МІНІСТЕРСТВО ОСВІТИ І НАУКИ УКРАЇНИ
ЧЕРНІГІВСЬКИЙ НАЦІОНАЛЬНИЙ ТЕХНОЛОГІЧНИЙ УНІВЕРСИТЕТ

АНГЛІЙСЬКА МОВА

Методичні вказівки до практичних занять для студентів денної форми навчання спеціальності 152 «Метрологія та інформаційно-вимірювальна техніка»

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ЗМІСТ

Вступ

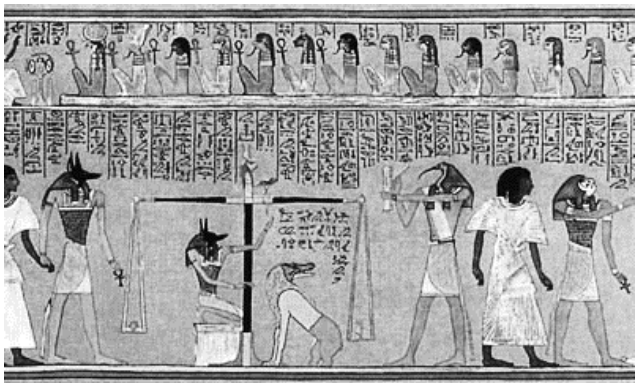
Методичні вказівки призначені для студентів вищих навчальних закладів денної форми навчання спеціальності 152 «Метрологія та інформаційно-вимірювальна техніка» та спрямовані та формування навичок англомовного, усного і писемного спілкування у професійному контексті.

Методичні вказівки укладені в рамках чинної навчальної програми з дисципліни «Іноземна мова за професійним спрямуванням» та відповідають вимогам навчального плану для студентів денної форми навчання спеціальності 152 «Метрологія та інформаційно-вимірювальна техніка» факультету електронний та інформаційний технологій ЧНТУ.

Методичні вказівки складаються з семи розділів, кожен з яких містить теми для групового обговорення, професійно-орієнтовані та автентичні тексти для опрацювання; завдання різних рівнів складності, спрямовані на засвоєння лексики і граматики, розвиток усних та писемних мовленнєвих навичок, а також контрольні списки для самоперевірки засвоєння матеріалу.

Матеріал, розміщений у методичних вказівках, сприятиме формуванню лінгвістичної та фахової компетентності студентів, а також розвитку навичок XXI століття, підвищуючи конкурентоспроможність випускників.

I. History of Metrology



Questions for group discussion:
How is Ancient Egypt connected with Metrology?
Scientists of what countries made great contributions to its development?

1. Read the article "Measurement through history" [1] and fill in the missing headings A-F:

A. 1791, Paris
B. 1215, England
C. 1960, USA
D. About 1643, Italy
E. About 3000 BCE, Egypt
F. 1824, London

People have been measuring since they began to buy, own and sell things, which means that the history of measurement is as long as that of civilisation. In fact, many aspects of civilisation would be impossible without measurement: science, for instance. Throughout history, science and measurement have worked in a virtuous circle, in which the technological developments that science produced permitted accurate measurements to be made, which then fed back into the testing and refinement of new scientific theories. Meanwhile, the growing internationalism of trade led to clarification and harmonisation of measurement systems. It's too long a story for a short space, but some of its highlights are:

1) ___

The cubit is defined as the length of the Pharaoh's forearm plus the width of his hand. Once this measurement has been made and carved into a granite block, wooden and stone copies are given to builders. Architects have the responsibility to check them each full Moon – with execution the penalty if they don't.

1196 ADE, England

The first documented call is made for standardisation of units in England, in the Assize of Measures. The primary concern is that beer and wine are properly measured.

2) ___

Magna Carta requires uniform measures throughout England, stating that ‘There shall be standard measures of wine, ale, and corn ... throughout the kingdom. There shall also be a standard width of dyed cloth, russett, and haberject, namely two ells within the selvedges. Weights are to be standardised similarly.’

About 1612, Italy

Thermometer invented, perhaps by Giovanni Francesco Sagredo (1571–1620).

3) ___

Barometer invented by Evangelista Torricelli (1608-1647).

1657, Netherlands

The pendulum clock is patented, by Christiaan Huygens (1629-1695) and the first one is built soon after. It is accurate to around 10 seconds per day, an amazing improvement on the six minutes a day or so ‘accuracies’ of previous mechanical clocks.

19 January 1762, Jamaica

William Harrison disembarks from his ship, carrying a very special watch: a chronometer called H4. His father, John Harrison, had designed it to keep time at sea with sufficient accuracy for sailors to work out their longitudes*. Despite being on board the ship since 18th November the previous year, H4 is only 5.1 seconds slow, a significant achievement for a mechanical device.

4) ___

The French National Assembly agrees to standardise the metre as one ten-millionth part of a quarter of the Earth’s circumference. As no-one knows exactly how long this is, various people set off to find out. Unfortunately, France fixes its official standard of length before all the results are in, and as a result the standard metre bar is a fifth of a millimetre too short. This also means the circumference of the Earth (through the poles) is a bit more than the forty million metres everyone was expecting it to be.

1799, Paris

The metric system is set up, through the adoption of two platinum/iridium alloy standards: a metre length and a kilogram mass.

5) ___

An act of Parliament introduces an improved and more widespread system of measurements, and an imperial standard yard is constructed. The yard is placed in the Houses of Parliament for safe keeping – which doesn’t turn out to be all that safe after all when they burn down in 1834. After this, a new standard yard bar is made and kept in a fireproof box, which is then bricked up in a wall in the new House of Commons and only taken out every 20 years to check the lengths of standard copies.

1842, London

The Excise Laboratory is founded in London to carry out chemical analysis to detect the adulteration of tobacco. This laboratory later becomes the Laboratory of the Government Chemist (now LGC) and is the oldest official chemical laboratory in Britain.

1875, Paris

Seventeen nations sign the Convention of the Metre, and the International Bureau of Weights and Measures is set up.

1955, Teddington, England

The first accurate atomic clock is built by Louis Essen (1908-1997) at the National Physical Laboratory (NPL). It keeps time to better than one millionth of a second per day.

6) ___

The first working laser is constructed by Theodore Maiman (1927–2007) in California. Initially a discovery in search of an application, it rapidly becomes essential to the accurate measurement of time, length and luminous intensity.

1960

The International System of Units (SI System) is established, including units of mass, length, time, temperature, current and luminous intensity.

1971

A seventh unit, of amount of substance, is added to the set of SI base units.

1994

The National Measurement Office (NMO) starts testing the accuracy of the UK's national lottery balls.

2. Find English equivalents to the words and phrases in the article: доброчесне коло, уточнення нових наукових теорій, штраф, першочергове завдання, точний до 10 секунд на день, поліпшення, значне досягнення, на одну п'яту міліметра закоротка, прийняття, виявляти фальсифікацію.

3. Read the article once again and discuss in pairs:
1. Which information was new for you?
2. What are surprising or interesting facts?
3. What conclusions could be made?
4. What can you add to the information given on the history of metrology?
Be ready to share the results of your discussion with the class.

Group work: *Find information regarding interesting/awkward cases in the history of measurements. Bring the text to the class together with a task to the text for your groupmates.*

Word building

How can we create new words from the existing ones?
Find examples in the text:

What do we measure? [1]

For a very long time, Britain used units which were based on familiar things - like feet. If everyone's feet were the same size, this would be an extremely simple and convenient system (and not just for shoemakers). As they aren't, a foot of a particular length had to be defined as a standard. Other units were treated in the same way until there were accepted values, used throughout the country, of all common units (though no-one ever seems to have got round to defining leagues properly, beyond deciding it took an hour to walk one).

A problem with this approach was that other countries naturally wanted similarly handy units, so they came up with similar-but-not-quite-the-same definitions, which in turn led to lots of argument when people in different countries tried to sell goods to one other. As it would be very inconvenient for countries to change the values of their units, and even more difficult to decide which countries were to change and which stay the same, these differences persist. For instance, to this day the British gallon is about one fifth larger than the US version of the unit with the same name.

There were even more problems when people in different countries tried to work together to make things. Problems of this sort came to a head in the Second World War, when efforts made by the Americans and British to build things together were frequently distrupted by the American foot being 0.0004% longer than the British version.

Since an engine part that is 0.0004% too large is sometimes wrong enough not to fit, it was soon clear that this problem needed urgent attention, so experts sprang into action to agree a common definition of the foot. Twenty years later, they succeeded. Sadly for them, by then the foot was being elbowed out by the metre as a standardized measure of length in the UK.

It wasn't only length units that were changing, nor were the changes confined to Britain. By many triumphs of diplomacy and horse-trading, in 1960 the world* agreed to adopt a single primary system of units, called the International System of Units, or SI for short.

