SPECIALISED COMMUNICATION AND TERMINOLOGICAL LITERACY

(IN FOREIGN LANGUAGE EDUCATION)

Ingrid Cíbiková et al.

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Authors:
PhDr. Ingrid Cíbiková, PhD.
PhDr. Božena Petrášová, PhD.
Mgr. Soňa Pavlíková

Reviewers:
prof. PhDr. Erich Petlák, CSc.
(Univerzita Konštantína Filozofa, Nitra)
prof. RNDr. Anna Tirpáková, CSc.
(Univerzita Konštantína Filozofa, Nitra, Katedra matematiky FPVal)

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prof. PhDr. Jiří Fiala, CSc. (Univerzita Palackého, Olomouc); prof. PaedDr. Zdenka Gadušová, CSc. (Univerzita Konštantína Filozofa, Nitra); prof. PaedDr. Alena Hašková, CSc. (Univerzita Konštantína Filozofa, Nitra); prof. WSH dr hab. Michał Kaczmarczyk (Wyższa Szkoła Humanitas, Sosnowiec); prof. PhDr. Eva Malá, CSc. (Ostravská univerzita, Ostrava); prof. PhDr. Libor Pavera, CSc. (Vysoká škola ekonomická v Praze); prof. PhDr. Dušan Pavlů (Univerzita sv. Cyrila a Metoda v Trnave); prof. PhDr. Ivo Pospíšil, DrSc. (Masarykova univerzita, Brno); prof. dr hab. Dariusz Rott (Uniwersytet Śląski w Katowicach); prof. PhDr. Miloš Zelenka, DrSc. (Jihočeská univerzita v Českých Budějovicích); prof. UEK dr hab. Zbigniew Widera (Uniwersytet Ekonomiczny w Katowicach).

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The textbook is manual of instruction in foreign language education for educators, students, and specialists as a key output of KEGA project No: 006UCM-4/2021-2023 and is closely related to the second output ENGLISH SLOVAK – SLOVAK ENGLISH STEM DICTIONARY/VOCABULARY produced according to the demands of educational institutions and curricular reform.

The authors

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Ingrid Cíbiková

PREFACE

The textbook SPECIALISED COMMUNICATION AND TERMINOLOGICAL LITERACY (IN FOREIGN LANGUAGE EDUCATION) is manual of instruction in the field of education, specialised communication, terminology, predominantly in universities and upper secondary vocational education. The textbook is an output of KEGA project No: 006UCM-4/2021-2023 and is closely related to the second output ENGLISH SLOVAK – SLOVAK ENGLISH STEM DICTIONARY/VOCABULARY produced according to the demands of educational institutions and curriculum reform. The procedural step by step educational and terminology procedures of this publication is the key methodology for science educators in foreign language education. The bilingual English Slovak STEM dictionary/vocabulary is intended to serve as an introductory terminology for educators, Slovak/Czech students, and specialists, it is a practical terminographical product focused on the teacher training, specialists training and students' terminology learning, and on the translation of specialised texts.

The objective of the project is the extension of a real offer of existing teaching materials for teaching/learning specialised language and basic terminology of sciences at universities and Secondary Vocational schools by up to the present absence of bilingual comparative (Slovak English) aspect. The next objective is to detect the needs of students and teachers for complementing the bilingual material for teaching specialised language and communication in foreign language education. The key publication of the project is a supplementary teaching and terminology manual (theoretical, terminological, and didactical) for universities and secondary vocational schools focused on the Slovak-English specialised communication. The second practical terminographical outcome of the project is the bilingual Slovak English/English Slovak STEM specialised dictionary. The entries are ordered alphabetically. It is an open vocabulary, terminology dictionary and that is why the educators and students can add any term from STEM subject fields: science, technology, engineering, biochemistry, biotechnology etc. continually. Each entry contains an equivalent, a definition, context, and sources and the terms are exclusively excerpted from specialised texts, textbooks, and scientific papers during the comparative terminology work.

The textbook can be widely used, it can be used in primary education, bilingual secondary education, university education, and lifelong education. The instructional textbook, manual can also be used by primary school teachers and pupils, especially those applying CLIL methodology. The pilot schools in KEGA project

are the primary school Cerová, (pilot teacher is Mgr. Soňa Pavlíková), secondary upper vocational chemical school in Bratislava and secondary vocational school of agriculture and rural services in Trnava.

The abbreviations STEM and CLIL support the main objective of the project and curricular reform in the Slovak republic.

STEM in general relates to education concept, to curricular reform, it is an approach to learning, and from our point of view it is the educational development that integrates the special subject fields and foreign language education.

By the end of both related publications and presented terminology usage in learning and teaching, educators and students should be able to recognise and use domain terminology, manage the linguistic and terminology information, verify the knowledge and information, excerpt the equivalents from parallel texts, manage the pre-translation process and translation process, and use accurate terminology equivalents in specialised communication and specialised translation. And finally, students should be able to transfer the knowledge or information to the specialised communication and professional life.

The authors answer the questions of what makes science the science, what are the problems of teaching terminology and science and what is the availability of special English/Slovak dictionaries on the Slovak market. Unfortunately, teaching terminology in universities and secondary vocational schools is missing, and what is more, there is the absence of bilingual conceptual oriented terminology products (glossaries, dictionaries, taxonomies, ontologies, nomenclatures) with definitions and context in the Slovak republic and the educators and students do not use dictionaries in educational process. The instructional textbook deals with the special language and specialised communication, focuses on the importance of terminology and terminology work. The authors define STEM concept, CLIL method, scientific and terminological literacy and point out the breaking of rules in the case of terminology culture by individuals or community of specialists.

There is a strong lack of systematic care and intervention for national terminology in Slovakia. The survey revealed huge amount of unprofessionally formed new terms and massive borrowing from English. The huge risk is the subsequent use of inconsistent terminology in practice which is very difficult to eradicate and reflect the level of terminology culture. Every national terminology is a bearer of cultural, linguistic, and conceptual values and during the translation and looking for an adequate equivalent across languages there is the contact mixing.

It is also necessary to keep in mind the different term formation across languages, diversity of conceptual systems, their relationships, variability of terms, consistency of terminology, historical traditions, preference for native language, the importance of teamwork of terminologists and specialists and ability of compromise.
The urgent need to tackle issues of terminology and a lack of interest on terminology in public and government in building knowledge society in Slovakia is recognized, that is why the authors of the textbook call for urgent government assistance like that of Francophone countries.

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Introduction

The current development of specialized language, communication and terminology is the result of everyday progress in science and technology, and an increasing need for specialized communication in foreign languages. Unfortunately, the specialized language is relegated to the margins of interest. Reflecting the needs of labour market, theory and practice testify the fact that specialized communication, documentation of knowledge and the use of relevant terminology as well as the appropriate quality of foreign language education supported by well-prepared specialized dictionaries currently require increased attention in the Slovak society. Our pedagogical and professional observations and experience, as well as research activities in the field of specialized communication and language users' reality, convince us of the fact how urgently contemporary society needs to reevaluate and increase terminological literacy and culture.

The ambition of KEGA outputs is the implementation and fusion of teaching specialised language, communication, and terminology of sciences and foreign language education in all degrees of education, primary, Vocational school education, and universities within the foreign language education. After finishing education, it is necessary to master the relevant specialized language and terminology which correspond to the same demands of foreign companies in Slovakia.

Many educators think that the student learns terminology automatically in university, vocational and dual education. It is not true. And what is more, the special knowledge and terminology are not reflected in the textbooks used at secondary foreign language education. Foreign language teaching at universities and vocational schools should be also focused on acquisition of relevant terminology. However, the educators and students do not have enough teaching materials to rely on. At Slovak schools, only textbooks aimed at learning general English, are used. The most frequently used English language textbooks come from foreign publishers (Oxford university Press, Cambridge), and their strength is the monolingual aspect of the English language system. It is the urgent time to start interdisciplinary and comparative education.

The educators should understand the difference between the norms of the mother tongue and the English language, the terminology equivalents. Educators urgently should practice the phenomena breaking the Slovak language codified rules, and keep the recommendation of terminology standards, namely the preference for native language. "Even though borrowing from other language is an accepted form of term creation, native language expressions should be given preference over direct

loans" (ISO 7O4, 2009). The educators must contribute to the development of national vocabulary/terminology and stop developing the creativity of students in foreign language. For example, cooltainer in Slovak environment. The terminology is exact science and document the knowledge. That is why the submitted teaching and learning material reflect the comparison of linguistic, conceptual, and cultural similarities, term formation methods and chemical nomenclatures.

From the point of view of education, teaching and learning, the specialized language and specialized communication has its roots firstly in family, secondly in the primary education (which is about the basics of knowledge and science), thirdly continues in the secondary education (which is about responsibility in general), and in the secondary vocational schools (which is about workmanship, expertise). Then the education and teaching and learning process continue in higher education at colleges or universities (which is about the specialization). And finally, learning the specialization continues in lifelong education courses. And what is more, to meet the labour market and foreign company demands is seen as the best strategy to combine foreign language education with the special language synergistically.

The procedural step by step educational procedures of this publication as the instructional textbook or manual is the key methodology for science teachers in foreign language education.

Step 1: To understand the concept of the terms: specialised language, specialised communication, and specialised translation.

1 STEP 1: SPECIALISED COMMUNICATION

In principle, ***subject-specific communication*** among specialists is not very different from general communication. The restrictions imposed on the elements involved in special communication that give it a specificity not found in general communication are of a different sort. Specialized communication differs from general communication in two ways: in the type of oral or written texts it produces, and in the use of a specific terminology (Cabré, 1999).

According to Sager "***special communication****, i.e., purposeful communication between experts on the topic of their discipline, and in particular the way in which the lexicon contributes to the achievement of effective communication*" (Sager, 1990). In special communication terms are considered substitute labels for definitions because only a full and precise definition is the proper linguistic representation of a concept (Sager, 1990).

1.1 Specialised language

According to ISO standard 10241 ***special language/ specialised language*** or ***language for specific purposes (LSP)*** is a language used in a domain or subject and characterized using specific linguistic means of expression, **LSP**: with the note **DEPRECATED** (ISO 10241-2:2012, 2.9).

Later according to ISO standard 1087 is ***special language/ specialised language*** a natural language used in communication between experts in a domain and characterized by the use of specific linguistic means of expression. The specific linguistic means of expression always include domain-specific terminology and phraseology and can cover stylistic or syntactic features (ISO 1087-1). Similar definitions are given by Canadian terminologists Pavel & Nolet, Sager, and Nedobity.

Specialized language/also special language is "a natural language used by a community of subject specialists in a particular field of knowledge" (Pavel, Nolet, 2001).

Special languages have been defined as "semi-autonomous, complex semiotic systems based on and derived from general language; their effective use is restricted to people who have received a special education and who use these languages for communication with their professional peers and associates in the same or related fields of knowledge" (Sager, 1990).

Nedobity from the Vienna university claims that specialised languages are "the tools for specialised communication by which modern society conveys its achievements and experience from generation to generation. These languages are characterized by using clearly defined concepts, to which preferably ambiguous terms are assigned" (Nedobity, 1983).
As Cabré states, *"Specialists use terms to express themselves and exchange thoughts and organize the structure of their disciplines*" (Cabré, 1999).

1.2 Specialised translation

According Cíbiková **Specialised translation** is a type of translation and designation used in language industry, translation and localisation industry, translation service, translation departments, translation journals (JoSTrans-The Journal of Specialised Translation: specialising in non-literary translation issues) and translation schools. Translation studies/Translatology/Traductology has an interdisciplinary character, that is why the classification of the types of translation is not accurate and is borrowed from other fields.
Specialised translation or non-literary translation are frequently discussed concepts and designations by scholars, translators, terminologists, and freelancers.
Translation intermediaries discuss the types of translation. There are some attempts to classify the types of translation according to different criteria (*medium*: translation and interpreting), (*situation*: audiovisual translation, court interpreting, official translation, etc.), (*specialisation/subject fields, domains, terminology studies/knowledge documentation*: economic, legal, scientific, commercial, technical, medical, etc.), (*text types*: translation of literary texts and translation of non-literary texts), according *translation services*: (*literary*: stories, poems, plays etc.., *professional*: medical translation, legal translation, *technical*: engineering documents, instruction manual, user guide, technical training, *administrative*: translation of documents and management texts of organisations, other types: website translation, script translation), level of specialisation, receivers, translation methods, procedures, strategies, solutions, etc. From the linguistic point of view Jakobson speaks about the following types of translation (interlingual, intralingual and intersemiotic) and other criteria can be added: style, genre, signs (Jakobson. In: Munday 2005, Asensio, 2007, see also htpp:// espressotranslations.com, Key translation industry trends 2021).
Specialised translation terminology is still not internationally harmonized, that is why the term ***non-literary translation*** is usually used as a terminology quasi synonym. But from the terminological point of view, it is the problem of generic and

specific concepts. The strong argument that has been derived from logical relationship between concepts in conceptual system of Translation studies. In general, there are two categories of texts to be translated: literary and non-literary texts. Then non-literary translation is broader generic term and specialised translation is specific term. Logically, specialised translation would be designated for highly specialised scientific and technical texts. But the current problem is that in many countries, every present-day translation is **specialised translation,** and it is considered the tautology for non-literary translation (In: Cíbiková, 2022, pp.14-16).

Because of the exploration of scientific, technical, and otherwise specialised texts used for translation the designation ***Specialised translation*** is frequently used by many authors. Despite the typology problems ***Specialised text and specialised translation*** are the designations defined by different scholars.

Specialized translation covers the specialist subject fields falling under non-literary translation, the best known of which include science and technology, economics, marketing, law, politics, medicine, and mass media, most of which are dealt with in this volume, as well as lesser researched areas such as maritime navigation, archeology, geography and nutrigenomics (Lang, 2006, p. 9, IN: Gotti).

Specialised translation relates to every translation that has to do with a specific area of knowledge, for example, marketing or law. A specialised translator has mastered the precise terminology, text typologies and linguistic conventions of their respective field(s) "(Nikolell, 2017, In: Amarasinghe, 2020, pdf., In: Cíbiková, 2022, pp.14-16).

Step 2: To understand the concepts terminology, concept, conceptual system, term, term formation principles, term formation methods.

2 STEP 2: TERMINOLOGY

The special knowledge and terminology are not reflected in the textbooks used at foreign language education. Foreign language teaching in universities and in upper vocational schools should be also focused on acquisition of relevant terminology.
Terminology is a linguistic and interdisciplinary subject field that deals with the designating the concepts and the documentation of knowledge. Terminology documents the knowledge, and the knowledge is the basics of education. Terminology has a cognitive, communicative, and sociocultural function (Cíbiková, 2016, 2022), Available on: http://terminologickeforum.sk/).
Pavel and Nolet define terminology in two ways, terminology can be understood either as a collection of special words belonging to a certain subject field, art, author, or social entity, or as a linguistic discipline concerned with the scientific study of the concepts and terms used in specialised languages (Pavel, Nolet, 2001).

2.1 The importance and function of terminology

If terminology for non-professionals is an option, for specialists is a necessity (Fathi, 2017).
The specialists in terminology Silvia Pavel and Diane Nolet claim that "the main function of terminology is the transfer of specialized knowledge and the authentication of related terminological usage "(Pavel and Nolet, 2001, p.8).
Sageder states, that some experts "see terminology as a separate scientific discipline. They focus on developing a theoretical framework for Terminology ... Terminology as such is then used by linguists, scientists from cognitive sciences, and sociolinguists. The output of their effort is represented by a consolidated theory of Terminology" while the others "see terminology as a practice and an art ... Here, terminology represents a tool for communication; terminology is a target. The output of their effort culminates in the issuing of standardized dictionaries for specialized fields, or dictionaries for specialized areas" (Sageder, 2010. p.127-128).
Anja Drame claims that terminology uses knowledge of many other scientific disciplines and plays a key role whenever specialised knowledge is:
1. created (research, development).
2. used (specialized texts).
3. recorded (databases, dictionaries).

4. mediated (education, training).
5. implemented (technology and knowledge transfer);
translated and interpreted (Drame, 2006, In: Pavel, Nolet, 2001).

No society, no government, no company, no professional can avoid terminology, because the terminology is everywhere. There is no knowledge, no special communication, no specialised translation without terminology (In: Cíbiková, 2022).

