper above into German.

Bei einer Messung wird als erstes der Nullstrich des Nonius als Komma abgelesen. Links vom Nullstrich liest man auf der Strichskala die vollen Millimeter ab.
Nun muss ermittelt werden, welcher der weiter rechts stehenden Striche der unteren Skala mit einem der oberen Skala übereinstimmt – dieser gibt den Zehntelmillimeterwert an. Das Addieren der beiden Werte ergibt das zu ermittelnde Maß.

1.5 Micrometer (screw gauge)

Exercises page 13

1. Label the sketch of the mechanical micrometer a) to l) by reading the text above.



a) measuring faces
b) lock
c) anvil
d) spindle
e) screw
f) spring

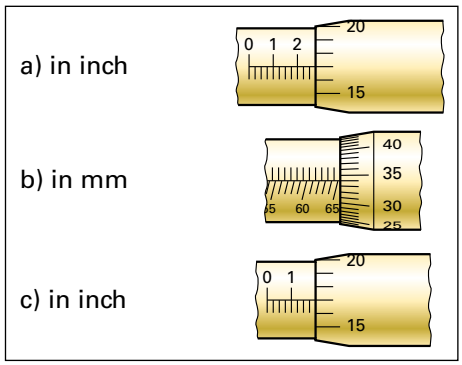
g) ratchet h) rotary thimble

i) main scale and auxiliary scale

j) sleeve k) frame

l) insulation plate

2. Read the correct measurements of the micrometers shown below.



a) 0.267 inch

b) 65.34 mm

c) 0.192 inch

1.6 Surface testing

Exercises page 14

1. Complete the missing information about form deviations in the table.

Degrees of form deviation	Examples	Possible cause
1st degree: form deviation	straightness or roundness, other than the required form	Clamping marks, wear in the guides of the machine tool
2nd degree: waviness	waves	Vibrations of machine tool
3rd degree: roughness	grooves	Geometry of the cutting tool, feed or depth of cut of the tool during fabrication of the part
4th degree: roughness	scoring, scales, bumps	Sequence of chip formation, surface deformation during fabrication of the part

2. Answer the questions in English.

a) Which surface testing instrument is very quick and easy to use? Why?
Surface roughness comparators, because they can be used during the manufacturing process, without having to place the workpiece in a measuring apparatus.

b) Explain why you can compare the surface roughness visually and by touching.
Because both methods make roughness comprehensible through senses.

c) Describe how a stylus instrument works.
Stylus instruments are surface roughness testers, which record the peaks and valleys by a diamond stylus. It is drawn at a constant speed across the workpiece. The amount to which the stylus is raised or lowered is printed in a diagram. It shows the increased surface profile.

Exercises page 15

1. Answer the questions in English.

a) Which surface texture parameters are often used in USA and which in Germany?
The surface parameter *Rz* is widely used in Europe, *Ra* is the most specified U.S. parameter.

b) Explain the difference between the surface parameter *Rmax* and *Rz*.
Rz considers the five highest peaks and the five deepest valleys. The complete evaluation length is divided into five cut-offs. In each of these the highest distance between peak and valley is a value (Rz_{1-5}). *Rmax* represents the maximum height of the five values in the sampling length.

c) Why is the surface texture parameter *Rmax* not a very reliable value?
Because it represents only an extreme and not the average surface texture. This means one scratch could give a false impression about the surface quality.

d) Explain the surface texture parameter *Ra*.
Ra (arithmetic average roughness) considers all peaks and valleys of the roughness profile. Thus, extremes are neutralised and have no significant influence on the final result.