Give your own examples of words with the following suffixes:

- nouns for things: -ment -ity -ness -tion -ence/-ance
- nouns for people: -er -or -ist -ee
- verbs: (usually it's simply the shortest word form) –ify -ise -en en-
- adjectives: -ous -able/-ible -al -ed/-ing -ful/-less -ic -ive
- adverbs: -ly

Define the parts of speech in the following sentences:

1. I fantasied a fantastic fantasy of a nonfantasy.
2. A beautiful beauty beatified me beautifully.
3. The craziest craziness is crazily crazy.
Take any word you like, change it into different parts of speech and create a sentence of a similar kind.

Here are the most common affixes, which are used to express the negative meaning of a word:
dis- un- in- im- il- ir- mis- -less

Use the affixes to make these words negative:

expected	regular	behave	efficiency	honest
probable	known	believable	logical	carelessly
interpret	help	appropriate	patient	legal
use	able	possible	approve	literate

Use words with affixes to give as many associations as possible to the following concepts:
a) universityb) metrology c) exams d) summer

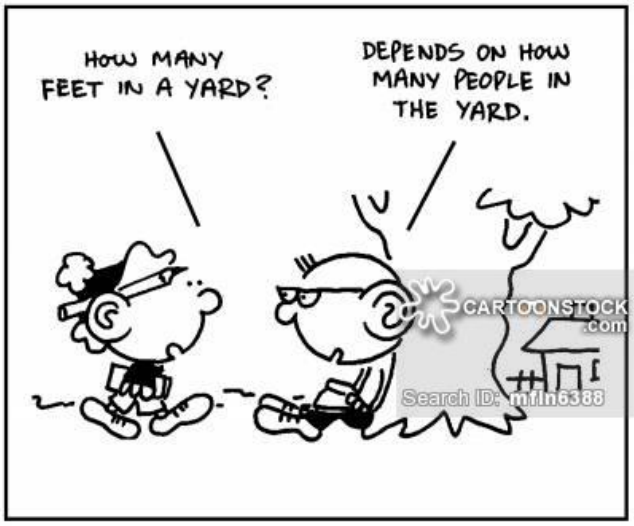
Group work: *Tell about the history of metrology using words with suffixes and affixes in different parts of speech.*

I. Checklist

I know:
- some facts from the history of metrology
- how to create new words from existing ones

I am able to:
- tell interesting facts from the history of metrology
- use suffixes and affixes in word building

II. Types of Measurement



Questions for group discussion:
What types of measurement systems are there? Where are they used?
Why is it important to know the difference?

1. Read the e-mail from an engineer to his co-worker [6]. Then mark the following statements as true (T) or false (F):
1) ____ The engineers must use the imperial system.
2) ____The pipes are 4 feet, 5 inches long.
3) ____The frame must weigh 20 kilograms or less.

Karen,

We have a problem with the project we're working on. The American engineer we are working with is using **imperial** measurements. This is incorrect. We all need to use the **metric** system.

Please inform the American engineer of the following:
The pipes we are using are 4.5 **meters** (450 **centimeters**) each, not 4 **feet**, 5 **inches**. Also, each pipe holds 15 **liters**, not 15 **gallons**. And the weight of the frame is no more than 20 **kilograms**, instead of 20 **pounds**. Mistakes like this make a big difference. Someone needs to contact him about this.

Rob

2. Write a word that is similar in meaning to the underlined part [6]:
1) The boy is over one <u>hundred centimetres</u> tall!
2) Is that 200 <u>imperial weight measurements</u> or kilograms?
3) There is only one <u>thousand millilitres</u> of soda left.
4) The measurement is just one <u>one-hundredth of a meter</u> off.
5) The <u>United States' system of measurement</u> uses gallons.
6. A ruler is <u>twelve inch length</u> long.

3. Use the words to fill in the blanks [6]:

metric *gallons* *kilograms* *inch*

1) Get seven _____ of water.
2) My design only weighs seventeen _____.
3) The _____ system is used worldwide.
4) The worm is less than a(an) _____ long.

4. Divide the given units of measurement according to the metric or imperial system of measurement.

gallons, kilograms, inches, meters, feet, litters, pounds.

What other base units do you know?

5. Match the names of the base units and their definitions [6]:

1) Candela 3) Kilogram 5) Second
2) Ampere 4) Kelvin 6) Mole 7) Metre

a) The length of the path travelled by light in vacuum during a time interval of 1/299792458 of a second.
b) The mass of the international prototype of the kilogram.
c) The duration of 9,192,631,770 periods of the radiation corresponding to the transition between the two hyperfine levels of the ground state of the caesium 133 atom.
d) The constant current which, if maintained in two straight parallel conductors of infinite length, of negligible circular cross-section, and placed 1 metre apart in vacuum, would produce between these conductors a force equal to 2 x 10-7 newton per metre of length.
e) 1/273.16 of the thermodynamic temperature of the triple point of water.
f) The amount of substance of a system, which contains as many elementary entities as there are atoms in 0.012 kilogram of carbon 12. The elementary entities may be atoms, molecules, ions, electrons, other particles, or specified groups of such particles.
g) The luminous intensity, in a given direction, of a source that emits monochromatic radiation of frequency 540 x 1012 hertz and that has a radiant intensity in that direction of 1/683 watt per steradian.

6. Watch the video "Why the metric system matters – Matt Anticole" at TED-Ed on Youtube.com and answer the questions:

1) What factors supported the usage of the metric system?
2) What countries use the imperial system? Why?
3) Why is the unified system of measure so important?

Writing: Read the Rob's e-mail once again. Help him to contact the American engineer. Write an e-mail explaining the problem and sending the requirement. Follow the formal style of writing.

Look through your email, tick if you have the following:

- ☐ clear structure: opening, main body, closing, signature
- ☐ formal greeting
- ☐ complex sentences
- ☐ no contractions
- ☐ linking words

What would be the list like for an informal letter?

Look at the phrases. Where can we use them? Write down **I** for an informal letter and **F** for a formal one.

- How are you?
- Dear Sir/ Madam,
- To whom it may concern
- I hope you are doing well
- I am writing to make a reservation
- just a quick note to …
- Could you please let me know if
- I would also like to know if
- Can you call me…
- I am attaching my CV for your consideration.
- Please see the statement attached.
- I'm attaching/sending you …
- I can't wait to see you soon.
- Send my love to …
- Yours faithfully,
- Yours sincerely,
- Best wishes,
- Kindly,
- Love,
- Sincerely Yours,

II. Checklist

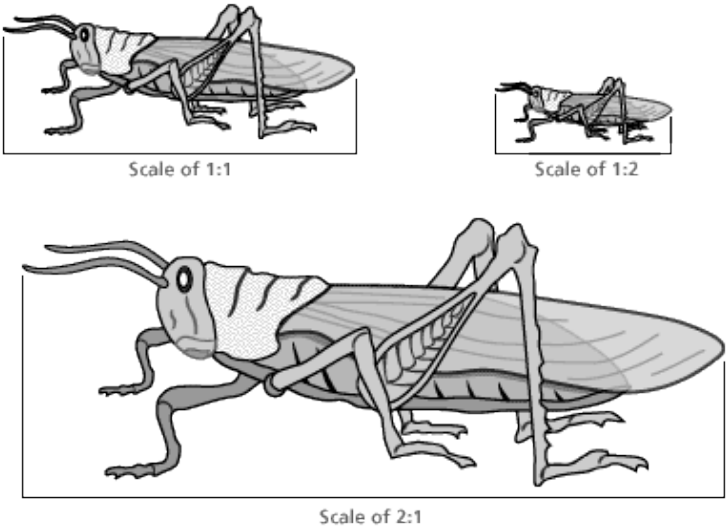
I know:

- ☐ two main measuring systems
- ☐ different base units used in the systems
- ☐ countries where the systems are used

I am able to:

- explain differences between the metric and imperial measuring systems
- write formal e-mails

III. Dimensions and Drawings



Questions for group discussion:
What kind of drawings do engineers make?
What is the purpose of engineer's drawings?

1. Read this e-mail from an engineer and choose the correct answers [6]:

1. What is the note about?
a) drawing a cell phone diagram
b) determining the scale of a cell phone
c) choosing materials to make a cell phone
d) explaining a cell phone's dimensions

2. Which is NOT true about the engineer's request?
a) He wants different views of the phone.
b) He wants to see what's inside the phone.
c) He wants to know the dimensions.
d) He wants the drawing to be actual size.

3. What can you infer about the company?
a) It recently hired new engineers.
b) It typically makes larger devices.
c) It has never made cell phones before.
d) It provides cost analysis to engineers.

Julia,

After many meetings and cost analyses, we're finally moving forward with the cell phone project to expand, for the first time, into the communications market.

What I need from you in these early stages is a **CAD drawing** detailing the **schematics** of the device.

The blueprint should include details for the **dimensions** of the phone. This includes the device's **length, width, depth** and the **perimeter** of the screen.