Standardised terminologies shall reflect a coherent terminological system that corresponds to the concept system of the subject field. The terminology shall be precise and lead to increased clarity in communication. One **primary function of standardized terminology** shall be to indicate preferred, admitted, and deprecated terms. A term recommended by a technical committee shall be considered a **preferred term** whereas **admitted term** shall represent an acceptable synonym for a preferred term. **Deprecated terms** are terms that have been rejected (ISO, 2009, pp. 35-36). In the project terminology research, it is degree of equivalence abbreviated DEG/EQU.

According Cabré, terminology is a necessity for all professionals involved in the representation, expression, communication, and teaching of specialized knowledge. In order to inform, transfer, buy, and sell their products, scientists, technicians, and experts in any sector need terminology to represent and communicate their knowledge. Cabré also mentions that terminology is needed by professionals in documentation and information science, as well as linguists working in language engineering and thematically specialized expertise (Cabré 2002).

In Conference of Translation Services of European States (COTSOES) have been stated that the growing importance of terminology is recognised even greater with the growing demands of our multilingual society and external communication. Most documents today are designed for specialized communication, including business, law, pharmacy, and commercial texts. These texts are written in special language and most of the text is composed of terminology of a particular domain (COTSOES, 2003).

According to Fathi, the use of terminology starts from very simple occasions in our ordinary life and develops to the higher communicative levels. Terminology plays an important role in the understanding of contexts and specialized texts. Fathi mentions that specialized language has the same function as general language – to communicate, but on a different level. Learning a vocabulary of a domain would give us the opportunity to comprehend specific topics and communicate about them (Fathi, 2017, In: Cíbiková, 2022).

2.2 Terminology and nomenclature

Kudashev delineating the difference between the nomenclature and terminology; while terminology (as vocabulary) is a system of designations denoting groups of concepts, nomenclature is a set of designations denoting a group of objects (Kudashev, 2013, p.52). Andrews et al., in the same way as Kudashev, outline the difference between the terminology (in the meaning of vocabulary) and the nomenclature, which may seem almost identical at the first sight. They claim that "The system of choosing or revising names of terms is nomenclature. Nomenclature is the naming of terms (from the Latin nomen [name] + calator [caller]). Although sometimes used as a synonym for terminology, we understand nomenclature to be the system for devising or choosing names, which are the body of named terms that belong to a specific terminology" (Andrews et.al., 2016. p. 8).

Similarly, Horecký also sees the difference between terminology and nomenclature. Horecký defines terminology as a collection of specialised terms used in the scientific disciplines. Consequently, in terminology understood in this way, a nomenclature as an individual group of terms naming certain things or concepts classified according to the field system is identified. Horecký states an example for botany – botany terminology is a collection of morphological, physiological and botanical terms, while botany nomenclature includes names of individual plants (Horecký, 1956).

The terminology is not limited to designating/naming the concepts, but also to the documentation of knowledge and conceptual systems. Terminology deals with the classification system as a structured scheme for classifying knowledge, beings, and things, to improve study and research, which is created according to alphabetical, associative, hierarchical, numerical, ideological, chronological, spatial, and other criteria. The ignorance of conceptual system as a set of concepts divided according to the logical relationships between them may be a serious problem.

2.3 Designation. Concept.

Many specialists, politicians and journalists have **a** real problem to designate, recognise and use the designations *concept* and *term*.

A designation is a representation of a concept by linguistic or non-linguistic means. Designations are categorized as:

- terms designating general concepts,
- appelations designating individual concepts
- symbols designating either individual or general concepts (note: not all symbols are designations),

Since appelations constitute unique names designated to individual concepts relating to specific subject fields, places, organizations, titles, or products, their forms will have been generated and/or elaborated by the relevant bodies. For example: Ministry of Agriculture: specific political institutions or units, United Nations: specific organizations, Nike: specific brand names, specific awards). Symbols are an important aid to international communication because their visual representation of concepts functions independently of any given language. They can communicate information directly under difficult circumstances (e.g., traffic signs, Symbols used to designate sports activities at the Olympics, the Mobius Loop used in the field of environment to designate recyclability). Characters that replace words or parts of words, such as mathematical symbols or currency symbols, are considered symbols. Example: §, £, >, =, ≠, %. It should be noted that the designations of SI units are considered symbols rather than abbreviations since they do not vary from language to language, have no plural and are never written with periods (full stops). Example: m- metre, l-litre. Alphanumeric codes made up of combinations of letters, numbers or both are considered symbols, if they do not represent words in a natural language or abbreviated forms. Example: C2 H5 OH (chemical compound ethyl alcohol), A4 (paper format), (ISO, 2009, pp. 34-37, ISO, 1999, pp. 22-26).
The sign denoting **a** concept, such as a term, phrase, abbreviation, formula or symbol. Example: water = H2O. Also designator. (Available on: The acts as a synthesis of the definition. Government of Canada`s terminology and linguistic data bank). In mathematical sciences, in arithmetic, the following types of designations are used, i.e. by a term and predominantly by a symbol/formula. Mathematical science is precise and systemic. That is the reason why designation by the symbol is largely used in practice. An additional asset is that this type of designation is understandable across almost all languages and has an international character. Moreover, the symbol saves time and is more economical.
Specialized concept is a concept which reflects specific or technical knowledge within **a** given subject field (ISO, 2009, p.1).
A concept is a mental representation of a certain object in a given specialised context/field, expressed by linguistic forms (a designation, a definition, a term, an appellation), by symbols, codes, formulae or even icons, diagrams, pictures etc.
Concepts can be either *general* (depicting a set of two or more objects forming a group) or *individual* (depicting a single object). "The coming together of a unique set of characteristics to make a concept is an everyday occurrence. The concept made up of this set of characteristics is represented by a designation (i.e. a term, appellation or symbol). Since a designation is not attributed to an object but to a

concept, the latter depicting one or more objects, terminological analysis is based upon a representation of the concept in the form of a designation or a definition" . The concepts contextualized in the special language of the subject field can be expressed in the various forms of human communication according to the system used. The combination of unique sets of characteristics is represented in special language by a designation (i.e., a term, appellation or symbol). (ISO 704:2009, p.4). **Concept** is a unit of knowledge abstracted from a set of characteristics or properties attributed to a class of objects, relations, or entities. (The Government of Canada`s terminology and linguistic data bank: Available on: www.termium.com/didacticiel/tutorial/glossa/terminology-eng.html>[online] [cit.6.11.2011]

2.4 Conceptual system

Concept/Conceptual system is a set of concepts structured according to the logical relationships among them. (The Government of Canada`s terminology and linguistic data bank: Available on: www.termium.com/didacticiel/tutorial/glossa/terminology-eng.html>[online].

ISO standard, defines ***a conceptual system*** as "a set of concepts structured according to the relations among them is said to form a concept system. Concept systems are represented graphically by concept diagrams. The basic relations among concepts, which has to be considered when modelling a concept system are: hierarchical relations: generic relations and partitive relations; associative relations" (ISO 704:2009. p. 8).

1. Hierarchical relations – concepts are organised into levels of subordinate and superordinate concepts (or, if being on the same level, the concepts are coordinate)
   - generic relation – occurs when the intension (a unique group of characteristics) of the specific (subordinate) concept includes the intension of generic (superordinate) concept plus additional delimiting characteristic. In other words, the generic concept can be called a parent; the specific concept a child and concepts, which are coordinate, are siblings. Generic relations can be represented by the tree diagram or the intended list of concepts.
2. Partitive relation – when a superordinate concept represents a whole and the subordinate concepts stand for the parts of the whole. Partitive relations can be represented by rake diagrams and intended lists.
3. Associative relations – are non-hierarchical and occur when a thematic connection can be found among the concepts based on experience (ISO 704:2009).

The role of the concept system is to clarify concept relations in a given subject field and to describe the way of knowledge organisation (Cabré, 1999).

The conceptual system facilitates the comparative analysis of concepts and designations across languages, helps students to understand the similarities and differences, helps specialists in writing the definitions, and translators in specialised translation.

Different subject fields view the same bodies of knowledge in different ways, for example the Physics and Chemistry terms: atom, atomic mass, boiling point, electron, enzyme, melting, radioactivity in our terminology research have different definitions, contexts and subject field. The same objects may be combined to form different units of knowledge with different intentions and extentions. Thus resulting in different concept systems and distinct designations.

The types of concept system:

– generic concept system, a system in which all the concepts in a vertical series relate to each other as generic and specific concepts,
– partitive concept system, a system in which all the concepts in a vertical series relate to each other as a whole and its parts,
– associative concept system, a system in which all the concepts relate to each other by association. The type of associative relation between any two concepts may vary within a system.

The formal and graphical representation of concept system:

The more complex a concept system, the more useful it is to clarify relations among concepts by representing them formally or graphically. Concept relations can be represented formally in a list. The formal representation used in International Standard is a numbered and indented list as exemplified by the following:

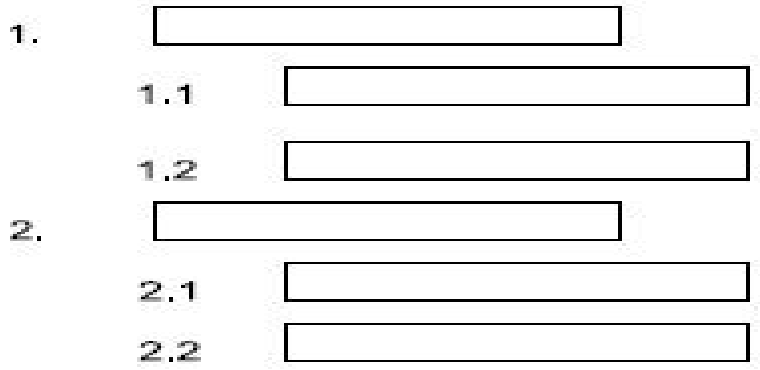


Diagram 1: Formal representation of concept system, Source: ISO 2009
Tree diagram to represent generic concept relations.

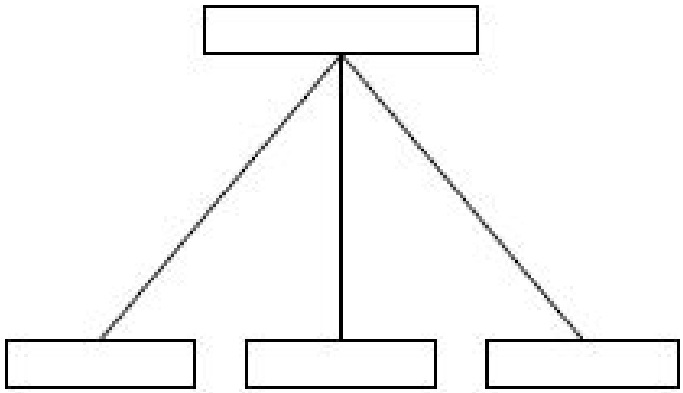


Diagram 2: Graphical representation of concept system: Tree diagram. Source: ISO 704,2000.
Rake or bracket diagram to represent partitive concept relations.

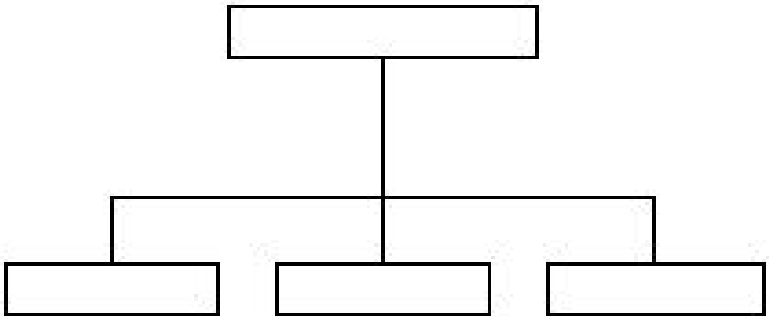


Diagram 3: Graphical representation of concept system: Rake diagram. Source: ISO 704, 2000
Line with arrowheads at each end to represent associative concept relations.

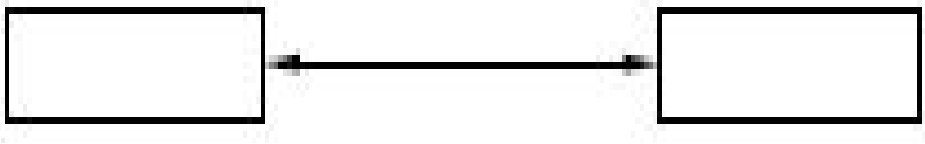
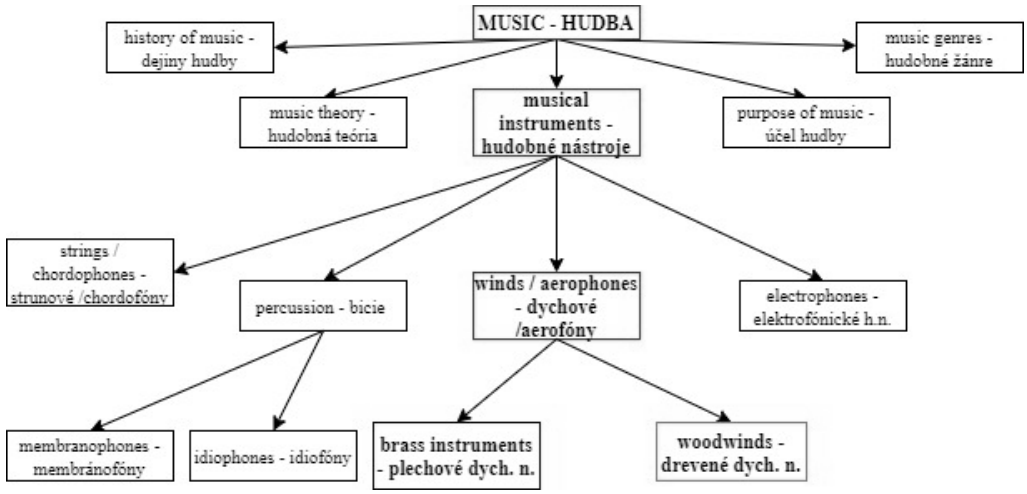


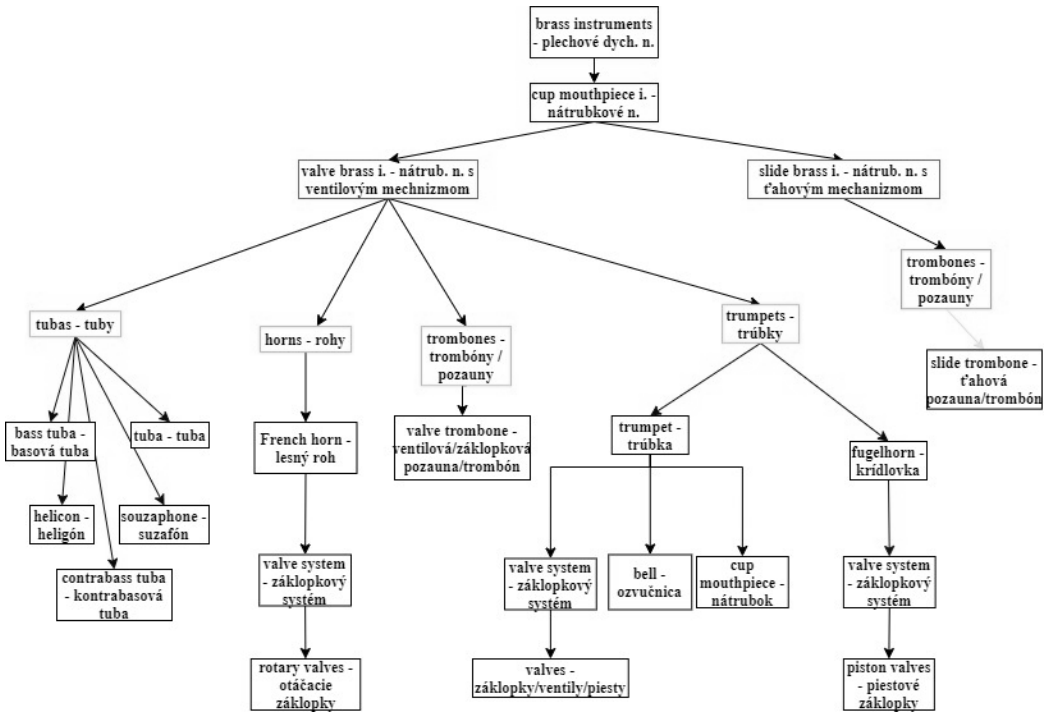
Diagram 4: Graphical representation of concept system: Associative relations Source: ISO 704, 2000, p.2-14.