As for **scale**, the device is small. So make the drawing at least four times larger than the device.

The **diagram** also needs an **exploded view** to show how the components will fit together. This includes the circuit board, battery, microphone, speakers and liquid crystal display. We also need a **cross-section** of the phone to see those components all within the outer casing.

Don't forget to show the **geometry** of the phone from different angles.

Please contact me with any questions you have.

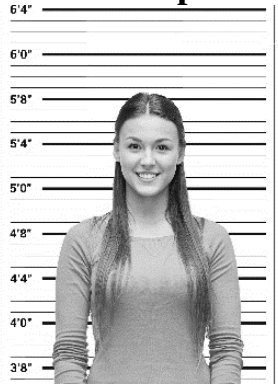
-Dave

2. Translate the highlighted words.

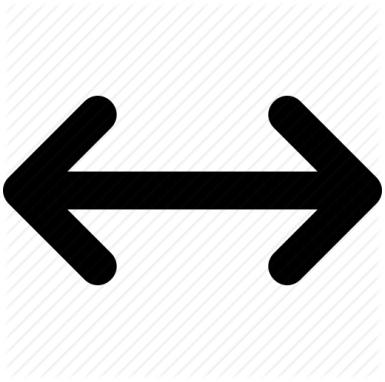
3. Fill in the missing words [6]:

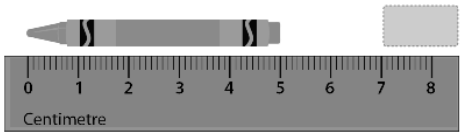
1) _____ show how machine's pieces fit together.
2) Draw the plans at a small _____.
3) The _____ shows the layout of the new machine.
4) Add all sides to calculate the _____.

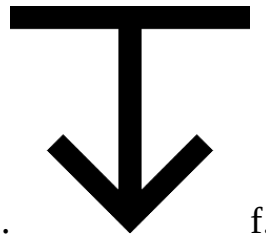
4. Look at the pictures. Write down the names of dimensions:

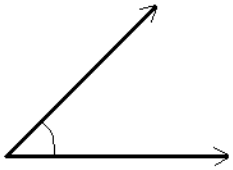
a. 

b. 

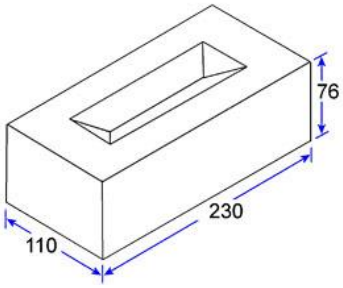
c. 

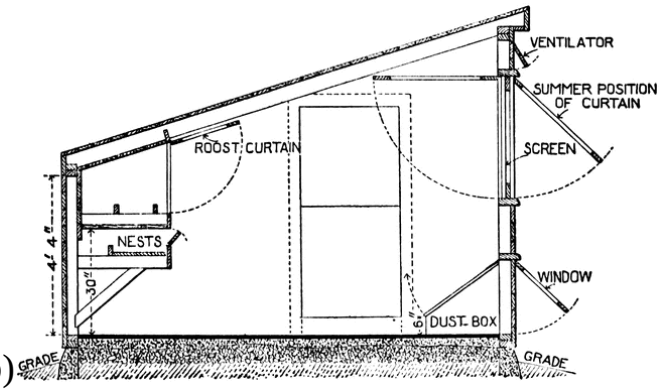
d. 

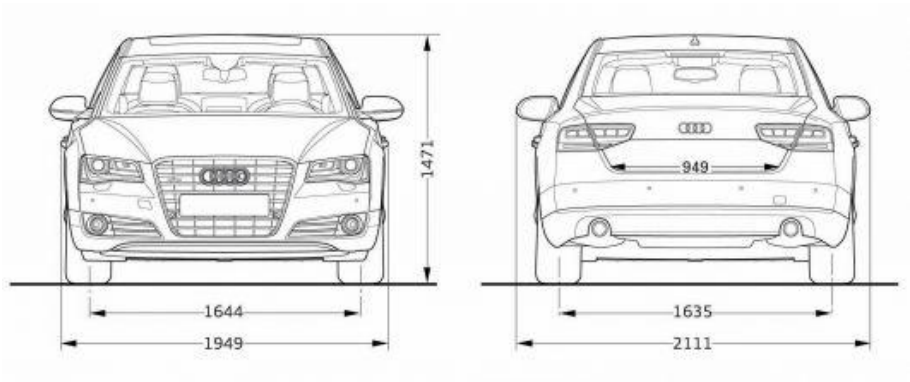
e. 

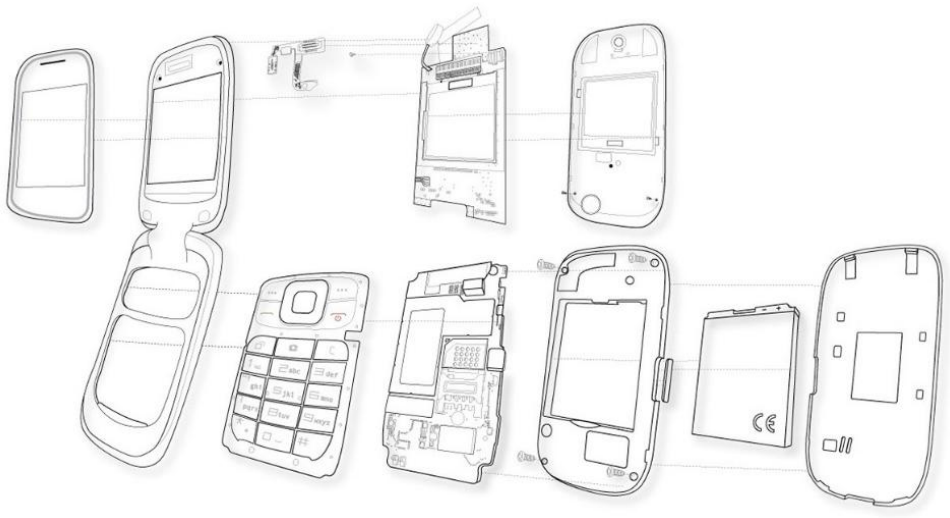
f. 

5. Work in pairs. Take turns to describe the diagrams. Define the types of the diagrams and explain what they show.

a) 

b) 

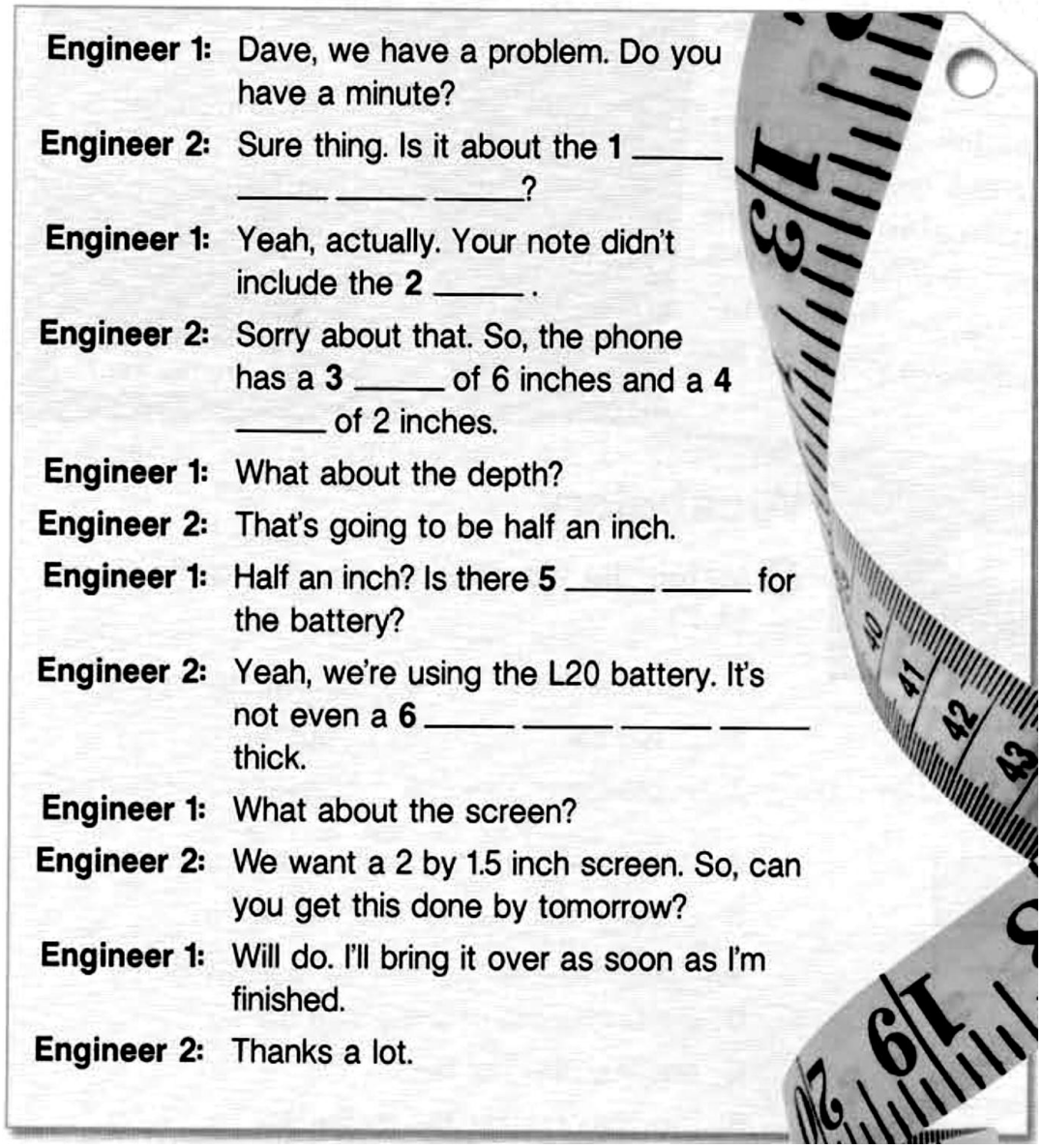
c) 

d) 

6. Listen to a conversation between two engineers [6, Book 2. Unit 8. ex.6 and 7 p. 19]**. Mark the following statements as true (T) or false (F):**

1) ___ The note didn't include the dimensions.
2) ___ The depth of the phone is 1 inch.
3) ___ The screen size has not been determined.

Listen again and complete the conversation.



Engineer 1: Dave, we have a problem. Do you have a minute?

Engineer 2: Sure thing. Is it about the **1** _____ _____ _____ _____?

Engineer 1: Yeah, actually. Your note didn't include the **2** _____.

Engineer 2: Sorry about that. So, the phone has a **3** _____ of 6 inches and a **4** _____ of 2 inches.

Engineer 1: What about the depth?

Engineer 2: That's going to be half an inch.

Engineer 1: Half an inch? Is there **5** _____ _____ for the battery?

Engineer 2: Yeah, we're using the L20 battery. It's not even a **6** _____ _____ _____ _____ thick.

Engineer 1: What about the screen?

Engineer 2: We want a 2 by 1.5 inch screen. So, can you get this done by tomorrow?

Engineer 1: Will do. I'll bring it over as soon as I'm finished.

Engineer 2: Thanks a lot.

Listen for the third time. Mark intonations: rising ↑ falling ↓ and pauses: long ‖ and short |. Read the dialogue by roles.

Speaking: Student A you are creating a drawing of a new product. Ask student B questions regarding the dimensions and some other requirements to the drawing. Act out the dialogue.

Listen to the dialogues of your groupmates and fill in the engineer's notes:

Notes

Engineer:
Product:
Dimensions:
Requirements:

III. Checklist

I know:

- ☐ different types of drawings
- ☐ names of dimensions

I am able to:

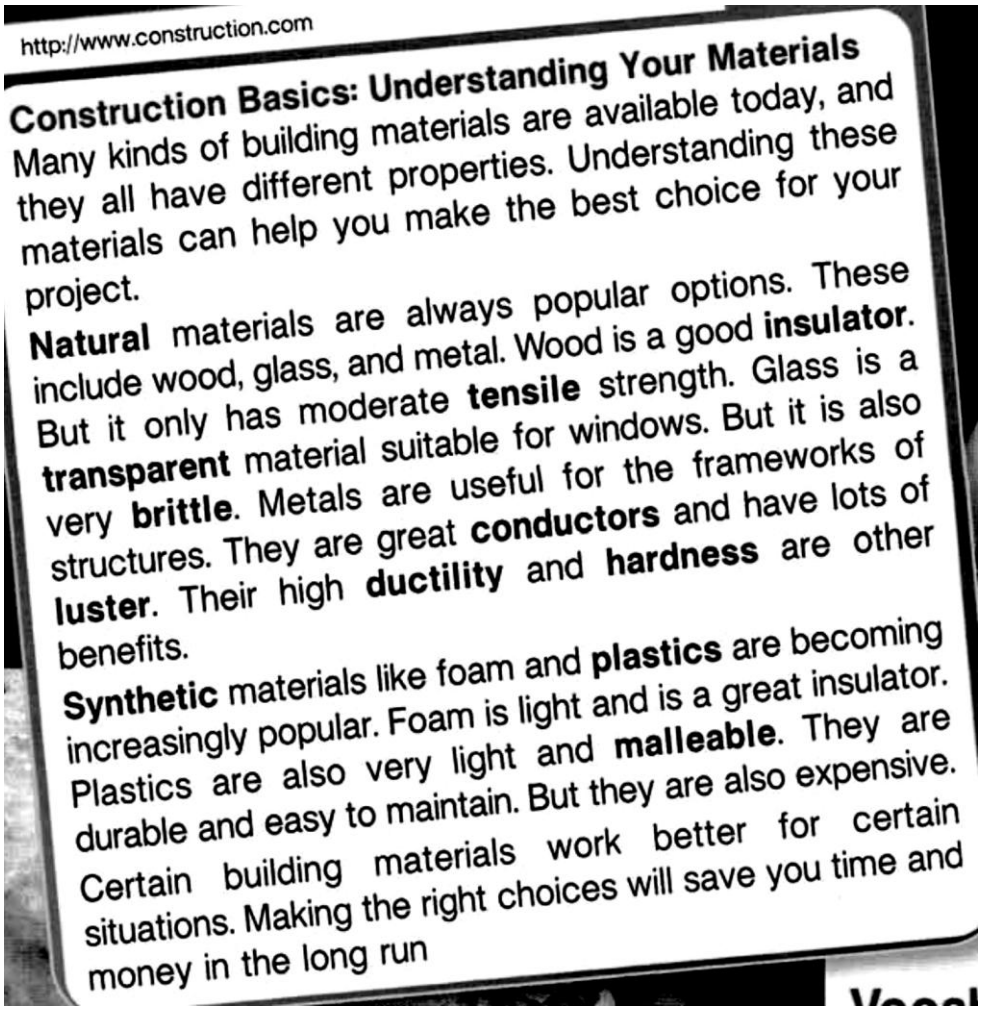
- ☐ describe diagrams
- ☐ discuss drawings
- ☐ fill in engineer's notes

IV. Metrology of Materials

Questions for group discussion:
What materials are used in engineering?
What can be measured regarding materials?
How does the choice of a material influence the product?

1. Practice reading: building, available, properties, options, insulator, tensile, suitable, conductor, luster, ductility, synthetic, malleable, durable.

2. Read an abstract from the website of Abel Construction Co. Complete the table using information from the passage [6].



http://www.construction.com

Construction Basics: Understanding Your Materials

Many kinds of building materials are available today, and they all have different properties. Understanding these materials can help you make the best choice for your project.

Natural materials are always popular options. These include wood, glass, and metal. Wood is a good **insulator**. But it only has moderate **tensile** strength. Glass is a **transparent** material suitable for windows. But it is also very **brittle**. Metals are useful for the frameworks of structures. They are great **conductors** and have lots of **luster**. Their high **ductility** and **hardness** are other benefits.

Synthetic materials like foam and **plastics** are becoming increasingly popular. Foam is light and is a great insulator. Plastics are also very light and **malleable**. They are durable and easy to maintain. But they are also expensive. Certain building materials work better for certain situations. Making the right choices will save you time and money in the long run

Material	*Properties*
Glass	
Metal	
Plastic	

3. Write one-two sentences to each paragraph, expressing the main idea.

4. Match the words (1-6) with the definitions (A-F)

1. malleable 3. plastic 5. ductility
2. natural 4. insulator 6. luster

a) a material's ability not to break
b) coming from nature, such as wood
c) a material that contains heat or electricity
d) the brightness or shine of a metal
e) easily shaped or bent
f) a common synthetic material

5. Say true or false [6]:

1) Cotton is a synthetic material.
2) Glass is brittle and can shatter.
3) You can stretch rubber because it has very low tensile strength.
4) Foam retains heat well and is a good conductor.
5) Most glass is transparent.
6) Metals have low levels of hardness.