A conceptual system serves to:
- model concept structures based on specialized knowledge of field,
- clarify the relations between concepts,
- form the basis for a uniform and standardized terminology,
- facilitate the comparative analysis of concepts and designations across languages,
- facilitate the writing of definitions.

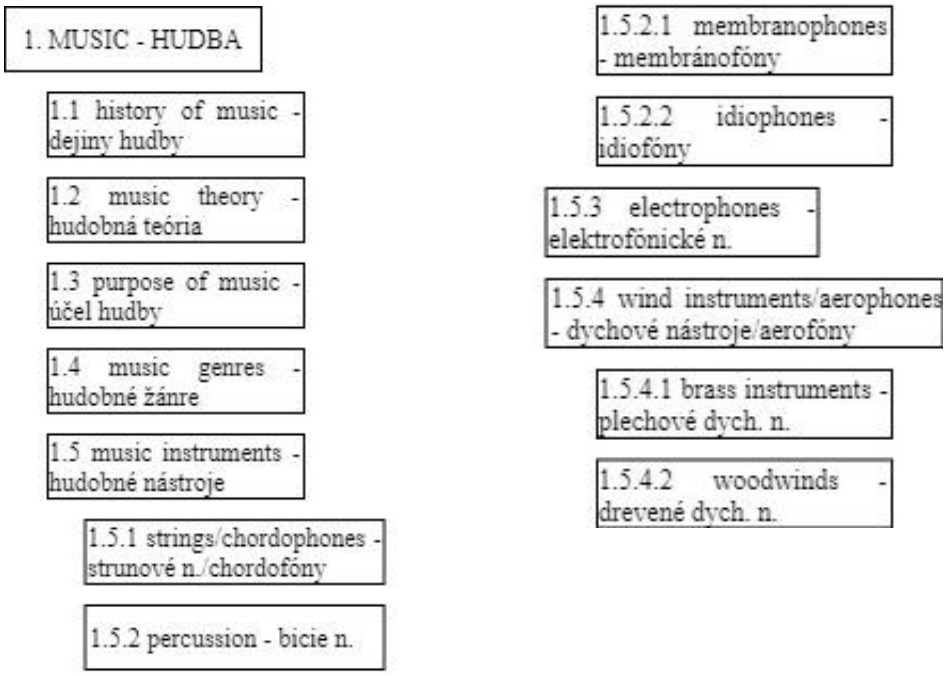
As an example of graphical representation of conceptual system is bilingual comparative conceptual system of musical instruments:
In the graphic representation of musical instruments there are two types of relations between concepts – generic and partitive. Generic relations, where all the concepts relate to each other as generic and specific concepts, are represented by a straight arrow (tree diagram). On the other hand, partitive relations, where the concepts relate to each other as wholes and their parts, are represented by an angled line (rake/bracket diagram) (ISO 704, 2009).



Graph 1 [Graphic representation of the bilingual concept system of music, based on Sliacka, Schmidt-Jones, Hopkin, Tvrdoň and Grác].



Graph 2 [Graphic representation of the bilingual concept system of brass wind musical instruments].



Graph 3 [Formal representation of the bilingual concept system of music].

2.5 Term

A term is a designation consisting of one or more words representing a general concept in a special language in a specific subject field (ISO 704,2009, p. 34).
A word (simple term), multiword expression (complex term), symbol or formula that designates a particular concept within a given subject field. Also, terminology unit
Term is a verbal designation of a general concept in a specific subject field. (ISO 1087-1:2000)
Note: A term may contain symbols and can have variants, e.g., different forms of spelling. (Available on: Termium Plus. The Government of Canada`s terminology and linguistic data bank).
A term is a designation consisting of one or more words representing a general concept in a special language. A simple term contains only one root while a term containing two or more roots is called a complex term.
A preffered term has to be accepted and used by subject specialists (ISO 704,2009, p. 34).

2.6 Term formation principles

For a standardized terminology, it is desirable that a term be attributed to a single concept. Before creating a new term, it is required to ascertain whether a term already exists for the concept in question. Well-established usage has to be respected. Established and widely used designations, even if they are poorly formed or poorly motivated, should not be changed unless there are compelling reasons. If several designations exist for a single concept, the one that satisfies the largest number of principles listed should be selected.
The following principles, even though not all applicable for any one term, can provide assistance when creating new terms or systematizing existing terminologies.

Transparency
A term is considered *transparent* when the concept it designates can be inferred, at least partially, without a definition. In other words its meaning is visible in its morphology. To make a term transparent, a key characteristic, usually a delimiting characteristic, is used in the creation of the term itself.

Consistency
The terminology of any subject field should not be and arbitrary and random collection of terms, but rather a coherent terminological system corresponding to the

concept system. Existing terms and appelations and new terms must integrate into and be consistent with the concept system. For example: Synthetic fabrics: nylon, orlon, dacron, rayon...
Any designation for a new synthetic fabric should be consistent and respect the pattern arising from the concept system.

Appropriatness
Proposed terms and appelations should adhere to familiar, established patterns of meaning within a language community. Formations that cause confusion shall be avoided. Example: The *term* **atomic energy** is confusing and misleading because it suggests that the energy or power is created from the atom. A more scientifically precise and appropriate *term* is **nuclear energy.** *Terms* shall be as neutral as possible. They should avoid connotations, especially negative ones.

Linguistic economy
A *term* shall be as concise as possible. Undue length is a serious shortcoming.
It violates the principle of linguistic economy, and it frequently leads to ellipsis (omission).
Example: **term bank** instead of **terminological data bank, e-mail** instead of **electronic mail.**

Conciseness verzus accuracy
The requirement for conciseness often conflicts with that for accuracy.
The greater the number of characteristics included in a *term*, the greater the precision and transparency of the *term.* However, increasing the number of *characteristics* often makes a *term* too long and inconvenient to use. Practicality should govern and decision to give preference to one pattern of term formation over another. For instance, shortened forms should be favoured whenever a long, precise *term* is not suitable (e. g. Oral communication in a factory). In contrast, *complex terms*, even made up of 5 or 6 words, are acceptable in scientific publications.

Derivability and compoundability
Productive term formations that allow derivatives and compounds (according to whatever conventions prevail in an individual language), should be favoured. Example: **herb** vs. **medicinal plant**: The *term* **herb** with its derived *terms* **herbaceous, herbal, herbalist** and **herby** is preferred over **medicinal plant** which produces no derivatives.

Linguistic correctness

When neoterm or appelations are coined, they should conform to the morphological, morphosyntactic and phonological norms of the language in question.

Preference for native language

Even though borrowing from other language is an accepted form of term creation, native language expressions should be given preference over direct loans. Technically, appelations are not translated but remain in their original language.

2.7 Term formation methods

Term-formation patterns depend on the lexical, morphosyntactic, and phonological structures of individual languages and recommendations cannot be given in an International Standard.

For instance, each language has its own rules for the abbreviation process and language-specific conventions dictate whether a term will consist of a single lexical element, several morphological elements combined to form a single unit, several words arranged in a string, or a terminological phrase.

However, the following term-formation methods apply to the English language, and may also apply to other languages:

CREATING NEW FORMS/ NEOTERMS

A new form is the creation of a new lexical entity that never existed before. Formation processes such as derivation, compounding or abbreviation can be used to create new forms for terms or appellations.(ISO 704,1999)

derivation

The derivation process involves forming a new term by adding one or more morphological elements, or affixes, to a root or a word. Example: phosphor + ous = phosphorous, co- + education- + al = co-educational, de- + toxi(n) + fi + -cation = detoxification.

compounding

involves combining existing words or word elements to create a new form that contains two or more roots but designates a single concept. Compounds may be complex terms, phrases or blends. The elements of the complex term or phrase or phrase often include qualifiers to a superordinate term in the form of adjectives, proper names, noun or verbal qualifiers, and may be joined by a hyphen or by fusing, or may not be joined at all (ISO 704, 2009, p.51).

Blends result from fusing two or more words, after one or more of them have been clipped. The formation of blends uses a combination of two processes, compounding after clipping. When the combining of words involves an essential characteristic from the intension of the concept, the compound is considered a transparent term.

Example:
- complex terms (joined by hyphenation): composer-conductor, high-definition television
- (joined by fusing): downsizing, outflow
- (not joined): member country, information highway,
- Phrase: video-on-demand
- blend (back and front clipping) information + entertainment = infotainment
- (back and back clipping) cybernetics + organism = cyborg
- (back clipping only) cybernetics + space = cyberspace
- (back and front, back clipping)
- quasi- + stellar object = quasar - (druh nebeského telesa).

Abbreviated forms

Excessive length makes some terms difficult to use. Shortening the word or words designating a concept can create a new abbreviated forms. The original long term is called the full or expanded form. Good writing practice dictates that both the full form of a term and the abbreviated form be indicated the first time a potentially unfamiliar abbreviated form is used in a text. In general, an abbreviated form should be easy to pronounce. In English, the types of abbreviated forms are: **short forms, clipped terms, abbreviations, initialisms, acronyms.**

A very long complex term or appellation can be reduced. The short form uses fewer words to designate the same concept. A clipped term is formed by truncating the front, middle or back portion of a simple term. Both ends may also be truncated. Abbreviations are created by omitting words and/or parts of a word making up a term. In some cases, the first letter of a word will suffice. In others, the first letters of short phrases are grouped together. Abbreviations usually end with a period (full stop-.).

Initialisms are abbreviations created by using the first letter (or sound) of each or some of the elements of a complex term or appellation. Initialisms are always pronounced letter by letter.

Acronyms are abbreviations created by combining initial letters or syllables from each or some of the elements of the full form. The new designation is pronounced syllabically like a word.
For example: Full form: Intergovernmental Group of Twenty-four on International Monetary Affairs, short form: Group of Twenty-four, clipped terms: parachute - chute, taxonomy -taxon, influenza - flu, prefabricated house -prefab, abbreviations: page p., et cetera etc., initialisms: United Nations U.N., ante meridian a.m., personal computer PC. acronyms: United Nations Educational Scientific and Cultural Organization, UNESCO, disc operating system DOS, date of birth DOB
Terms can be formed by any combination of formation processes.
Example: CD-Rom technology- Compact Disk-Read only memory technology
initialism + acronym + compounding
AIDS- acquired Immune Deficiency Syndrome
acronym whose full form includes an acronym

USING EXISTING FORMS
can be used to create new terms/neoterms by processes such as conversion, terminologization, semantic transfer and transdisciplinary borrowing.
It should be borne in mind that using existing forms may lead to homonymy, and as a result lead to confusion and ambiguity.
However, existing terms can be used in new combinations to create neoterm (e.g. by compounding, derivation (ISO 704, 2009, p. 53).

Conversion
New terms/neoterms can be created by changing the syntactic category (e.g., grammatical function) of existing forms.
Example:
in economics: output (noun) to output (verb),
in mathematics: constant (adj.) constant (noun),
in recycling: empty (adj.) to empty (verb) an empty (noun).

Terminologization is the process by which a general language word or expression is transformed into a term designating a concept in a special language.
Example: circuit
general language: line enclosing an area
electrotechnical field: arrangement of devices or media through which electric current can flow.

Semantic transfer is the process whereby an existing term within a special language is used to designate another concept by logical extension: terms designating a concept corresponding to concrete objects can be extended to abstract objects, a part extended to the whole, a container extended to the substance contained, etc.
Example: screen
concrete: the portion of a computer monitor on which information is displayed
abstract: the information displayed on a computer screen.

Transdisciplinary borrowing
also known as internal borrowing, a term from one subject field is borrowed and attributed to a new concept in another subject field within the same language.
The characteristics that make up the intension of the concepts in the two fields are often comparable by analogy.
Example: virus
medicine virus (infectious agent which causes diseases)
computer science virus (infectious agent causing computer malfunctions).

TRANSLINGUAL BORROWING
Existing terms or concepts in one language can be introduced into another language by borrowing,
either by direct loan or loan translation.

Direct loan
Existing terms are frequently adopted from one language to another if there is no current term for the concept in the second language.
The borrowed term may be pronounced, spelled, or inflected differently in the borrowing language.
Example: de Raster en raster (digitizer grid).

Loan translation
is the process whereby the morphological elements of a foreign term are translated to form a new term/neoterm.
Loan translations are also known as calques. Example: De weltanschauung – worldview (ISO 704, 2009, pp.51-55).

Step 3: To understand the concepts of the terminological literacy and terminology culture.

3 STEP 3: TERMINOLOGICAL LITERACY AND TERMINOLOGICAL CULTURE

3.1 The consistency of scientific and terminological literacy

Only a few linguists, terminologists and specialists have explained the concepts of *terminology literacy, scientific literacy,* and *terminology culture*. It seems that they have not been the subject of terminology research for decades either in Slovakia or abroad. But when we look on the concept of *scientific literacy* or *literacy in science* it can be found numerous definitions and what is more the designations are intertwined and interrelated.

Probably the first definition of scientific literacy was published by Hurd (1958): "Understanding science means knowing something about the procedures of theoretical inquiry and recognizing these procedures as the means by which the imagination of man and the laws of nature." Through the years the definition evolved, and many different definitions were published by various authors (e. g. Waterman, 1960; DeBoer, 1991; Roberts, 1983), (Cíbiková (2021, 2022).

3.2 Terminological (Terminology) literacy

On the other hand, linguists and terminologists argue about these concepts, but usually do not define them, although they are the key terms in the terminology conceptual system. In Slovakia these concepts have been discussed by Masár, Mistrík and defined by Stoffa (2008) and Cíbiková (2009, 2013). Everyday language reality and today's society urgently requires a reassessment of terminological literacy and culture. It is very important to implement terminology into education at the beginning of specialised education. We still remember the statements of our former teachers from University in Nitra that "to know means to name correctly" (Štefan Horváth, 1983, lecture manuscript) and connect them with the current language user situation and desire to build a knowledge society in Slovakia. Systematic terminological work is the result of the educational process not only in translation but also in education of subject specialists in a particular field of knowledge.

Most dictionaries and encyclopaedias define literacy in general as the ability of a person to read and write, which may be considered as a primary literacy. But today has been presented and formed secondary literacies such as (computer, scientific,

technical, linguistic, artistic, terminological) literacy and the ability to negotiate, to defend, to present, which take to the individual an active part in today's specialised/professional communication. In addition, today's Europeans should be able to apply these types of secondary literacies in a foreign language and in foreign companies. Terminology literacy should be essential and coherent for all types of secondary literacies. Terminology literacy does not mean the ability to designate objects and processes correctly, but it is a more complex ability.

Stoffa (2008) defines terminological literacy (conceptual literacy) as the ability of terminology users to use the correct terms and solve the terminological problems in their subject field". Later Cíbiková (2009, 2013) reflects the current sociolinguistic situation, re-evaluates and re-formulates terminology literacy as the ability of a language user to use adequate and consistent terms in functional communication and at the same time to do terminology work in a specific cultural and sociolinguistic situation.

Cíbiková (2021, 2022) finally re-defines *terminology literacy as the ability of a language users and specialists to use consistent terminology in functional specialised communication in 8 interrelated levels:* ***basic*** (*can recognise, characterise and understand the content of the concept, designate the concepts according terminology principles, and form term according national term formation methods*), ***functional*** (*can use terminology in the domain context and special communication*), ***conceptual oriented*** (*can understand and clarify a relationship between concepts*), ***defining*** (*can facilitate the writing of definitions, define the concepts according to principles for definition writing*), ***interdisciplinary*** (*can differentiate the same terms in different subject field*), ***comparative*** (*can facilitate the comparative analysis of concepts and designations across languages*), ***documentary*** (can *form the basis for a uniform and standardised terminology, can do terminology work and compile the terminographical products*) and ***perspective*** (*can develop perspectives of national terminology that include the nature of terminology, the role of terminology in professional life and society*).

This means that the consistency of scientific and terminology literacy as a systematic documentation of human knowledge may be understood.

3.3 Terminological (Terminology) culture

Linguists in Slovakia (Masár, Horecký, Považaj, Dolník, Findra, Kačala, Mislovičová, Ološtiak et al. In: Conference Proceedings: *Jazyková kultúra na začiatku 3. tisícročia*, 2009) most often deal with language culture, of which terminological culture is a part and at the same time the superordinate concept. From Karcova´s review

(*Slovenská reč*, 2010, vol.75, no. 3). Her conclusion was interesting, which can be a partial answer to the questions of increasing language culture. It addresses the care and cultivation of language culture in its naturalness, adequacy, and balance. The reviewer talks about different views on language culture, its capture, the functions and way of its cultivation, and the possibilities of different solutions.