6. Fill in the chart below.

	Transparent	Stiff	Flexible	Hard	Soft
Metal					
Plastic					
Rubber					
Wool					
Pottery					
Glass					
Cork					
Rock					

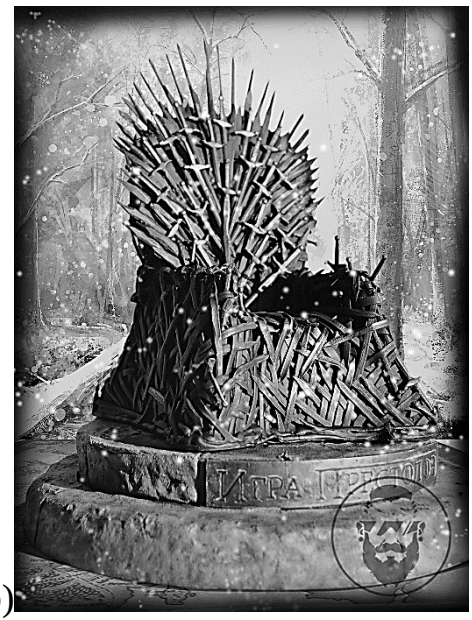
7. Match the properties and their definitions:

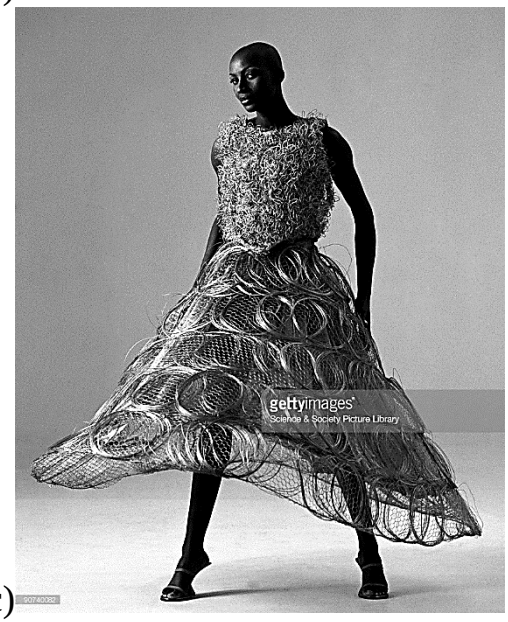
Opaque	attracted to a magnet
Brittle	difficult to break
Rough	even surface
Transparent	not man-made
Flexible	cannot be bent
Strong	uneven surface
Magnetic	you cannot see through it
Waterproof	reflects light
Smooth	you can see through it a bit
Translucent	soaks up water
Shiny	can be bent
Synthetic	difficult to scratch or squash
Absorbent	man-made
Rigid	you can see completely through it
Natural	hard but easily broken
Hard	does not soak up water or let water through

Group work: What materials haven't been mentioned yet? What are their properties?

8. Change the materials' characteristics (adj) to the names of their properties (n): e.g. shiny → shininess
hard, brittle, rough, transparent, flexible, strong, smooth, rigid.

9. Look at the pictures (a-d). In pairs, discuss if the materials have been used correctly. Give your arguments.

a)  b) 

c) 

d) 

10. Listen to a conversation between an engineer and her client [6, Book 2. Unit 9. ex.6 and 7 p. 21]**. Mark the following statements as true (T) or false (F):**

1. ___ The client wants to use synthetic materials.
2. ___ The engineer recommends steel over wood.
3. ___ The client has little money for the project.

Listen again and complete the conversation:

Client: Hi Beth. I'm calling regarding the building materials for the new park swing set.

Engineer: Okay. What can I do for you?

Client: I need advice on materials for the framework. I want to use **1** _____ materials.

Engineer: Well, your two main options are wood and steel.

Client: Which do you recommend?

Engineer: Steel's ductility makes it a **2** _____ _____. And it's not **3** _____, so it won't break from frequent use.

Client: Is it more expensive than wood?

Engineer: Yes, it does cost more. Is that **4** _____ _____?

Client: Somewhat. I'm **5** _____ _____ _____ _____.

Engineer: Well, wood is cheaper. But it absorbs moisture over time. This reduces its **6** _____.

Client: So is steel the better value?

Engineer: Yes. At least in the long term. It's very durable and requires less maintenance than wood.

Speaking: Student A, you are building a construction (on your choice). Ask student B questions to find out options for materials, recommendation, costs. Act out dialogues.

VI. Checklist

I know:

- ☐ names of materials and their properties

I am able to:

- ☐ prove usage of a particular material
- ☐ express the main ideas of a text
- ☐ conduct a dialogue on choosing a material

V. Measuring Devices

Questions for group discussion:
What measuring devices do you know?
Which of them have you used in practice?
Which of them do you find the most useful? Why?

1. Read the brochure. Then, mark the following statements as true (T) or false (F) [2]:
1) ___ Multimeters check inductance and current.
2) ___ QMT recently increased their inventory.
3) ___ Isolation transformers are on sale.

Meters

QMT offers high-quality meters. Our best-selling **multimeter** can measure voltage, resistance, and current! We also sell **inductance meters**, **capacitance meters**, and have both digital and **analog meters** in stock.

Scopes

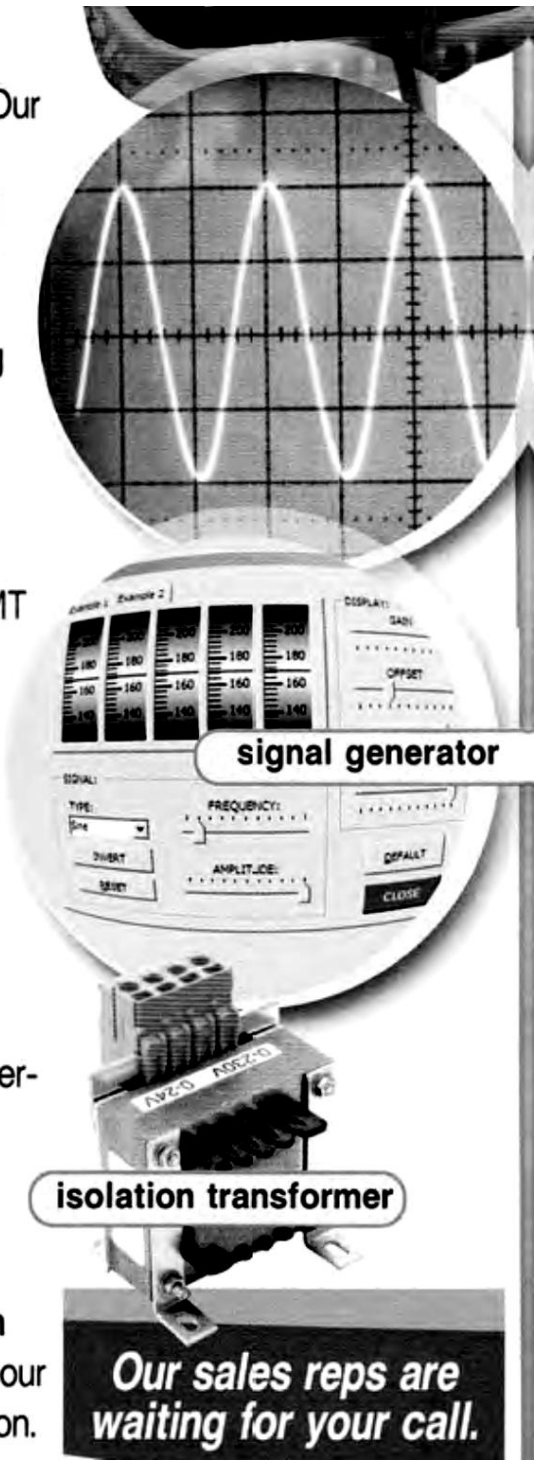
Our new **oscilloscope** provides increased levels of accuracy. QMT listens to our clients. As a result, we recently added **spectrum analyzers** and **logic analyzers** to our stock.

Other Testing Products

We carry **transistor testers**, **frequency counters**, and the ever-popular **signal generators**.

Safety Devices

Keep your employees and equipment safe with an **isolation transformer**. Take advantage of our buy one get one half off promotion.



2. Practice reading: quality, multimeter, voltage, inductance, capacitance, oscilloscope, analyzer, frequency, isolation.

3. Read the sentence and choose the correct word [2]:

1) The technician used the frequency counter / analog meter to track the speed of signal cycles.

2) A(an) spectrum analyzer / isolation transformer keeps power input and output separate.

3) A(an) signal generator / analog meter uses a moving needle to display measurements.
4) The man used a(an) signal generator / inductance meter to test the analog equipment.
5) The woman used an isolation transformer / inductance meter to get information about coils.
6) A spectrum analyzer / frequency counter shows voltage versus frequency.

4. Fill in the blanks with the correct words and phrases from the list [2]:
capacitance meter, logic analyzer, multimeter, oscilloscope, transistor tester
1) The technician used the _____ because she needed to measure both voltage and resistance.
2) The transistor wasn't working correctly, so the technician used a(an) _____.
3) The technician wanted to smooth power output, so he fetched the _____.
4) The technician used a(an) _____ to create a graph showing voltage versus time.
5) A(an) _____ shows signals in a digital circuit.