Masár (*Kultúra slova*, 1997) explains that „terminological culture is an integral part of language culture together with other terminological criteria such as semantic transparency, consistency, precise definition of the term and a clear style of specialised text ". He adds that if the term does not meet these principles, its naming power in the special text decreases and causes the barriers in specialised communication. Masár thinks about the need for development of Slovak terminology, he notices the changes in the language situation after 1989 and points out the massive borrowing from English, but also the substitution of domestic language means by foreign language means. In his opinion, this leads to the convergence of Slovak with English. He also opposes the uncritical download of all that globalisation entails and advocates the intervention into official texts (Karčová, 2010, p. 185-191).

Stoffa has tried to define terminological culture in the scientific conference Terminology Forum II. He defines *terminological culture* (conceptual culture) as "adequate use of terms in accordance with the rules and system of literary language, scientific style, with specialised national and international standards and practices of the relevant specialised/professional community". Cíbiková defines *terminological culture* as a part of a language culture that expresses an individual's or group's attitude to national terminology, to systematic terminological work, in accordance with standards, literary language, specialised/professional style, customs and compromises of the specialised community, in accordance with the development of terminology and scientific discipline.

Later the definition has been re-formulated by Cíbiková (2013) under the globalisation pressure and her experience with real terminological culture and terminological literacy in Slovakia. *Terminological culture* as a *part of language culture is the use of unified and consistent national terminology in the spirit of international terminological standards and terminology principles, to optimize specialised communication in the current cultural, sociolinguistic and professional situation* (Cíbiková, 2016, 2022, Cíbiková et.al. 2022).

Both terms as well as their definitions are related and complementary. Without terminology literacy there is no terminology culture.

Step 4: To understand the concept of terminology work.

4 STEP 4: TERMINOLOGY WORK

Terminology work is a fundamental part of terminology research.
Terminology work is defined in international ISO standard as "*work concerned with the systematic collection, description, processing and presentation of concepts and their designations*" (ISO 1087-1, 2000).
There are some phases and methods of terminology work: *excerption* – involves extracting terminological data by searching through a corpus, identifying concepts and their designations, *harmonization* – "activity leading to the designation of one concept in different languages by terms which reflect the same of similar characteristic or have the same or slightly different forms", and *terminography* – is involved in recording and presentation of terminological data which can appear in from of term banks or glossaries " (ISO 1087-1, 2000).
Sometimes used interchangeably with terminology management or terminography, although both are generally considered as only a part of terminology management (Wright and Budin, 1997)
Pavel and Nolet states that "terminology work requires a number of abilities, such as:

- the ability to identify the terms that designate the concepts that belong to a subject field
- the ability to confirm the usage of the terms in pertinent reference documents
- the ability to describe concepts concisely
- the ability to distinguish correct usage from improper usage
- the ability to recommend or to discourage certain usages with a view to facilitating unambiguous communication" (Pavel-Nolet, 2011, p.18).

Terminology work consist of 3 related parts:
1. Excerption
2. Harmonisation/Standardisation
3. Terminography

Excerption is a part of terminology work which involves extracting terminological data by searching through a corpus (set of special texts). It is impossible to compile the information of the term and concept from dictionaries and then used them in any terminology product.

The terminologist has to identify the term in the special text. Term identification is a part of term excerption involving recognition and selection of designations (abbreviations, symbols, appelation).
Then the terminology work continues with the **harmonisation**, consisting of *concept harmonisation,* an activity for reducing or eliminating minor differences between two or more concepts which are already closely related to each other. *Term harmonisation* is an activity leading to the designation of one concept in different languages by terms which reflect the same or similar characteristics or have the same or slightly different forms.
In many contexts, both the full form and shortened forms coexist. The shortened forms may produce synonyms or homonyms which woul not occur if the full forms were used.
It is a **function of terminology work** to draw attention to potential difficulties of this kind, and users of shortened forms need to be aware of the potential for misunderstanding. In documents, it is common practice to give the full form (togethet with the shorter form) when the term first occurs, so that the shortened form may be used throughout the rest of the document. World Health Organization (WHO).
Terminography is a part of terminology work concerned with the recording and presentation of terminological data. NOTE Terminological data may be presented in the form of term banks, glossaries, thesauri or other publications" (ISO 1087-1:2000, p.10).
Stefaniak describes terminology work as follows: "The aim of terminology work is, firstly, to give translators timely terminological support: to find a correct equivalent, to clear the meaning of a concept, to coin a brand-new term or to help them choose the right equivalent in a given context, out of many equally correct terms, based on the criteria of consistency, accuracy and clarity. Secondly, the aim of terminology work is to manage the existing terminology resources. This work is both of a descriptive and prescriptive nature" (Stefaniak, 2017. p. 109).
There is the instruction how to do the terminology work and terminology research:

4.1 Scientific methods in terminology research

In terminology research, the following methods have been used: term and symbol observation, term excerption from scientific parallel texts in English and Slovak language, conceptual analysis, term analysis, comparative analysis of bilingual conceptual systems, classification of concepts into conceptual system, harmonisation of the term and discussion with the experts and specialists, compiling the

terminology record according Cabré, terminography: compiling the terminological product, and synthesis of data.

Conceptual analysis and terminological analysis are recommended by ISO standards and canadian Termium Plus.

Concept analysis/Conceptual analysis is the analysis required to identify and determine the scope of a concept designated by a given term as it is used in a particular subject fielld.

Termium Plus states that *terminological analysis* is "the analysis of terms in context and of the concepts designated by them within a given subject matter in order to determine their interrelationships" (TERMIUM Plus, 2012).

Terminological analysis is based upon a representation of the concept in the form of a designation or a definition" (ISO 704:2009, p.4).

In the case of terminography, the bilingual concept systems and terminology records have been ready for multiple uses, for example, glossary, dictionary, and database …).

"Terminological activities can result in a variety of terminology products, such as terminology standards, dictionaries, glossaries, terminology databases, etc. Terminology products and terminology services, such as terminology consultancy and training services, terminology information and documentation, outsourcing of terminological tasks, information services, etc., are usually used as tools for the implementation of a national policy" (UNESCO, 2005. p. 4).

The English language belongs to analytical languages, the Slovak language to synthetical languages. Due to different language types, differences in the concepts are present.

In the conclusion of comparative terminological research in the conceptual systems, there are some findings and recommendations for practice. Findings during the terminology work help to model concept structures based on specialised knowledge of the field and clarify the relations between concepts.

4.2 Terminography

Terminography is a part of terminology work concerned with the recording and presentation of terminological data. NOTE Terminological data may be presented in the form of term banks, glossaries, thesauri or other publications" (ISO 1087-1:2000, p.10).

The survey of giving academic lectures at schools and universities (medical faculties, faculties of economics) revealed that many lecturers do not feel the need to give lectures in Slovak with consistent Slovak terminology and give lectures in

English language. So, students do not know and use national domain terminology which is not developing. The situation allows massive borrowing from English, hybrid terms and hybridisation of specialised communication. The academics relied on new technologies, giving examples from practice, on the creativity of students and understanding the system of science, conceptual system of subject field automatically without education. The educators forget that without theory there is no practice and in the flood of website information it is impossible to understand the system of science.

The survey on using and existence of bilingual Science dictionaries was realised by members of the KEGA project.

4.3 Survey on using and existence of bilingual dictionaries in the Slovak republic.

The survey was aimed at finding out the responses for two survey questions:

Q1: Is there enough of any natural science bilingual dictionaries on the Slovak market for the use of CLIL method in education?

Q2: Is the development of students' language skills more effective by using the CLIL method in teaching vocabulary?

A questionnaire-based survey focused on usage of natural sciences bilingual dictionaries (English/Slovak) and experience with teaching these subjects through the CLIL method was piloted in January and February 2020. The questionnaire was sent to twenty-four primary schools and twenty-eight bilingual secondary grammar schools which represents fifty-two addressed schools in total. Overall return was 22 questionnaires from the teachers of chosen primary schools (which represents 81.8% female teachers and 18.2% male teachers) and 20 questionnaires from the teachers at bilingual secondary grammar schools (80% female teachers and 20% male teachers) which counts 42 questionnaires altogether. The respondents providing their answers were only from two natural science disciplines, namely physics and chemistry. The data from biology and mathematics were not provided by any respondent and for that reason the results of the survey are processed limited to chemistry and physics. Questions in the questionnaire were stated in Slovak language.

The main aim of the survey was to find out if there were enough English/Slovak dictionaries of natural sciences on the Slovak market. The next objective was to find out if CLIL method is used in teaching natural sciences. In the questionnaire, it should have been discovered too if the respondents found the CLIL method

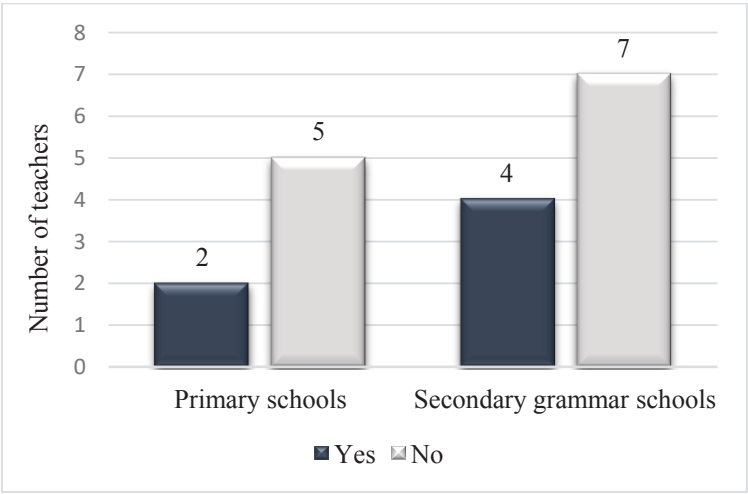
beneficial in teaching natural science vocabulary/terminology. Sixteen questions were asked in total.

Physics and chemistry teachers indicated the length of their teaching practice. An average teaching practice lasted sixteen years at primary schools and fourteen years at bilingual secondary grammar schools.

Referring to teaching specialisation the results of the survey manifest that 3 teachers at primary and secondary grammar schools teach physics and mathematics, 3 teachers teach chemistry and physics, 1 teacher teaches physics and physical education, 8 teachers teach chemistry and maths, 6 teachers teach chemistry and biology, 1 geography teacher represents the other subject that is taught in combination with chemistry, 5 teachers teach both physics and chemistry, 6 teachers teach physics and mathematics, 4 teachers teach chemistry and mathematics and 5 teachers teach chemistry and biology.

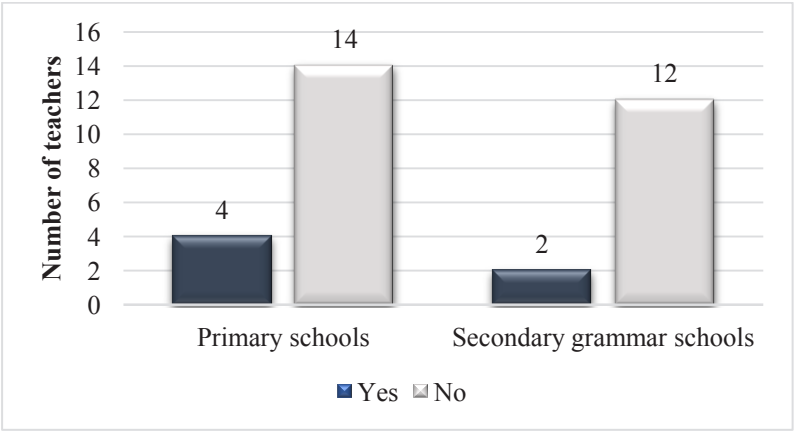
Respondents were asked to state their level of English language. At primary schools 9 teachers (40.9%) were at intermediate level, and 10 teachers were upper-intermediate level (45.45%), 2 teachers (9.09%) advanced level and 1 (4.5%) teacher could not speak English. At bilingual secondary grammar schools 11 teachers (55%) reached advanced language level and 9 teachers (45%) achieved the upper intermediate level.

The first question in the questionnaire asked the teacher respondents about their use of a bilingual English/Slovak dictionary in teaching physics. The question was answered by 7 teachers of physics at primary schools. The research shows that 5 of the teacher respondents (71.4%) do not use dictionaries in teaching physics, 2 teachers use bilingual internet dictionaries compiled by a Terminology Commission of Slovak physical society in 2007 by Peter Čerňanský, Ivan Červeň et al. The question was answered by 7 teachers of physics at bilingual secondary grammar schools (63.63%) who do not use dictionaries in teaching physics and 4 teachers (36.37%) who use Macmillan dictionary available on the internet.



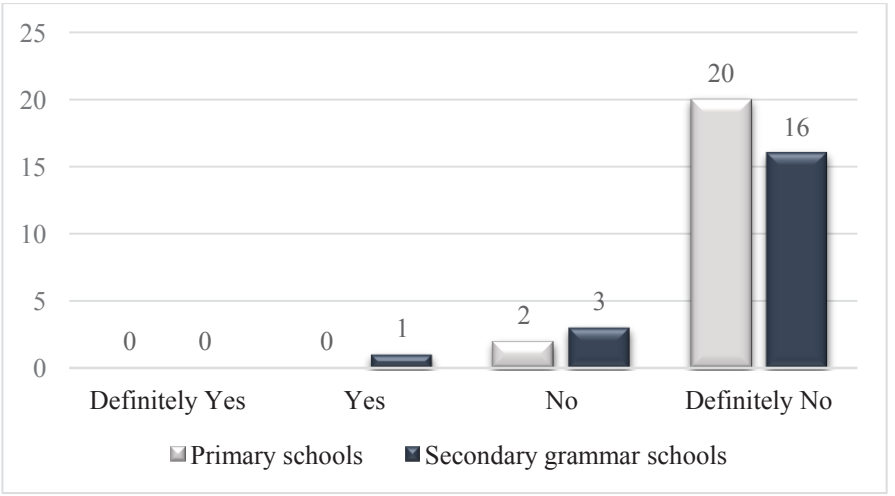
Graph 1: [Graphical comparison of using English Slovak/Slovak-English dictionary of physics in teaching physics].

The second question in the questionnaire asked the respondents about using a bilingual English/Slovak dictionary in teaching chemistry. This question was answered by 18 respondents who teach chemistry at primary schools. The research shows that 14 of them (77.78%) do not use a dictionary in teaching chemistry. 12 teachers at bilingual secondary grammar schools (85.7%) do not use dictionary in teaching chemistry and 2 teachers (14.28%) use dictionaries available on the internet.



Graph 2: [Graphical comparison of using of bilingual English-Slovak dictionary in teaching chemistry]

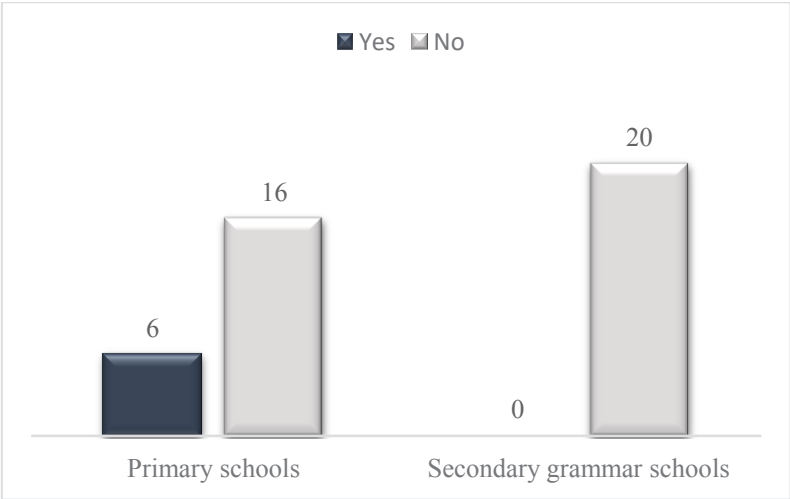
The third question aimed to inquire if there are enough dictionaries available on the Slovak market for teaching physics and chemistry. The survey has shown that 20 from 22 teachers (90.9%) at primary schools and 16 from 20 teachers at bilingual secondary grammar schools (80%) thought that there is a lack of bilingual English-Slovak dictionaries of physics and chemistry.