5. Which of the devices from the brochure would you like to order and why?

Writing: **You want to buy one of the devices from the brochure for your measuring laboratory. Write a letter of enquiry to QMT:**

- ask for details on one of the devices
- clarify conditions of the promotion
- clarify the payment and shipping terms
- leave your contact information

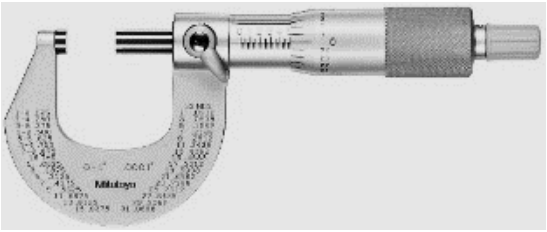
6. Discuss in pairs: at what stages of production do we perform measurements?

7. Read the article "Post-process Measurement" [4] and fill in the missing words:
rectangular, standard, post-process, outside, screen, tolerance, reading

Traditionally, measurements have been made after the part has been produced. It is called the 1) _____ measurement. The post-process measurement can be used to high production run of smaller parts. The inspection process can be made by traditional methods. If the dimensions are not within the given 2) _____ zone, a correction can be made to the next part through the machine tool.

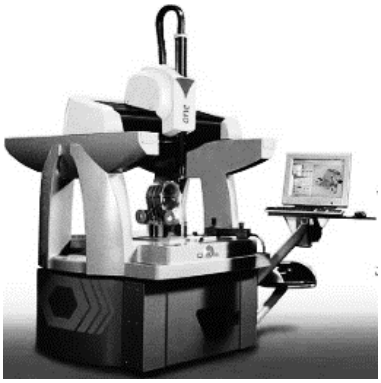
Gauge blocks are individual square, 3) _____, or round metal blocks of various sizes. Their surfaces are lapped and are flat and parallel within a range of 1-5 micro

inch. Gage blocks are available in sets of various sizes. The blocks can be assembled in many combinations to obtain desired lengths. The gage block assemblies are used as an accurate reference length to measure the part's length.



The micrometer is commonly used for measuring the thickness and inside or 4) _____ diameters of parts. Micrometers are also available for measuring depths. Micrometers can be equipped with digital readout to reduce errors in 5) _____.

The profile projector is used for measuring two-dimensional contours of precision specimens and other work pieces produced. The part to be measured is magnified by an optical system and projected on a 6) _____. The reading on the screen gives the dimension of the part.



A coordinate measurement machine (CMM) is an advanced, multi-purpose quality control system used to help inspection keep pace with modern production requirements. A CMM provides instant measurement results without complicated setup and operating procedures. It combines surface plate, micrometer and Vernier type inspection methods into one easy to use machine. CMM can check the dimensional and geometric accuracy of everything from small engine blocks, to sheet metal parts, to circuit boards.

A CMM consists essentially of a probe supported on three mutually perpendicular (X, Y & Z) axes. Each axis has a built-in reference 7) _____.

Procedure for simple measurements on a CMM includes:

- Calibration of the probe system.
- Define datum(s) on the work piece.
- Perform measurement(s).
- Compute the required dimensions from measurements made in Step 3.
- Assess conformance to specification.

8. Translate the words into your native language: a gauge, to assemble, readout, specimens, instant, a probe, conformance.

9. Read the article again and answer the questions:

1. What is the post-process measurement?
2. What are the advantages of gauge blocks?
3. What can be measured with a micrometer?
4. What does a CMM combine?

10. Write a summary of the article (up to 500 characters). Use your own words to express the main idea and relevant details.

Useful phrases:

- *the article is about / deals with / describes*
- *at the beginning / in the first part / in the introduction / in the main part / in the end / finally*
- *the author says / points out / describes / explains / emphasises / concludes that*
- *the article ends with*

11. Watch the video "Handheld CMM – XM Series" at KeyenceUSA on Youtube.com and tick the words that you hear:

- ☐ measuring machine
- ☐ innovation
- ☐ to bridge the gap
- ☐ built-in broad camera
- ☐ augmented reality
- ☐ on-screen guidance
- ☐ customisable
- ☐ added value
- ☐ improvements

Explain the procedure of using the handheld CMM.
What are its advantages?

Group work: Choose one of the measuring devices that is not mentioned in this chapter. Prepare a presentation. State:

- ☐ the name of the device and its manufacturer
- ☐ its features and functions
- ☐ the procedure of usage
- ☐ advantages and possible disadvantages

Focus on Phrases for Presentations

Introducing the topic
As you all know, today I am going to talk to you about…
Today I would like to outline…

Structuring the presentation
I'll start with / I'll begin with…
then I will look at …next… and finally…
I will be glad to answer any questions that you may have at the end.

Starting the presentation
To begin with … .
To start with

Changing the topic/speaker
Now I'd like to move on to … .
Next I'd like to take a look at … .

Summary
To sum up… In conclusion …

Finishing and thanking
Thank you for your attention.
I'd like to thank you (all) for your attention and interest.

Inviting questions
Does anyone have any questions?

V. Checklist

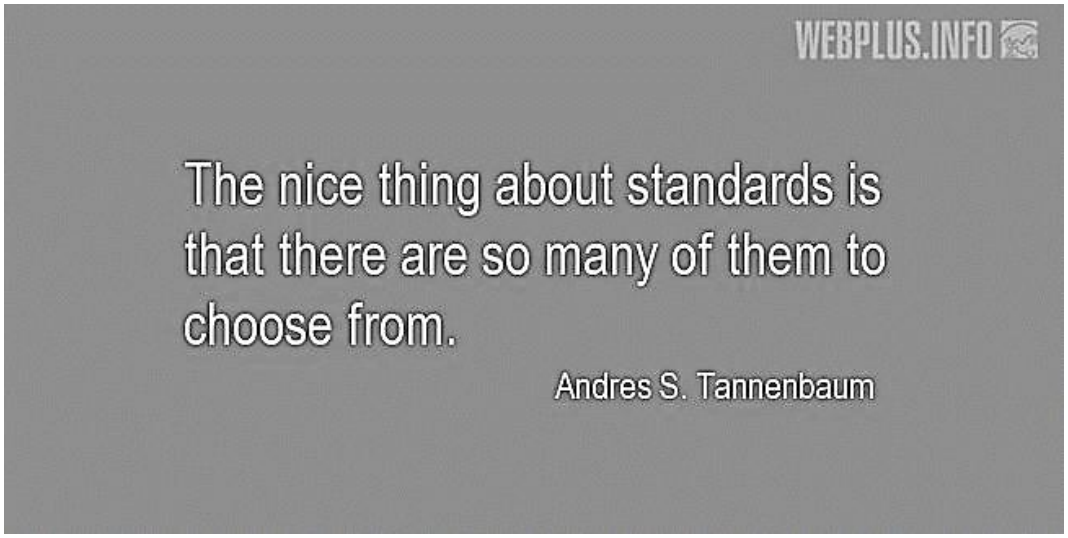
I know:

- ☐ different measuring devices
- ☐ their features and functions
- ☐ advantages of a particular device

I am able to:

- ☐ describe measuring devices
- ☐ write official letters of enquiry
- ☐ write a summary
- ☐ present a measuring device

VI. Validation and calibration



Questions for group discussion:
What are measurement standards?
What types of standards do you know?
Who carries out calibration and certification?

1. Read the article "Who's who in measurement?" [1]and check your answers to the questions.

In a small number of laboratories around the world, the base units are realised as accurately as is technically possible, which involves a great deal of expensive, complex, and delicate equipment, not to mention a number of highly trained metrologists. Which is not very convenient when it comes to actually measuring things. So, a route is needed from the realised base units (known as primary standards) to the watch on your wrist or the thermometer in your ear. This route must ensure that your watch and thermometer make their measurements with the accuracies you expect, and it must be a route that people have confidence in.
The route that bridges the gap, and gives both the confidence and convenience that people need, is called measurement traceability, and it works like this.
1. The primary standards are held at a national level, by National Measurement Institutes (NMIs).
2. The primary standards are used to check the values of reference standards held by calibration laboratories around the country.
3. These calibration laboratories then check the values of working standards which they receive from the organisations who make or use measuring instruments. These organisations might be the people who make your watch or thermometer, or they might be – for example - factories, hospitals or research laboratories.
This series of steps is sometimes known as a 'chain of traceability' for a measurement. The reference standards and working standards

may be measuring instruments – thermometers for example – or they may be physical objects, like gauge blocks (standardised metal shapes used for judging distances). In some areas, standard samples are used, such as a sample of a radioisotope with a particular activity, or a chemical solution with a specified concentration.
There is a price to be paid for the convenience that this system provides: at each stage of the chain of traceability that runs from the lasers at your NMI to the watch on your wrist, the uncertainty of measurement increases. NMIs and calibration laboratories try to minimise this increase, for example by radio-linking clocks directly to national time standards. But this cannot be done for all units and at each stage of the calibration process, a little extra uncertainty is introduced:
In some cases the pyramid is shorter than this. For example, hospitals may send their instruments directly to an NMI to be checked. This usually happens either because only the NMI can provide the accuracy that is needed, or because such a small number of instruments are used that it's not economic for anyone else to get involved.

2. Translate the key words.
What strategies did you use to translate these words? *(guessing from context, translation, dictionary look-up etc.)*

3. Work in groups. Write down the main idea of each paragraph.

4. Write one sentence stating what you learned from this text.

5. Evaluate the text from 1 (minimum) to 5 (maximum):

interesting	1	2	3	4	5
difficult	1	2	3	4	5

Grammar focus

Read the article "Who's who in measurement?" once again and find example of ***Passive Voice***.
Why is it used there?
How do we form Passive Voice?

Paraphrase the sentences using Passive Voice:
1. Laboratories involve highly trained metrologists.
2. People believe that calibration is very important for devices to function properly.
3. Scientists defined primary standards long ago.

4. The company has changed its working standards twice this year.
5. May be they will send their product directly to an NMI from next year.

Work in groups. Describe the 'chain of traceability' for a measurement of: a) a thermometer, b) a watch, c) an ammeter. Use only Passive Voice.

6. Read the article "Measurement Accreditation" [1] and fill in the missing parts (A-E).

1) ___, and they not only have to carry out their work correctly, but their clients need to be confident that they do so. In order to assure this, the laboratories have to go through a process called **accreditation**, which means that they are assessed against internationally recognised standards to demonstrate their competence, impartiality and capability. In the UK, the organisation responsible for carrying out accreditation is the United Kingdom Accreditation Service (UKAS).
2) ___, partly since it is essential to international activities like trade, manufacturing and research, and partly because not every country has its own NMI and not every NMI holds primary standards of all the base units. Also, an important aspect of checking that national standards really have the values they are supposed to is the concept of international comparison. In such a comparison, a standard artefact is sent round to the NMIs of several countries, all of whom measure it and report their results to each other. Anyone whose system isn't working properly is likely to get a result noticeably* different from the rest.
3) ___The authority which oversees all this international activity is the Bureau International des Poids et Mesures (BIPM), which keeps close contact with the world's NMIs. In some countries, just one organisation acts as the NMI (such as NIST** in the USA), but in others, including the UK, the role is split between different laboratories: The National Physical Laboratory (NPL) - maintains the majority of the UK's measurement standards; LGC - maintains chemical and biochemical standards; TUV NEL - maintains standards of flow; the National Measurement Office - maintains standards for mass, length and volume and is also responsible for legal metrology.
4) ___ For instance, legal metrology is harmonised at an international level through The International Organisation of Legal Metrology (OIML), while European NMIs work together through the European Association of National Metrology Institutes (EURAMET).
5) ___ …International Standards, and The International Organization for Standardization (ISO) is responsible for defining and revising them. It is based in Geneva, Switzerland. Among many others, ISO is responsible for ISO 17025, 'General requirements for the competence of testing and calibration laboratories' which is the Standard that specifies how UKAS (and its overseas equivalents) accredits calibration laboratories National bodies such as BSI (British Standards Institution).

Despite this international system, there are still areas where stated values are not really fit for purpose: would you be confident that a pair of shoes in your size would actually fit?

A) So, the system requires a great deal of ongoing co-operation between countries.
B) Calibration laboratories have a key function in the calibration pyramid
C) The internationally agreed recipes that describe how a laboratory should carry out accurate measurements are called
D) The calibration system is – and must be - a global one
E) NMIs also work with each other through groupings focused on particular regions or issues.

7. What is the main idea of the article?

8. Explain in your own words what is:
a) accreditation
b) international comparison
c) international standards

9. How would you answer the last question of the author? Give reasons from the point of view of a metrologist.

10. Watch the video "Temperature Measurement and Calibration – TecQuipment" available on youtube.com.

a) Tick the words and phrases that you hear.

- ☐ engineering
- ☐ applications
- ☐ advantages, disadvantages
- ☐ properties
- ☐ liquid glass thermometers
- ☐ thermowell
- ☐ emissivity
- ☐ water heater tank
- ☐ real-time data capture

b) Fill in the missing words:

a) Accurate temperature _____ is important in all areas of science…
b) TecQuipment Temperature Measurement and Calibration includes nine different temperature measurement devices, shows their _____, how to calibrate them…
c) It uses a platinum resistance thermometer as a _____ to accurately calibrate the other devices.

d) A window allows students to test the thermal infrared thermometer on a black matt or brushed steel _____ of the heater tank.
e) Students _____ crushed ice to the insulated icebox and water to the fully guarded water heater tank.
f) The sockets on the front panel _____ a resistance device and show the problems of adding resistances to your measuring circuits.

c) Write down 3 sentences summarising the main information from the video.
d) In the video, it is said that all devices have advantages and disadvantages. What could be the disadvantages of this device?

Group work: *You are working in a technical company producing devices for calibration. Choose one and prepare a presentation to your potential clients, stating the main characteristics and functions of the device.*

Writing: *Write a formal letter to TecQuipment management asking what devices they provide for the educational market of future metrologists. State your knowledge of their Temperature Measurement and Calibration device. Inform what operations you would like to perform at your laboratory classes. Ask for their recommendation on a particular device.*

VI. Checklist

I know:

- ☐ what is a measurement standard
- ☐ types of standards
- ☐ what is calibration and validation
- ☐ the process of measurement accreditation
- ☐ different devices used for calibration

I am able to:

- ☐ explain difficult terms in my own words clearly
- ☐ find key information in complex texts
- ☐ present calibration devices
- ☐ write formal letters of enquiry

VII. Careers in Metrology

Questions for group discussion:

What does this picture represent?
What are the attractive job positions in the sphere of metrology?
Where would you like to work?
What is the worst job position for metrologists, in your opinion?

1. Read the title of the text. What will it be about?

2. Look through the first two paragraphs. What is the main idea?

3. Work in groups. Read about one of the industries that employ metrologists [5].

a) define and translate the key terms
b) fill in the table:

Industry	Duties	Equipment	Other notes

c) exchange information with representatives of other subgroups to complete the table about all industries described in the text

Metrology at work [5]

What kind of career rewards precision and accuracy? One is metrology – the science of measurement. By evaluating and calibrating the technology in our everyday lives, metrologists keep our world running smoothly. Metrology is used in the design and production of almost everything we encounter daily, from the cell phones in our pockets to the walls of our homes.

Because metrology work is often interspersed with other job duties and occupational titles, the U.S. Bureau of Labor Statistics (BLS) does not collect employment or wage data specifically on metrologists. Metrology, however, is critical to the success of many different industries. Metrologists help to develop technology by designing or performing tests to determine a product's effectiveness. They also calibrate existing devices, such as fuel gauges or radio antennas, to keep them in working order. There

are many industries that employ metrologists. In the following industries, descriptions of metrology work provide a glimpse of the broad range of projects that rely on the science of measurement.

Aerospace. Complex machinery like airplanes requires metrology workers to consider both function and safety. Metrologists in aerospace supervise the manufacture of planes and are responsible for testing their components, including turbines and landing gear. Calibration technicians also regularly check the assembly process to ensure that the machinery is functioning correctly. Metrologists' contributions to the aerospace industry extend beyond structural assembly. For example, the instruments in a cockpit, such as the navigation system and altimeter, are subject to metrologists' review and calibration. Metrology also helps to ensure the safety of passengers inside the plane. Fabric in the plane's cabin is designed to be fire resistant, and metrologists set standards for measuring flammability and help test and develop new flame-retardant products.

Communications. Without metrology, dependable and secure digital networks couldn't exist. In computer network security, for example, metrologists thwart hackers by developing new programs to measure network activity and flag suspicious actions. Cell phone production also benefits from metrology work. Metrologists help test the phones' numerous components, recording under what circumstances the phones can function.

Construction. Metrology aids the construction industry in a number of ways. Metrology tools developed for building managers help them determine the cost-effectiveness of worksite decisions. By researching new methods to automate the construction process, metrologists help reduce labor costs. And the production of cheaper, more resistant building materials relies on measurement science. Metrologists also are involved in building design and may study structural durability. To help guide construction standards, metrology workers develop tests to evaluate a structure's resistance to daily stress from both people and the environment. For example, metrologists create trials to measure a home's resistance to earthquakes and fires.

Energy. All energy companies rely on the work of metrologists. Every building has a meter that displays its energy consumption, and calibration technicians ensure that these meters provide accurate readings. Consumption measurements are the underpinning of the energy industry; without them, energy companies wouldn't be able to charge customers by use. In a power plant, calibration technicians are also needed to continually verify its many gauges and measurements. The potential consequences of a power plant failure range from loss of electricity to nuclear meltdown. Metrologists are also involved in "green" energy. They help develop wind turbines and solar panels by testing energy output and construction methods. And metrology is critical for measuring the power consumption of new energy-efficient household appliances.

Healthcare. For many patients, the proper functioning of medical devices is a matter of life and death. And metrologists are required to calibrate and certify medical

devices, such as external pacemakers and fetal monitors. By fine tuning machinery, metrology workers ensure the accuracy of medical tests to allow for the best possible diagnoses.