Graph 3: [Availability of bilingual English/Slovak dictionaries of physics and chemistry on the Slovak market]

The fourth question asked respondents about the necessity to compile a bilingual English-Slovak dictionary of physics and chemistry for teaching vocabulary. The research shows that for all teachers (100%) at primary schools and 19 teachers at bilingual secondary grammar schools (95%) it is more than needed to compile a bilingual dictionary of physics and chemistry.

The second part of the question inquired about having respondents ever compiled a bilingual dictionary. 6 teachers at primary schools ever tried to compile a bilingual dictionary but they had never finished it. The reasons which influenced the results were a lack of time and a difficulty to accomplish this target due to a low level of their English. No teacher at bilingual secondary grammar school had ever tried to compile a bilingual dictionary.



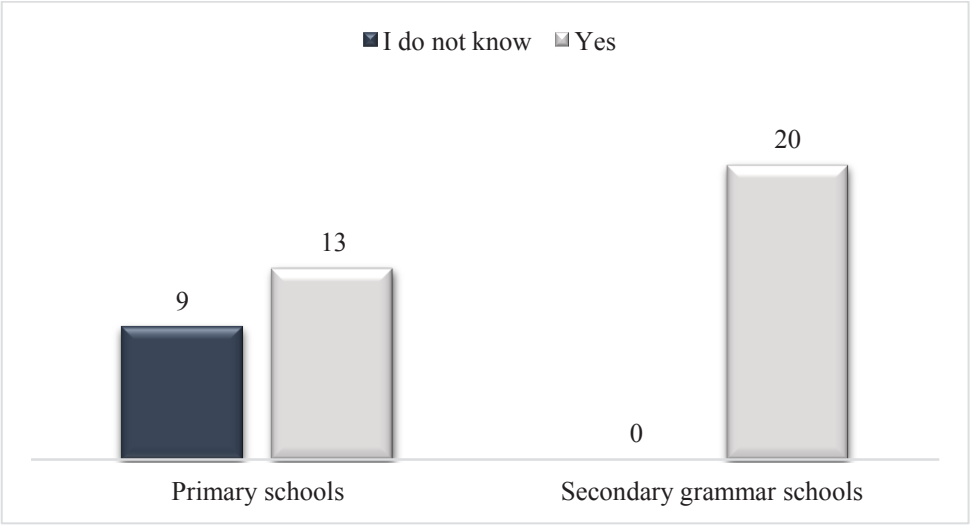
Graph 4: [A few teachers who have ever tried to compile a bilingual English-Slovak dictionary of physics and chemistry]

The respondents in the sixth question were asked if they verified correctness of the terminology, they used in teaching physics or chemistry. All teacher respondents at primary schools (12) verified correctness mainly on the internet sources. 16 teachers at bilingual secondary grammar schools always verified if the terminology was right and 2 respondents had never verified terminology.

If question six was answered positively, the respondents were further asked to specify in which way they verified accuracy of using terminology in materials they used in method CLIL. The question was answered by 12 teachers at primary schools and 20 teachers at bilingual secondary grammar schools that really use CLIL (regularly, seldom). At first, teachers usually use some of the internet sources namely: Glossary of Physics Terms,[1] Terminologies in Physics,[2] Glossary of Physics,[3] The Physics of the Universe,[4] Kalyan City Life[5] and MacMillan Dictionary.[6] Some of the respondents verify terminology with their colleagues.

1 Glossary of Physics Terms, available at: <http://tutor4physics.com/glossary.htm>
2 Terminologies in Physics, available at: <https://www.tutorialspoint.com/physics_part2/terminologies_in_physics.htm>
3 Glossary of Physics, available at: <https://en.wikipedia.org/wiki/Glossary_of_physics>
4 The Physics of the Universe, available at: <https://www.physicsoftheuniverse.com/glossary.html>
5 Kalyan City Life, available at: <https://kalyan-city.blogspot.com/2010/09/physics-definitions-terminology.html>
6 MacMillan Dictionary, available at: <https://www.macmillandictionary.com/>

In question number eight the respondents were asked if they had ever heard a term CLIL (Content and language integrated learning). The survey has shown that most of the respondents (73%) at primary schools and all teachers at bilingual secondary grammar schools (100%) are aware of the meaning of the term CLIL. There could be many factors that might have influenced the responses to the question. Age is the most important factor as all older teachers give negative answers. Teaching experience, the lack of information about meaning and using the method could be some of other factors that influenced the teachers' view on the CLIL method.Question number nine the purpose of which was to find out whether teacher respondents thought that physics or chemistry vocabulary were appropriate for teaching through the CLIL method was put. 13 respondents (59%) at primary schools agreed with the subject's appropriateness. Other respondents could not answer. All of 13 respondents stated their appropriateness due to technical terms. All respondents at bilingual secondary grammar schools (100%) thought that physics and chemistry were appropriate subjects for CLIL method teaching.



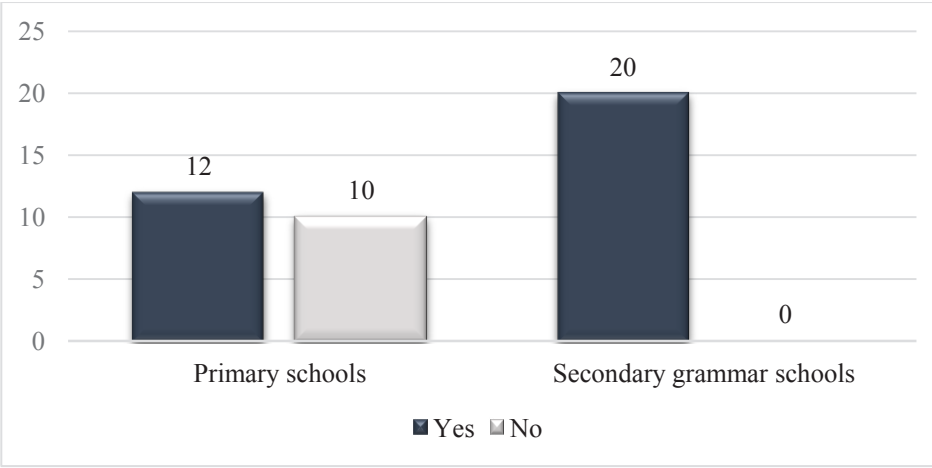
Graph 5: [Graphical comparison of appropriateness of physics and chemistry for teaching through CLIL method]

The tenth question asked the respondents if they had ever applied the CLIL method for teaching vocabulary in physics and chemistry lessons. In case this question was answered positively, they were further asked to state what way they used for assessment of a CLIL lesson. 10 respondents at primary schools had never used the CLIL method. The rest of the respondents had some experience with using the

method in their lessons. As the way used for assessment of a CLIL lesson as a prevailing answer was stated an oral evaluation.

The results coming from the respondents´ answers at bilingual secondary grammar schools proved that all teachers used the CLIL method not only in the teaching of physics and chemistry, but also in biology and mathematics. Most teachers provide feedback on language in class and clarify the mistakes on tests and reflect this in a grade. They do a project occasionally, where part of the grade is determined by a presentation or another language output activity.

If the respondents never used the CLIL method, they were asked to reply to questions from sixth to eleventh focused on using foreign languages in a chemistry and physics lesson.

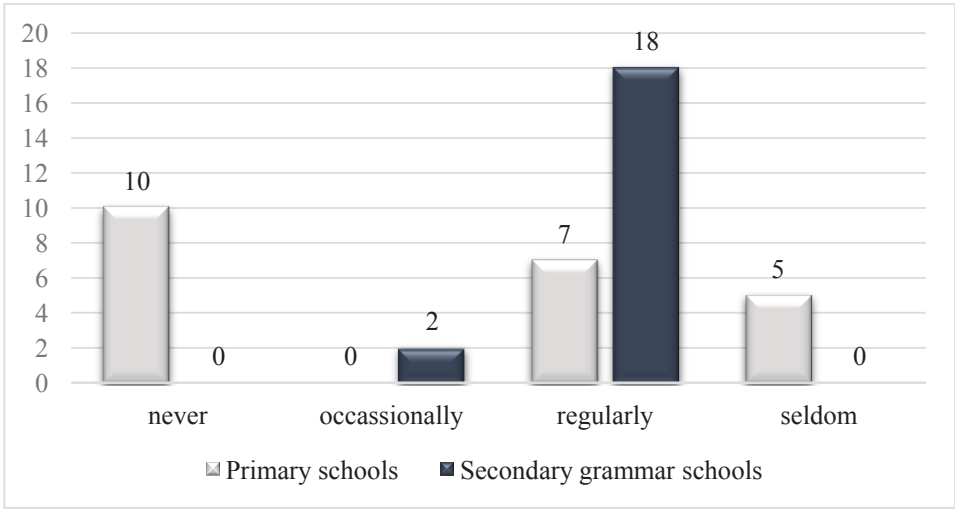


Graph 6: [Teachers who applied CLIL method in teaching vocabulary (physics, chemistry)]

Question number eleven was focused on frequency of applying foreign materials in teaching vocabulary in physics and chemistry lessons. The results are as follows: 10 teachers (45%) at primary schools have never used foreign materials in their lessons, 7 teachers (32%) use foreign materials regularly, 5 teacher respondents (23%) use the materials rarely. Some of the teachers at primary schools who sometimes use foreign materials are willing to change their opinion and try to apply the CLIL method in their lesson. However, it will depend on their motivation and willingness to invest a lot of time and energy to implement the method.

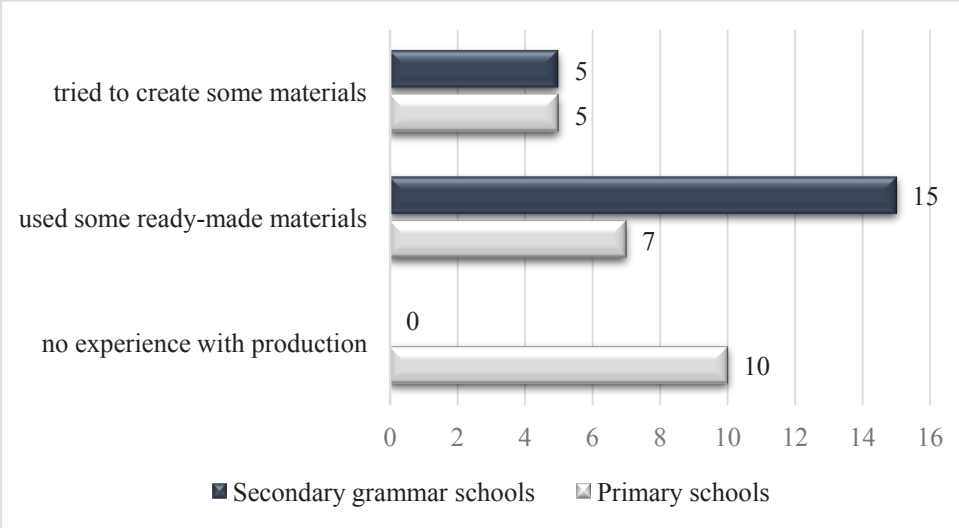
Up to 18 teachers (90%) at bilingual secondary schools regularly use foreign language materials and 2 teachers use these materials occasionally. Bilingual schools are known for their quality. Students intensively study the language in the first

class, which can also be called linguistic preparation, because the weekly lesson of the language in this year presents twenty hours. The remaining ten hours are divided among the other subjects. Other years students learn subjects in the English language and end with a state language examination.



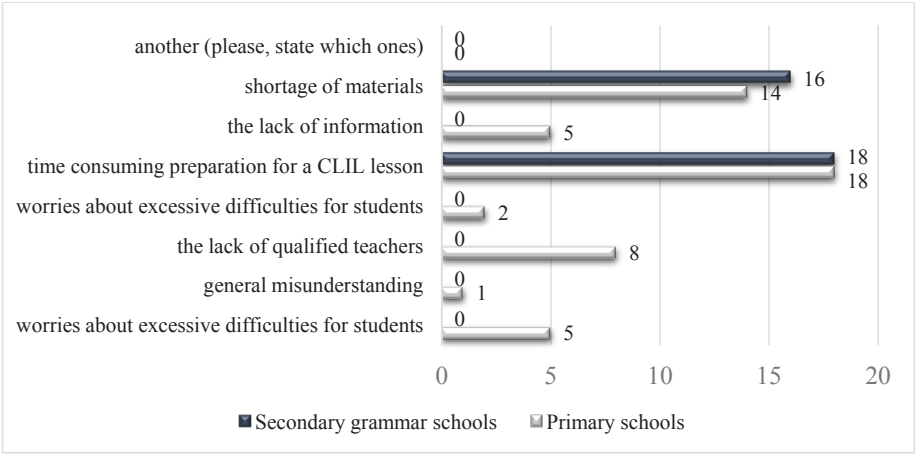
Graph 7: [Application of foreign materials in teaching vocabulary in physics and chemistry]

The twelfth question was targeted on finding out if the teacher respondents have ever had some experience with CLIL materials' production to teach vocabulary in physics or chemistry lessons or if they preferred using ready-made materials. 10 teachers (45.45%) at primary schools stated that they had no experience with production of CLIL materials, 7 teachers (31.81%) have ever used ready-made materials. The results show that only 5 teachers (22.72%) have tried to create their own materials for teaching vocabulary in physics and chemistry. The presumptions that most of the teachers would have hardly any experience with creating materials for a CLIL class were confirmed. According to their responses it is a demanding and time-consuming process. On the other hand, 15 teachers at bilingual secondary schools use some ready-made materials from the internet and 5 teachers tried to create their own materials.



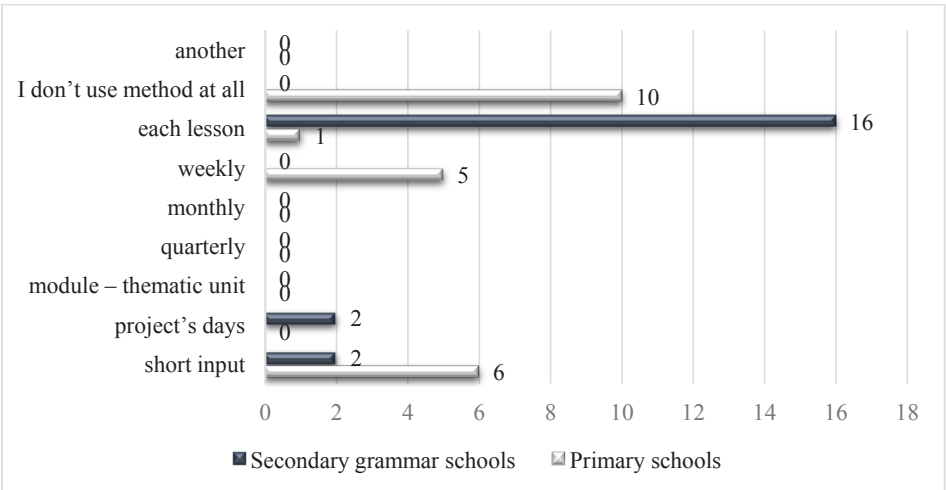
Graph 8: [Teachers−experience with CLIL materials production]

The thirteenth question dealt with the inquiry of what the teachers find the most problematic situation in the process of implementation of the CLIL method to teaching vocabulary in physics and chemistry. Survey at primary schools shows that most of the teachers (81.81%) suppose that the time-consuming preparation for a CLIL lesson would be the most problematic. Most of the respondents at primary schools (63.63%) find the lack of materials, bilingual dictionaries, and didactic sources also problematic. The teachers place the worries about excessive difficulty for students and the lack of information about the way of using the CLIL method as another serious difficulty. 1 teacher finds the general misunderstanding of approach by parents and students as the most serious obstacle during the implementation of CLIL. Most teachers at bilingual secondary schools (90%) suppose that the time-consuming preparation for a CLIL lesson is the most problematic during the implementation of the CLIL method and 80% consider the lack of materials, bilingual dictionaries, and didactic sources as a serious problem.



Graph 9: [Most problematic situations in the process of implementation CLIL method]

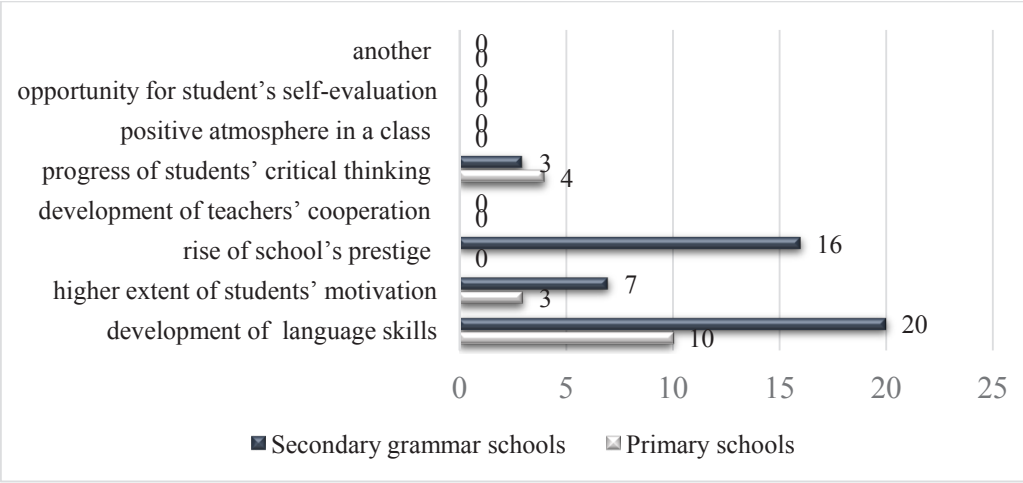
The results proceeding from the question on what form of the CLIL method the teacher respondents use in teaching vocabulary in physics and chemistry lessons and the frequency of its use were as follows: 45.45% teacher respondents replied that they did not use the method at all, 6 teachers (27.3%) used a short input, and 5 teachers used this method weekly. There was only 1 teacher who used CLIL every day. She was the youngest teacher of all, and she was at the advanced level of English. There is a considerable difference between primary schools and bilingual secondary grammar schools. 16 teachers at bilingual secondary grammar schools use CLIL method in every lesson, 2 teachers use short input and 2 use project's days.



Graph 10: [Frequency of using CLIL method in chemistry and physics lessons]

The purpose of the fifteenth question was to find out the benefit of using the CLIL method in education. This question was answered by 12 teachers at primary schools as they use CLIL method in fact and 20 teachers at bilingual secondary grammar schools. Teachers that did not use CLIL did not answer the question. Concerning the benefit of the CLIL method, 10 respondents came to an agreement that using the CLIL method was beneficial for the development of students' language skills. The progress of students' critical thinking was found as the second biggest benefit by 4 teachers. 3 teachers found the higher extent of students' motivation and active involvement in education as the third important benefit of the CLIL method. The fact that nobody chose the options such as a positive atmosphere in a class as the benefit of the CLIL method was surprising.

All teachers at bilingual secondary grammar schools found development of students' language skills the most important, 16 teachers found the rise of a school's prestige important, 7 teachers believed that CLIL method increases student's motivation, and 3 teachers found the progress of students' critical thinking as other benefit.



Graph 11: [Benefits of using the CLIL method in education]

The last question was aimed at the fact that the respondents found the CLIL method beneficial and if they agreed with implementation of the CLIL method to schools. 2 female teachers expressed their opinion that each extra form of education was beneficial for student's general range of knowledge. Other respondents were probably not willing to fill in the last question. Time-consuming filling in the questionnaire or absence of experience with the CLIL method could cause that the respondents did not mention their opinions.

CONCLUSION OF THE SURVEY

To sum up the findings, the main aim of the survey was to verify the existence of a bilingual English/Slovak dictionary of natural sciences and find out if it was possible to develop students' language skills with the CLIL method. Another goal of the survey was to gain a piece of information if the teachers knew and used the CLIL method in teaching vocabulary in natural sciences and if they considered the CLIL method beneficial in teaching vocabulary. As the questionnaire returned only from teachers who responded to physics and chemistry, the results of the questionnaire were interpreted only with these two natural sciences.

The research shows that 71.4% of teachers at primary schools and 63.63% teachers at bilingual secondary schools do not use dictionary in teaching vocabulary of physics and 77.78% of teachers at primary schools and 85,7% teachers at bilingual secondary schools do not use dictionary in teaching vocabulary of chemistry. It is due to a lack of bilingual English/Slovak dictionaries of physics and chemistry. For all teachers (100%) at primary schools it is necessary to compile a bilingual dictionary. Some of the teachers tried to compile a bilingual dictionary but they had never completed it. They verify the accuracy of using terminology mainly on the internet.

The respondents would have been more aware of the CLIL method's existence. Some of them applied the method in teaching vocabulary in physics or chemistry lessons. The survey shows that most of the respondents have ever heard about the method but not all of them have already applied it in teaching vocabulary in their subjects. The longest teaching practice of the respondents lasts twenty-seven years and the shortest period five years. However, teachers with longer practice are not willing to try new teaching methods and their level of English is lower in comparison with younger teachers.

The survey proves that most of the teachers agree with the fact that physics or chemistry is an appropriate subject to be taught through the CLIL method. This method could be used in teaching vocabulary in science. Moreover, 45 per cent of the respondents do not use foreign languages and materials in teaching vocabulary in physics or chemistry lessons. Most common reasons why foreign languages are not used in non-language subjects is the lack of time for integration of foreign languages and a lack of materials, bilingual physics and chemistry dictionaries and didactic sources.

The survey shows that most respondents has not had any experience with the production of CLIL materials except for five teachers who have already tried to compile their own materials. According to the teachers' opinion the lack of qualified teachers and time-consuming preparation for a CLIL lesson will be the most

problematic during the implementation. Regarding frequency of using the method in physics or chemistry lessons, more than 45% of the respondents do not use the CLIL method at all. Most of the respondents come to an agreement that using the CLIL method encourages the development of students' language skills. Teachers should apply the method in teaching vocabulary in physics or chemistry lessons because there are many materials in English available either on the Internet or in scientific books that could be used by teachers in the planning of a CLIL lesson. Students who would like to study physics or chemistry at a university could benefit from the CLIL lessons and gain knowledge during their studies.

According to the results from the survey it is apparent that teachers do not use dictionaries in printed form in teaching physics and chemistry. They do not have at disposal any bilingual dictionary for physics and chemistry neither at primary schools nor at bilingual secondary grammar schools. Only a few teachers of all use bilingual dictionaries available on the internet. Two of them use a bilingual English/Slovak dictionary of physics. There are approximately 4,000 Slovak physical terms and their English equivalents but disadvantage with this online dictionary is absence of explanation or definition of physical quantities. The dictionary was compiled by a Terminological commission of Slovak physical society in 2007 by Peter Čerňanský, Ivan Červeň et al.

The results of a brief survey that were conducted in autumn 2019, present the existence of some specialised bilingual dictionaries available on the Slovak market. According to a search on the internet stores and internet websites there is no existence of a bilingual dictionary of physics or chemistry – see Table 1. The closest to these needs are the technical dictionaries and scientific-technical dictionaries, however, they do not provide an optimum solution as their scope is not only physics or chemistry but also other different areas like architecture, biology, economics, geography, mathematics, agriculture (at least 30 fields).

Table 1: [Specialised dictionaries (English-Slovak and/or Slovak-English) available on the Slovak market]

Name of dictionary	*Languages*	*Author(s)*	*Year of publication*
Akademické pojmy pre vysokoškolákov	EN-SK, SK-EN	Marián Kika	2016
Ekonomický slovník	EN-SK, SK-EN	Jozef Magula	2004
Obchodný slovník	EN-SK, SK-EN	Jozef Magula	2003
Právnický slovník	EN-SK	Jozef Magula	2002
Slovník medicíny	SK-EN	T. Langová	2002
Slovník medicíny	EN-SK	T. Langová	2002
Slovník výpočtovej techniky	EN-SK, SK-EN	Daniela Magulová	2001
Strojárenský slovník EÚ	EN-SK, SK-EN	John Smith	2019
Technický slovník	EN-SK, SK-EN	Ladislav Véhner	2004
Viacjazyčný slovník mobilnej pracovnej techniky	EN-DE-SK	Juraj Bukoveczky et al	2008
Výkladový slovník inteligentných dopravných systémov	EN-SK, SK-EN	Tibor Schlosser	2008

To conclude the findings, a special dictionary for natural sciences is absent on the Slovak market. The Slovak market offers only a dictionary for natural sciences being a part of other special dictionaries.

The results of research clarify that for all teachers (100%) it is necessary to compile a bilingual dictionary of physics and chemistry. A bilingual dictionary could help the teacher prepare better materials for their teaching more effectively and faster. It could be a helpful tool for pupils too.

The results of research clarify that for 10 teachers at primary schools (83.33%) and for all teachers at bilingual secondary grammar schools using the CLIL method is beneficial for the development of students' language skills. The progress of students' critical thinking is found as a second biggest benefit by 4 teachers at primary schools. Three teachers find the higher extent of students' motivation and active involvement in education as the third important benefit of the CLIL method and 16 teachers at bilingual secondary grammar schools considered a rise of the school's prestige and competitiveness more important.

The project is aimed at studying the situation at secondary vocational schools, however, we found mapping the situation at bilingual secondary grammar schools interesting as a start. The project is not at the same time focused on primary education, but we have found out that teachers start using the CLIL method at primary schools. These teachers are mostly the ones with English language specialisation.

The next survey is predominantly going to be focused on secondary vocational schools in 2022.

There is a strong lack of systematic care and intervention for national terminology in Slovakia. The survey revealed huge amount of unprofessionally formed new terms and massive borrowing from English. The huge risk is the subsequent use of inconsistent terminology in practice which is very difficult to eradicate and reflect the level of terminology culture. Every national terminology is a bearer of cultural, linguistic, and conceptual values and during the translation and looking for an adequate equivalent across languages there is the contact mixing.
It is also necessary to keep in mind the different term formation across languages, diversity of conceptual systems, their relationships, variability of terms, consistency of terminology, historical traditions, preference for native language, the importance of teamwork of terminologists and specialists and ability of compromise.
The authors recognize the urgent need to tackle issues of terminology in building knowledge society in Slovakia, Also, they point to a lack of interest on terminology in public and government, and they call for urgent government assistance like that of Francophone countries.

Step 5: To compare teaching science in the Slovak republic and the UK. STEM concept

5 STEP 5: Teaching Science

From the point of view of teaching and learning, the specialized language and specialized communication has its roots firstly in family, secondly in the primary education (which is about the basics of knowledge and science), thirdly continues in the secondary education (which is about responsibility in general), and in the secondary vocational schools (which is about workmanship, expertise). Then the teaching and learning process continue in higher education at colleges or universities (which is about the specialization). And finally, learning the specialization continues in courses and in lifelong education. And what is more, to meet the labour market and foreign company demands is seen as the best strategy to combine foreign language education with the special language synergistically.
Science education provides the students with the opportunity to specialize in the subject fields related to those of Natural Sciences. It is no longer just a general science class. Learners can usually pick between biology, chemistry, or physics. This allows for a more focused approach to learning and understanding scientific concepts.

Science education in Slovakia is like that in the UK, but there are some key differences in the system how the subject is presented. The main difference is that in the Slovak republic is the teachers training focused on Biology or Chemistry, but in UK on Science. The result of education is not appropriate because of interdisciplinarity and fusion of some new subject fields as Biochemistry, Biotechnology, Nanotechnology, and the knowledge of the students are not complete.

One of the most interesting differences is the fact that while in the UK the subject called *Science* is taught as that integrating all the Natural Science disciplines, in Slovak state schools, the learners are offered individual sciences as school subjects on their own. Thus, in Slovakia, students are not necessarily offered a school subject called Science, but separate subjects of Physics, those of Chemistry, Biology, Geography as well as Mathematics. Within these separate sciences, other subdisciplines are included: e.g., Biology comprises Botany which is usually covered within one school year. Another subdiscipline presented during a school subject called Biology is Zoology where the same period of time is focused on this discipline. The

basics of Anatomy are also presented to the learners in terms of Biology as a school subject lasting one year. Another natural science discipline included in the curriculum is Geography. This school subject includes for example Geology/ Mineralogy where the same system as for the previous discipline works and covers one school year as well. As for Physics, its scope covers Mechanics, Thermodynamics, Kinetics, or Optics.

On the other hand, the new trend has been working in practice at Slovak private schools. Most of them offer education according to the international standards (e.g., those of Cambridge University at Besst in Trnava). There are also some bilingual educational institutions using the method of CLIL in Slovakia offering (pre-) primary and/or secondary education in selected foreign languages together with a foreign language terminology in terms of Science (see the link in Bibliography).

In Slovakia, Science - generally covered in individual school subjects - is a compulsory subject from ages 6 to 15. As mentioned before, it is taught in a more integrated way than in the UK, with pupils learning about a variety of scientific topics, such as physics, chemistry, biology, and geography, in a single course.

At the primary school level (ages 6-10), Science is taught through a variety of activities, such as experiments, projects, and field trips. Pupils learn about basic scientific concepts, such as the properties of matter, the life cycle, and the forces of nature.

At the secondary school level (ages 11-15), Science is taught in more details. Pupils learn about more complex scientific concepts, such as the atom, the periodic table, and the process of photosynthesis. They also learn about scientific research and how to design and conduct experiments.

In addition to the compulsory science course, pupils can also choose to study more advanced science courses, such as chemistry, physics, and biology, at the upper secondary school level (ages 16-18). These courses are designed to prepare pupils for further study in science and engineering at the university level.

Overall, science education in Slovakia is designed to give pupils a broad understanding of the natural world and to develop their scientific skills and knowledge. Science is seen as an important subject for all pupils, regardless of their future career plans.

5.1 Teaching science in the Slovak republic

Science education in Slovakia is overseen by the Ministry of Education, Science, Research and Sport of the Slovak Republic. The ministry sets the national curriculum for Science and provides funding and support for schools. In Slovakia, Science Education is an important part of the national curriculum, and it is taught in a systematic manner from primary to secondary education.

The primary education system is formally divided into two stages. Standard primary schools last 9 years (8 before approximately the mid-1990s, however since the early 1990s students can attend an "8-year grammar school ", where they can start studying just after 5 years (4 prior to the school year of 2009/2010) of primary education.

Secondary education not only focuses on higher education in these subjects, but vocational training is also a key aspect. This ensures that students are well-prepared for both academic and practical applications of their knowledge.

Here's an overview of how Science is taught in Slovak schools:

1. Curriculum Structure: The Slovak educational system is divided into several stages, including primary education (ages 6 to 15) and secondary education. Science education is an integral part of both primary and secondary curricula.
2. Compulsory Subject: Science is considered a compulsory subject at both the primary and secondary education levels. This means that students are required to study various scientific disciplines.
3. Scientific Disciplines: The Science curriculum typically covers a broad range of scientific disciplines, including biology, chemistry, physics, and geography. As students progress through the education system, they delve deeper into these subjects.
4. Practical Work: Practical experiments and hands-on activities are an essential component of science education in Slovakia. Students are encouraged to perform experiments, collect data, and develop their practical skills.
5. Assessment: Assessment methods include examinations, written assignments, and practical assessments. At the secondary level, students may take a final school-leaving examination called Maturita, which includes a science component.
6. Specialization: In secondary education, students often have the option to specialise in a specific field of science, such as biology, chemistry, geography or physics, depending on their interests and future career goals.

7. Cross-Curricular Integration: Science education is often integrated with other subjects, such as mathematics and environmental education, to provide a holistic understanding of scientific concepts.
8. Curriculum Updates: The Slovak curriculum is periodically updated and revised to ensure that it aligns with current scientific knowledge and pedagogical best practices. It's important for teachers and schools to stay updated on these changes.
9. Teacher Training: Teachers are required to have specialised training in Science Education. They are responsible for delivering the curriculum and facilitating practical work and experiments.
10. Extracurricular Activities: Schools may offer extracurricular science-related activities, clubs, and competitions to further engage and challenge students with an interest in science.
11. Higher Education: Students who excel in Science have the opportunity to pursue science-related degrees at Slovak universities, leading to careers in various scientific fields.

Here are some specific examples of how science is taught in Slovak schools:

- In primary schools, pupils might learn about the water cycle by building a model of the water cycle or by going on a field trip to a river or lake. They might also learn about the human body by drawing a diagram of the digestive system or by building a model of the heart.
- In secondary schools, pupils might learn about the atom by building a model of an atom or by conducting an experiment to show how atoms react with each other. They might also learn about the periodic table by studying the properties of the different elements.
- In advanced science courses, pupils might learn about the chemistry of organic compounds by investigating how polymers are formed. They might also learn about the physics of electricity and magnetism by building a more complex electric circuit.

It could be concluded that in Slovakia, Science Education is designed to provide students with a strong foundation in scientific knowledge, critical thinking skills, and practical abilities. The curriculum is structured to prepare students for further study or careers in science and related fields, as well as to promote scientific literacy among all students.