4. Using information from your tables, write a summary of the text. *State in what industries metrologists can work and what duties they may perform. Explain why it is important.*

5. Formulate the main message of the text.

6. Work in groups. Choose one of the industries that employ metrologists (it may not be described in the text) and prepare a presentation. Include:

a) name of the companies that represent the industry
b) job positions for metrologists that they have
c) required skills and knowledge
d) job duties
e) salary
f) any other information that you find important or interesting

Task for listening the presentations:
a) before listening write several question to the topic announced, check if the presentation has the answers, otherwise ask for more information
c) comment on the content of the presentation or its form
d) after all presentations choose the industry you would like to work in. Explain why.

7. What is the procedure of job application? Make a list of documents needed. Which of them have you ever written?

8. a) Brainstorm: what is a good CV?

b) Read the article "How to write a successful CV" by Kevin Peachey, finance reporter, BBC News [7]. Check if you were right.

If sending a CV as a hard copy, along with a job application, then it needs to be neat and typed if possible. Most libraries have public computers which can be used by those who do not have their own.

Increasingly, applicants are asked to send a digital copy of a CV. If this is the case then the first set of "eyes" to see it might be an automated search for key words, so experts suggest applicants ensure mandatory requirements in the job advert are included in a CV.

Corinne Mills, managing director of Personal Career Management, which provides career coaching, says that digital CVs should be in a simple format and font so readability is not affected on different screens.

Other tips from Mrs Mills, the CIPD, and the National Careers Service include:

- Tailor a CV to a specific job - it is vital to ensure the script is relevant to each job application, rather than sending the same generic CV
- Keep it simple - it should be easy to read and use active language. Two pages of A4 is enough with a mini profile included in the first half page
- Include key information - personal details, including name, address, phone number, email address and any professional social media presence should be clear. A date of birth is no longer needed, owing to age discrimination rules. A photo is only essential for jobs such as acting and modelling, otherwise it is a matter of choice
- Showcase achievements - offer evidence of how targets were exceeded and ideas created, but always be honest
- Check and double check - avoid sloppy errors, take a fresh look the next day and ask for a second opinion from a trusted friend or colleague

c) Summarise in a few sentences: What is a good CV?

9. a) Google for available Metrology vacancies. Find the one that interests you. Analyse the requirements towards a candidate.

b) Visit the website https://europass.cedefop.europa.eu and create your CV to apply for the job.

c) In pairs exchange your CVs. Evaluate:

- size
- readability
- job requirements included
- information given
- personal achievements
- errors

d) Give your feedback from the point of view of a potential employer.

10. a) What is the aim of a <u>cover letter</u>?

b) Read the sample cover letter and fill in the missing phrases (A-G). There are more phrases than necessary.

A) Through my education *D) Besides* *G) Yours sincerely*
B) However *E) As a response to your advertisement*
C) I am also familiar with *F) Please find attached*

To
Mr. Ray Delorenzo
Human Resource manager
National Oceanic and Atmospheric Administration
118 South Greenwood Street
Olathe, KS 66062

Sub: Job application for the position of Research Executive

Dear Mr. Delorenzo,

1. ___ for a job vacancy that was published in US mail dated November 28th; I hereby put forth my application for the position of a Research Executive within your organization. I have graduated from the Hydro meteorological Institute for Training and Research in September 2013 and I am looking forward to explore my technical and researching skills and implement them so as to assist your research and development team in carrying out their functions effectively.

2. ___, I acquired adequate knowledge in climatology, physical meteorology, applied meteorology, hydro meteorology and maritime meteorology. I am well prepared with a clear understanding of the fundamental laws of thermodynamics, fluid dynamics and motion, the hydrological cycle and atmospheric boundary layer. 3. ___ orbital instrumentation such as ASTER, Aura, DMC, EROS, Envisat, GOMOS and AVHRR and other observation systems like Meteorological Aerodrome Report, Argo, Weather balloon, Global Sea Level Observing System and Automated Surface Observing System.

4. ___, I have developed essential researching skills which I am relying upon to help me progress in the field of meteorology. Upon joining your team, I promise to utilize the best of my abilities to help increase the efficiency of the team as well as its performance thereby contributing to your organization's growth and development.

5. ___ my resume where you will find my academic history mentioned in detail along with my contact information. Kindly consider my application favorably and give me an opportunity to serve your organization. You may contact me anytime during the week if you wish to discuss my application in detail.

Thanking you.

6. ___,

Thomas Littlefield

Enclosure: CV

c) Divide the cover letter into sections. What is the purpose of each section?

d) Continue working on your job application. Write a cover letter to supplement your CV.

e) Check if your cover letter:

- has clear structure
- introduces you
- clearly indicates your interest and seasons
- matches your skills and experiences with the skills and experiences required by the job
- encourage the reader to read your CV

- finishes with a call to action
- has no errors

11. a) Imagine that the employer looked through your CV and cover letter and decided to invite you to the interview. What are your next steps? How will you prepare?

b) Read the Job Interview Tips and evaluate each of them as true (T) or false (F). Give reasons.

1. Conduct research on the employer, hiring manager, and job opportunity.
2. Review Common Interview Questions and prepare your responses.
3. Always wear your best suit.
4. Arrive on time, relaxed and prepared for the interview.
5. Make good first impressions.
6. Create the image of a good worker.
7. Remember to limit your body language to the minimum.
8. Ask insightful questions about the company.
9. As the interview winds down, ask about the next steps in the process.
10. Thank interviewer(s) in person, by email, or postal mail.

c) What questions do you expect to hear at the interview?

Look through the "Most Common Interview Questions" [3]. Which ones are surprising? What is their aim?

1. "Tell me a little about yourself."
2. "What are your biggest weaknesses?"
3. "What are your biggest strengths?"
4. "Where do you see yourself in five years?"
5. "Out of all the other candidates, why should we hire you?"
6. "How did you learn about the opening?"
7. "Why do you want this job?"
8. "What do you consider to be your biggest professional achievement?"
9. "Tell me about the last time a co-worker or customer got angry with you. What happened?"
10. "Describe your dream job."
11. "Why do you want to leave your current job?"
12. "What kind of work environment do you like best?"
13. "Tell me about the toughest decision you had to make in the last six months."
14. "What is your leadership style?"
15. "Tell me about a time you disagreed with a decision. What did you do?"
16. "Tell me how you think other people would describe you."
17. "What can we expect from you in your first three months?"
18. "What do you like to do outside of work?"
19. "What was your salary in your last job?"

20. "A snail is at the bottom of a 30-foot well. Each day he climbs up three feet, but at night he slips back two feet. How many days will it take him to climb out of the well?"
21. "What questions do you have for me?"

d) Watch the video "Interchange Video Book 2 – Unit 10 – The Job Interview". Write down the strengths and weaknesses of the the 1st and the 2nd candidate.

Which of them would you hire? Why?

e) You are preparing for an interview. Complete the table:

Strengths	*Weaknesses*
Opportunities	*Threats*

f) Make up dialogues "At the Interview". Here are several useful phrases you may use for answers:

Phrases for Describing Yourself

- I was born and raised in …

- I attended the University of …
- I've just graduated from the University of …
- I have worked for 5 years as a …

What Type of Position You are Looking for?

- I'm looking for a position in which I can …
- I'm interested in an …
- I am more interested in a full-time position.
- I am more interested in a part-time position.

Describing Your Profile

- I developed some important skills.
- I'm used to ...
- I'm a very organized person.
- I manage my time well by planning out …
- I work well under pressure.

Talking about Your Strengths

- I've always been a great team player.
- I believe my strongest trait is ...
- I realized my strength is ...
- I pay close attention to ...
- I am a trouble shooter.
- I'm good at ...
- I have very good organizational and time management skills.

Expressions for Talking about Your Weaknesses

- I feel my English ability is my weakest trait.
- I always try to solve my own problems instead of asking a co-worker who might know the answer.
- I become nervous when ….
- I tend to spend too much time doing smth
- Sometimes I have trouble delegating duties to others.

Explaining Why You Want this Job

- I want to take on more responsibility.
- In line with my qualifications.
- I want to further my career in ...
- I am impressed by the quality of your products.

Explaining Why the Company Should Hire You

- You should hire me because I'm confident and …
- There are two reasons I should be hired. First, …
- I'm a perfect fit for this job because …
- I should be hired because I'm …
- I think I am a great match for this position.

VII. Checklist

I know:

- ☐ industries where metrologists work
- ☐ duties that they may perform
- ☐ necessary skills and knowledge
- ☐ equipment that metrologists work with
- ☐ requirements towards writing CVs, cover letters

I am able to:

- ☐ talk about my work of a metrologist in a specific industry
- ☐ write my CV and a cover letter to apply for a job
- ☐ answer common job interview questions

Використані джерела

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