5.2 Teaching science in the UK

In the United Kingdom, Science is taught as a core subject in primary and secondary education, and the curriculum is designed to provide students with a strong foundation in various scientific disciplines. The approach to teaching Science in UK schools follows the National Curriculum, which sets out the content and objectives for each key stage of education.

Here is a general overview of how Science is taught in UK schools:

1. Key Stages: The National Curriculum divides a student's education into key stages, with Science Education covering Key Stages 1 to 4. Key Stage 1 covers ages 5 to 7, Key Stage 2 covers ages 7 to 11, Key Stage 3 covers ages 11 to 14, and Key Stage 4 covers ages 14 to 16.
2. Core Subjects: Science is considered one of the core subjects, alongside English and mathematics. This means that students are required to study Science throughout their primary and secondary education.
3. Science Disciplines: The curriculum covers various scientific disciplines, including Biology, Chemistry, and Physics. Students learn about key concepts, scientific methods, and how to conduct experiments and investigations.
4. Practical Work: Practical experiments and investigations are an integral part of Science Education in the UK. Students are encouraged to conduct experiments to gain hands-on experience and develop their understanding of scientific principles.
5. Assessment: Students are assessed through a combination of examinations, coursework, and practical assessments. The General Certificate of Secondary Education (GCSE) exams are typically taken at the end of Key Stage 4, and students can choose to study separate sciences (biology, chemistry, and physics) or combined science.
6. Choice of Qualifications: After GCSEs, students have the option to pursue further education in science, including A-levels in biology, chemistry, and physics. These qualifications are often required for entry into university-level science courses.
7. Practical Skills: The curriculum also emphasizes the development of practical skills, scientific inquiry, and problem-solving abilities.
8. Cross-Curricular Links: Science is often taught with a cross-curricular approach, integrating scientific concepts with mathematics, technology, and environmental education.

9. Special Educational Needs: The curriculum is designed to be inclusive and adaptable to the needs of students with special educational needs.
10. Curriculum Updates: The National Curriculum and the way science is taught in UK schools may evolve over time, so it's important to refer to the latest curriculum documents and guidance provided by the Department for Education for the most up-to-date information.

Overall, Science Education in the UK aims to equip students with a strong understanding of the natural world and the skills needed to think critically and engage with scientific concepts, which can prepare them for further study or careers in science-related fields.

Science is a compulsory subject in all UK schools from ages 5 to 16. It is divided into three main disciplines: biology, chemistry, and physics. In primary schools (Key Stages 1 and 2, ages 5-11), Science is taught in a more thematic way, with pupils learning about a variety of scientific topics, such as the human body, plants and animals, and the weather. In secondary schools (Key Stages 3 and 4, ages 11-16), Science is taught more separately, with pupils studying each of the three disciplines in more depth.

At Key Stage 3 (ages 11-14), pupils learn about the fundamental concepts of science, such as the structure of matter, energy, and forces. They also learn about scientific enquiry and how to conduct experiments.

At Key Stage 4 (ages 14-16), pupils can choose to study the three sciences separately or in a combined Science Course. Combined science covers the basics of all three sciences, while separate science courses allow pupils to study each discipline in more depth.

Science is taught in a variety of ways in UK schools. Teachers use a variety of teaching methods, such as lectures, discussions, practical experiments, and demonstrations. Pupils are also encouraged to work independently and in groups to complete projects and assignments. One of the key aims of science education in the UK is to develop pupils' scientific literacy. This means that pupils should be able to understand and use scientific knowledge to make informed decisions about their lives and the world around them. Science education also aims to develop pupils' critical thinking skills and their ability to solve problems.

Here are some specific examples of how science is taught in UK schools:

- In primary schools, pupils might learn about the solar system by making a model of the planets or by watching a video about space exploration. They might also

learn about the human body by dissecting a frog or by drawing a diagram of the circulatory system.
- In secondary schools, pupils might learn about the particulate nature of matter by conducting an experiment to show how smoke diffuses through the air. They might also learn about the laws of motion by investigating how the distance an object travels is related to the force applied to it.
- In combined science, pupils might learn about the chemistry of photosynthesis by investigating how plants use sunlight to produce food. They might also learn about the physics of electricity and magnetism by building a simple electric circuit.
- In separate science, pupils might learn about the biology of genetics by studying how traits are passed down from parents to offspring. They might also learn about the chemistry of acids and bases by investigating how they react with each other.

Overall, Science Education in UK schools is designed to give pupils a broad understanding of the natural world and to develop their scientific skills and knowledge. The National Curriculum for Science aims to ensure that all pupils:
- Develop scientific knowledge and conceptual understanding through the specific disciplines of biology, chemistry, and physics.
- Develop an understanding of the nature, processes, and methods of science through different types of science inquiries that help them answer scientific questions about the world around them.
- Are equipped with the scientific knowledge required to understand the uses and implications of science, today and for the future.

STEM and CLIL concepts support the idea of authors of final publications of KEGA project and the curricular reform too.

5.3 STEM abbreviation and the content of the concept

The abbreviation STEM relates to education and stands for Science, Technology, Engineering and Maths. STEM is an approach to learning activities providing an enjoyable and engaging setting in foreign language education.

STEM in national KEGA project No: 006UCM-4/2021 is understood as the development in science education that integrates Biology, Chemistry, Physics and Mathematics subject fields. At the end STEM integrates Science, Technology, Engineering and Mathematics.

STEM is a closely related to education and the presented curricular reform. The term STEM reflects the innovative element of 9 co-educational areas: Language and

communication, Nature and society, Man and nature, Man and society, Man and values, Mathematics and work with information, Man and the work of world, Art and culture and Health and exercise, co-responsibility for the results of pedagogical activity in schools and also is supported by the School Act of 2008. The Ministry of Education, Science, Research and Sport of the Slovak republic has announced the curricular reform on the level of ISCED 1 and ISCED 2 at the end of 2020.

Hašková and Lukáčová compare the conceptions of both previous as well as the announced curricular reforms and focus on the impact of these reforms of the subjects of technology. The authors claim that the reform is never an isolated modification of the curriculum but the philosophical and ideological change that must be accepted by all the actors involved in its implementation including demands of teachers (Hašková, Lukáčová, 2023, pp. 1566 - 1574). The idea supports Porubský who point out that issues of education reform, school reform or curricular reform have become more political and economic than pedagogical in recent years, not only for Slovakia but also for the broader international context (Porubský et.al., 2014). Hašková and Lukáčová conclude that the technically oriented subjects are supposed to have the most prominent space within the last 33 years of the history of Slovak education (Hašková, Lukáčová, 2023, pp. 1566 - 1574).

5.4 CLIL abbreviation and the content of the concept

CONTENT AND LANGUAGE INTEGRATED LEARNING has been defined by many scholars. According to Coyle CLIL method can be defined as "*Content and Language Integrated Learning (CLIL)* as a dual-focused educational approach in which an additional language is used for the learning and teaching of both content and language" (Coyle et al., 2010, p. 1). Coyle explains that an additional language is often a learner's second (foreign) or non-native language. There is focus not only on content, but also on language. CLIL is not a new form of language education and not a form of subject education, but it is an innovative fusion of both (Coyle et al., 2010).

Dale and Tanner claim that CLIL is the way of teaching where subject content (history, science, or physical education) is taught through language (often English). Further, CLIL subject teachers implement language into their lessons and CLIL language teachers interweave the subject into their language lessons. Sometimes teachers focus on both the content and the language (Dale & Tanner, 2010).

According to Marsh and Langé CLIL means both studying a subject through a second/foreign language and acquiring a second/foreign language by studying a content-based subject. They both describe CLIL as "a generic term which refers to

any educational situation in which an additional language, and therefore not the most widely used language of the environment, is used for the teaching and learning of subjects other than the language itself" (Marsh, Langé, 2000).

Tennant sees Content and Language Integrated Learning (CLIL) as "an increasingly popular teaching method" where "regular subjects, such as history and maths, are taught in a foreign language in order to enhance target language exposure and acquisition". Tennant continues that "CLIL is now one of the new buzz words, or acronyms, in EFL/ELT." He says that "CLIL is simply another name for cross-curricula content and not such a bright new thing in teaching" (Tennant, 2005).

STEP 6: to understand the difference between lexicography and terminography as a part of terminology work and Terminology products.

6 STEP 6: Terminography versus Lexicography

It is important to differentiate between terminography and lexicography. Terminography deals with **specialized vocabulary** and lexicography deals with **general vocabulary**.

According to Spanish linguist Maria T. Cabré, *lexicography deals with the principles and methods of writing dictionaries* (Cabré, 1999, p. 31). The Slovak linguist J. Mistrík claims that *lexicography is a branch of linguistics that deals with the theory and practice of compiling dictionaries of different kinds and types* (Mistrík, 2002, p. 100).

The dictionary of lexicography defines lexicography as *the professional activity and academic field concerned with dictionaries and other reference works. It has two basic divisions: lexicographic practice, or dictionary-making, and lexicographic theory, or dictionary research* (Hartman & James, 1998, p. 85).

According Burghanov lexicography *refers to the process, result, and theoretical evaluation, of the making of reference works…* and continues with three characteristics:

a) which represent a wide range of heterogenous knowledge structures and, depending on cultural and historical traditions of a particular linguistic community…

b) which provide information about lexicon of one or more languages and, depending on cultural and historical traditions of a particular linguistic community…

c) which are formed by alphabetically arranged listings of words furnished with paraphrases in the same language or translation equivalents and, optionally, any linguistically relevant information that may be included in a dictionary (Burkhanov, 1998, p. 137,138).

The term **terminography** is young, therefore some linguists as e.g., Wiegand claim before 1975 the term terminological lexicography was preferred. ISO standard 1087 defines terminography as *terminology work that is concerned with the recording and presentation of terminological data.*

ISO standard 22128 defines terminography *as part of terminology work concerned with the recording and presentation of terminological data* (ISO 22128, 2008, p. 2).

The Spanish linguist and terminograher M.T. Cabré defines terminography as: *the process of compiling, describing, processing, and presenting the terms of special subject fields in one or more languages,* (Cabré 1991, p. 10).

Terminography involves gathering, systematizing, and presenting terms from a specific branch of knowledge or human activity (Cabré 1991, p. 115).

Hartmann & James define terminography as *complex of activities concerned with the design, compilation, use and evaluation of terminological dictionaries* (Hartmann & James, 1998, p. 139).
Collins English Dictionary define terminography as *compilation of the terminology used in a specific field.* (Collins English Dictionary. Available on: <https://www.collinsdictionary.com/submission/16359/terminography> [cit.2016-12-1].

6.1 Terminographical products

Terminographical products follow generally accepted *terminology practices, as standards, rules, conventions, and recommended procedures* (ISO 22128, 2008, p. 2).
Terminographical product is *terminology product consisting of a set of designations and terminological and/or linguistic information to support special language use* (ISO 22128, 2008, p. 2).

6.2 Terminology product

product that supports special language use or the field of terminology.
note: products that support special language use refer to dictionaries, databases, and other products for the dissemination of specialised terminology while products that support the field of terminology refer to journals, training manuals, tools, etc.
Terminology service is a service that involves the production and/or dissemination of terminology or terminographical products or supports education in the field of terminology.
Terminology products fall into four categories:
1. terminographical products,
2. terminology documents,
3. educational products,
4. terminology tools.

Terminographical product is the product category which includes all products that provide a terminology or terminologies and terminological and/or linguistic information to support special language use.
Terminographical product is the terminology product consisting of set of designations and terminological and/or linguistic information to support special language use (ISO 22128, 2008).
Terminographical product category represents the largest set of products and forms the core of the terminology products produced by terminologists.

This category includes:
1. printed terminologies,
2.electronic terminologies,
3. terminology databases,
4. systematic terminologies for information management,
5.terminology lists,
6.vetted terminologies,
7. terminology equivalents,
8. pictorial terminologies,
9. multimedia terminology products.
For more detailed information see international standard ISO 22128, 2008).

Terminology product verzus terminographical product

It is important to distinguish the terms *terminology product* and *terminographical product. Terminology product* is a product that supports special language use or the field of terminology, refers to dictionaries, databases, and other products for the dissemination of specialised terminology.

Terminographical product is a product category which includes all products that provide a terminology or terminologies and terminological and/or linguistic information to support special language use (systematic terminologies for information management.

There are the differences in terminology in International and national standards:

ISO standard defines the category of **terminographical products**, more specifically its subcategory of **printed terminologies**, into which dictionaries belong: "*This category includes any terminographical product that is a closed set of designations in one or more specialized fields of knowledge with some textual support for at least some of the entries and disseminated in printed form. It may contain some lexical entries. ... The products in this category may be called a dictionary, a specialized dictionary, a glossary, a vocabulary, a lexicon, or a terminology*" (ISO 22128:2008, p.4).

ISO 22128:2008 distinguishes monolingual, bilingual, and multilingual terminologies. "***A bilingual terminology*** *includes entries in two languages and may be called a lexicon, a bilingual glossary, a bilingual dictionary, or a bilingual vocabulary. It is arranged in alphabetical or sequential order, most often by the source language; the other language equivalents may be accessed with an alphabetical, sequential, or numerical index or a table of equivalents. The microstructure contains at least one term in each of the two languages, and one textual support element. There may be exceptions when one of the language pairs does not have a term for a given concept. Entries*

often have terminological and/or linguistic information in only the source language" (ISO 22128:2008. p.4-5).

Slovenská norma definuje typy slovníkov: ***Terminologický slovník*** *ako názvoslovná norma je súbor terminologických záznamov reprezentujúci informácie v jednom alebo viacerých jazykoch spolu s ekvivalentmi, ktoré sa vzťahujú na pojmy alebo označenia z jednej alebo viacerých špecifických tematických oblastí. V angličtine sa vo význame jednojazyčného zoznamu označení a definícií v určitej tematickej oblasti používa aj výraz glosár.*

Výkladový terminologický slovník *obsahuje označenia a definície; môže byť jednojazyčný, dvojjazyčný alebo viacjazyčný.*

Prekladový terminologický slovník *obsahuje zoznam označení spolu s ekvivalentmi v jednom jazyku alebo viacerých jazykoch. V angličtine sa vo význame jednojazyčného zoznamu označení a definícií nazýva aj glosár*" (STN ISO 1087-1: 2003).

EQUIVALENCE

Equivalence is the important part of comparative terminology work and the data in compiling dictionaries.

According to Bergenholtz and Tarp, **equivalent** "*designates the translation of the lemma or other source-language expression into the target language. ... there are different stages of equivalence, namely full, partial and zero equivalence ... Lemma is the lexicographical term for what is popularly referred to as entry word or headword*" (Bergenhotz, Tarp, 1995. p. 17).

Similarly, Gouws and Prinsloo claim that "*full equivalence prevails where a source language item, represented by the lemma sign, is co-ordinated with a single target language item, represented by a translation equivalent, and this one-to-one relation exists on both a lexical and a semantic level. ... The source language item and the target language item have exactly the same meaning, function on the same stylistic level and represent the same register. This implies that the target language item can be used as a translation equivalent of the source language item without any restrictions. ... Partial equivalence prevails where the source and target language items do not display a one-to-one relation. ... This can be on the lexical or the semantic level or on both lexical and semantic levels. ... Zero equivalence prevails where the target language has no item to be co-ordinated as a translation equivalent with a lemma representing a source language item. The lexicon of a language does not necessarily develop parallel to the lexicon of any other language*" (Gouws, Prinsloo, 2005. p.154-158).

TERMINOLOGY EQUIVALENCE

Cabré claims, that "**Terminological equivalence** is the key to multilingual terminology. The authors of bilingual or multilingual technical dictionaries often start

from the principle that terminologies reflect objective structures of the real world. In fact, the way the real world is reflected in the structure of a special language may not be the same across languages, especially in fields that are not highly structured such as arts and social sciences" (Cabré, 1999. p. 48).

We have categorized equivalents according to Gouws and Prinsloo, who speak about three main categories: full equivalents, partial equivalents and zero equivalents.

The two terms designating the identical concept are called **synonyms**. Some of the excerpts have synonyms in both English and Slovak languages.

According to STN ISO 10241, for the cases, when a definition of a concept is present but no term was found, or it does not exist, we use the symbol of five periods (.....), (STN ISO 10241: 2000).

6.3 STEM English/Slovak dictionary

Terminology planning are the activities aimed at developing, improving, implementing and disseminating the terminology of a subject field.

Note: involves all aspects of terminology work and has among other objectives the objective of achieving vocabulary control through such normative documents as thesauri and terminology standards.

ENGLISH SLOVAK – SLOVAK ENGLISH STEM DICTIONARY/VOCABULARY provides 272 bilingual entries and terminology units from Biology, Chemistry, Physics and Mathematics subject fields. It is the open dictionary and that is why it may be compiled continually within any entry and any scientific field, technology, or engineering. The teachers, specialists and students can add any term from STEM subject fields: science, technology, engineering, mathematics, biochemistry, biotechnology etc.

The abbreviation STEM relates to education and stands for Science, Technology, Engineering and Maths. STEM is related to a broader educational concept and the presented curricular reform. STEM is an approach to learning activities providing an enjoyable and engaging setting in foreign language education. STEM is in the project understood as the development in science education that integrates the mentioned subject fields and foreign language education.

STEM dictionary is one of the final practical outcomes of the national KEGA project No: 006UCM-4/2021-2023 and is closely related to key publication of the project SPECIALISED COMMUNICATION AND TERMINOLOGICAL LITERACY in foreign language education.

The macrostructure of printed terminology consists of title, fair use statements, acknowledgements, table of contents, English and Slovak explanatory notes and

abbreviations, preface, English STEM dictionary part, and Slovak STEM dictionary part and Appendix. The arrangement of the dictionary is mixed, the subject fields are fused into STEM domains alphabetically. The dictionary practically starts with English part with Slovak equivalent and continues with Slovak part with English equivalent.

The microstructure and the entries are ordered according to recommended international terminological and terminographical standards, and terminology work is inspired by Cabré bilingual terminology records, which are intended for multiple use in terminography and are friendly for special language use. Each entry consists of terminological, linguistic, and encyclopaedic information. The terminology dictionary entries, approved by specialists, linguists, and terminologist, contain an equivalent, subject field, definitions, contexts, and sources and degree of equivalence. Entries have at least one definition and one context, some entries have two definitions and two contexts as a textual match to see the existence and functioning of the term in specialised text and specialised communication. Some of an approved entries by project team have abbreviations, synonyms, formulas, or illustrations. The degree of equivalence designates specialists and experts and shows preferred, admitted, obsolate, deprecated terms. All the terms are exclusively excerpted from highly specialised texts, textbooks, encyclopaedias, taxonomies, ontologies, and contemporary scientific journals used as a material during the comparative terminology work. Two compilers of the dictionary are specialists and an experts from the Biology and Chemistry domain. Terminology work has three stages, consist of *excerption* the terms from specialised texts, *harmonisation* and *terminography*, the methodology, process and practical usage is the content of both publications.

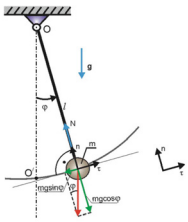
By the end of the using both publications educators, specialists and students should be able to recognise and use domain terminology, manage the linguistic and terminology information, verify the knowledge and information, excerpt the equivalents from parallel texts, discuss the designation of the concept with specialists, understand the usage of term in the context, manage the pre-translation process and translation process, and use accurate or preferred terminology equivalents in specialised communication and specialised translation. And finally, students should be able to transfer the knowledge or information to the specialised communication and professional life.

There are some samples of terminology dictionary entries:

TERM: matematické kyvadlo **EKV: mathematical pendulum**

ZDR/TERM: TEPLIČKA, I. 2020. *Fyzika pre maturantov a uchádzačov o štúdium na vysokých školách.* Bratislava: Enigma. ISBN 978-80-8133-038-4.
ZDR/TERM: KÚDELČÍK, J. – HOCKICKO, P. 2011. *Základy fyziky.* Žilina: Žilinská univerzita. ISBN 978-80-554-0341-0.
ZDR/TERM: ŠTOLL, I. 1995. *Mechanika.* Praha: ČVUT. [online]. [cit. 2023-15-2]. Dostupné na: <http://www.jaderny-prvak.8u.cz/wp-content/uploads/2013/02/Stoll-I.-Mechanika.pdf>.0

VO: FYZ
VZO/SKR/ILU/SYM:



DEF: Matematické kyvadlo je hmotný bod zavesený na závese s dĺžkou *l* pohybujúci sa účinkom tiažovej sily.
DEF: [Matematické kyvadlo] je to fiktívne kyvadlo, pričom jeho hmotnosť je sústredená v hmotnom bode zavesenom na nehmotnom závese dĺžky *l*.
DEF: Matematické kyvadlo představuje idealizovaný model tvořený hmotným bodem zavěšeným na nehmotném vlákně v tíhovém poli.
ZDR/DEF: TEPLIČKA, I. 2020. *Fyzika pre maturantov a uchádzačov o štúdium na vysokých školách.* Bratislava: Enigma. ISBN 978-80-8133-038-4.
ZDR/DEF: KÚDELČÍK, J. – HOCKICKO, P. 2011. *Základy fyziky.* Žilina: Žilinská univerzita. ISBN 978-80-554-0341-0.
ZDR/DEF: ŠTOLL, I. 1995. *Mechanika.* Praha: ČVUT. [online]. [cit. 2023-15-2]. Dostupné na: <http://www.jaderny-prvak.8u.cz/wp-content/uploads/2013/02/Stoll-I.-Mechanika.pdf>.
KON: [...], teda **matematické kyvadlo** je harmonický oscilátor.
KON: Vidíme, že perióda kmitov **matematického kyvadla** nezávisí od hmotnosti hmotného bodu, ale len od dĺžky závesu.
KON: Pro malé výkyvy je tedy **matematické kyvadlo** izochronní, t.j. jeho perioda nezávisí
na amplitudě a je rovna $T = 2\pi\sqrt{\frac{l}{g}}$.

ZDR/KON: TEPLIČKA, I. 2020. *Fyzika pre maturantov a uchádzačov o štúdium na vysokých školách.* Bratislava: Enigma. ISBN 978-80-8133-038-4.

ZDR/KON: KÚDELČÍK, J. – HOCKICKO, P. 2011. *Základy fyziky.* Žilina: Žilinská univerzita. ISBN 978-80-554-0341-0.
ZDR/KON: ŠTOLL, I. 1995. *Mechanika.* Praha: ČVUT. [online]. [cit. 2023-15-2]. Dostupné na: <http://www.jaderny-prvak.8u.cz/wp-content/uploads/2013/02/Stoll-I.-Mechanika.pdf>.
MIE/EKV: preferovaný

TERM: saturated solution EQU: nasýtený roztok
SOU/TERM: FLOWERS, P. – THEOPOLD, K. – LANGLEY, R. – ROBINSON W.R. 2019. *Chemistry 2e*. [online]. Houston : OpenStax. 2019. 555 p. [cit. 30.8. 2023] Available at:
<https://openstax.org/details/books/chemistry-2e>. ISBN 978-1-947172-61-6.
SF: CHEM
DEF: *Saturated solution* is when a solute's concentration is equal to its solubility, the solution is said to be saturated with that solute.
DEF: A *saturated solution* is a solution with the maximum amount of solute dissolved in it.
SOU/DEF: FLOWERS, P. – THEOPOLD, K. – LANGLEY, R. – ROBINSON W.R. 2019. *Chemistry 2e*. [online]. Houston : OpenStax. 2019. 555 p. [cit. 30.8. 2023] Available at :
<https://openstax.org/details/books/chemistry-2e>. ISBN 978-1-947172-61-6.
SOU/DEF: BALL, D.W. – KEY, J.A. 2014. *Introductory Chemistry – 1st Canadian Edition*. [online]. Victoria, B.C.: BCcampus. 2014. 918 p. [cit. 30.8. 2023] Available at :
<https://opentextbc.ca/introductorychemistry/>. ISBN 978-1-77420-003-2.
CON: A **solution** may be **saturated** with the compound at an elevated temperature (where the solute is more soluble) and subsequently cooled to a lower temperature without precipitating the solute.
CON: An example of the significance of entropy is that a **saturated** CsI **solution** is more than 60 times as concentrated as a solution of LiF (in molarity) in spite of the less favorable enthalpy change for the former.
SOU/CON: FLOWERS, P. – THEOPOLD, K. – LANGLEY, R. – ROBINSON W.R. 2019. *Chemistry 2e*. [online]. Houston : OpenStax. 2019. 564 p. [cit. 30.8. 2023] Available at :
<https://openstax.org/details/books/chemistry-2e>. ISBN 978-1-947172-61-6.
SOU/CON: MIESSLER, G.L. – FISCHER, P.J. – TARR, D.A. 2014. *Inorganic Chemistry*. Upper Saddle River : Pearson, 2014. 229 p. ISBN 978-0-321-81105-9.

DEG/EQU: preferred

Before compiling the dictionary, the terminology record has been compiled. Here is the sample one of them:

Terminology record: Sample of bilingual terminology record- Mathematics

1 ***(TER)*** Iracionálne číslo	2 ***(IDC)*** 2	1 ***(EQU)*** 1 (TER) irrational number	2 ***(IDN)***
3 ***(ZDR/TER)*** JONES C.et al.1999. Matematika na dlani, Bratislava. Príroda 1999. ISBN 80 07 010 10 6 Mihalíková, B., Ohriska, J.2012. Matematická analýza 1. Vysokoškolský učebný text. Košice, Univerzita P. J. Šafárika. Košice 2012		3 ***(SOU/TER)*** ATTWOOD G. et al.2017. Pure Mathematics, YEAR 1/AS, London, Pearson.2017. ISBN 978 1292208268 NELSON, D. 2003. Dictionary of Mathematics. London. Penguin Books 2003.	
4 ***(SYN)***		4 ***(SYN)***	
5 ***(VO)*** PV – MAT		5 ***(SF)*** NS – MAT	
6 ***(SKR)*** M		6 ***(ABBR)*** M	
7 (KON) Číslo e je *iracionálne číslo* , je základom prirodzeného logaritmu a má v matematike významnú úlohu. Vedeli napríklad, že dĺžka uhlopriečky jednotkového štvorca (čo je podľa Pytagorovej vety druhá odmocnina z dvoch) je iracionálne číslo?		7 ***(CON)*** 7 (CON) Surds are examples of *irrational numbers*.	
8 ***(ZDR/KON)*** JONES C.et al.1999. Matematika na dlani, Bratislava. Príroda 1999. ISBN 80 07 010 10 6 Mladý vedec. Most pri Bratislave: Apromod 2017, roč. 11, č. 33. MIHÁLIKOVÁ, B., OHRISKA, J.2012. Matematická analýza 1. Vysokoškolský učebný text. Košice, Univerzita P. J. Šafárika. Košice 2012		8 ***(SOU/CON)*** ATTWOOD G. et al.2017.Pure Mathematics, YEAR 1/AS, London, Pearson.2017. ISBN 978 1292208268 ALLENBY, J. 1985. Rings, fields, and groups: introduction to abstract algebra. British National Corpus	
9 ***(DEF)*** Reálne číslo, ktoré nie je racionálne.		9 ***(DEF)*** Irrational numbers cannot be written in the form __a b where a and b are integers.	

<table>
<tr><td colspan="2">10 (ZDR/DEF)
JONES C.et al.1999. Matematika na dlani, Bratislava. Príroda 1999. ISBN 80 07 010 10 6
MEDEK, V. et al.1975. Matematická terminológia. Bratislava.SPN 1975.</td><td colspan="2">10 (SOU/DEF)

ATTWOOD G. et al.2017.Pure Mathematics, YEAR 1/AS, London, Pearson.2017. ISBN 978 1292208268

NELSON, D. 2003. Dictionary of Mathematics. London. Penguin Books 2003.</td></tr>
<tr><td colspan="2">11 (MIE/EKV)</td><td colspan="2">11 (DEG/EQU)</td></tr>
<tr><td>12 (AUT)
M. H.</td><td>13 (DAT)
9.6.2022</td><td>12 (AUT)
M. H.</td><td>13
(DATE)
9.6.2022</td></tr>
</table>

STEP 7: In the chapter you can understand some methods and techniques of teaching science and specialised vocabulary and terminology. The instructional sheets for teachers are available, it is the manual for educators how to add another sheet and subject field.

7 TEACHING SPECIALISED VOCABULARY AND TERMINOLOGY

The chapter discusses specific methodology and strategies used for teaching terminology of Science as a subject provided at high schools in the English-speaking countries and compares the system differences in teaching the subjects of natural sciences at secondary vocational schools in Slovakia. To make the educational process more attractive and entertaining for secondary school students, the teacher is supposed to use activities that motivate students to arouse their interest and engagement in the subject. The age differences and individual approach to the students are a big challenge for every teacher who wants their pupils to be eager to learn new issues connected with various subject fields within Science. The chapter offers a set of activities and games that can be used for teaching specialised vocabulary of sciences – mathematics, chemistry, biology, physics, geography – and techniques for demonstrating and acquisition of new vocabulary. It also presents the research results achieved for traditional as well as for innovative approach in the educational process.

Terminology is the specialized vocabulary of a particular subject field of study. Teaching is a complex professional mastery that involves the imparting of knowledge and skills to students. To effectively communicate in the educational process, it is essential to have a shared understanding of the terminology used. Reflecting the needs of labour market, theory and practice testify the fact that specialized communication, documentation of knowledge and the use of relevant terminology as well as the appropriate quality of foreign language education supported by well-prepared specialized dictionaries currently require increased attention in the Slovak society. Pedagogical and professional observations and experience, as well as research activities in the field of specialized communication and language users' reality, convince the learners of the fact how urgently contemporary society needs to reevaluate and increase terminological literacy and culture. It is important for students to learn terminology in order to understand and communicate effectively in various subject fields.

One of the fundamental reasons for using consistent teaching of terminology is to ensure effective communication within the educational community. As an expert on didactics Marzano states, "Terminology provides a common language, allowing educators to communicate effectively about teaching strategies, curriculum, and student progress" (Marzano, 2007, p. 37). When educators use shared terminology, they can precisely articulate concepts, instructional methods, and assessment strategies. This clarity fosters a deeper understanding among colleagues, making it easier to collaborate, exchange ideas, and learn from one another´s experience. Additionally, teaching terminology plays a crucial role in promoting student-centred learning environments. It enables educators to communicate their expectations clearly, facilitating student comprehension and engagement. Quoting an educational psychologist Hattie, "When teachers and students share a common language of learning, it becomes easier for students to understand what is expected from them and make progress" (Hattie, 2012, p. 76). Students benefit from a consistent use of terminology, as it provides them with a clear framework for its understanding.

There are many ways to teach terminology. One common approach is to introduce the terms one at a time, providing definitions and examples. This can be done in a lecture, a textbook, or a handout. Another approach is to immerse students in the terminology by having them read and listen to texts that use the terms of a selected specific subject field. This can be done by assigning readings, listening to lectures, or watching videos. It is also important to help students understand the relationships between terms. This can be done by providing a glossary of terms, creating concept maps, or using Venn diagrams. It is also important to help students understand the relationships between terms, which could be achieved not only by traditional teaching methods, but also by more entertaining activities which are presented in the following part of the publication.

Many educators think that the student learns terminology automatically in vocational and dual education. And what is more, the special knowledge and terminology are not reflected in the textbooks used at secondary foreign language education. Foreign language teaching at vocational schools should be also focused on acquisition of relevant terminology. However, the educators and students do not have enough teaching materials to rely on. At Slovak schools, only textbooks aiming the learning of general English are used. English language textbooks prevailingly come from publishing houses abroad, e.g., Oxford university Press, Cambridge. They are only manifested in the English, which could be considered for both an advantage as well as for a disadvantage according to the point of view we look at it. The educators should understand the difference between the norms of the mother tongue

and of the English language, and urgently practice the phenomena breaking the Slovak language codified rules, as a preference for native language.
"Even though borrowing from other language is an accepted form of term creation, native language expressions should be given preference over direct loans" (ISO 704). That is why the teaching and learning material reflects the linguistic, conceptual, and cultural similarities, and term formation methods.

7.1 Teaching general vocabulary

According to Brown, teaching is showing or helping someone to learn how to do something, giving instructions, guiding in the study, providing with knowledge, causing to know or understand. He further states that teaching is guiding and facilitating learning, enables the learner to learn setting the condition for learning (Brown, 2006). Students who struggle to acquire new vocabulary may have generalized linguistic deficiencies, memory deficits, poor word learning strategies, or any combination of the three (Baker, Simmons, Kameenui, 1998).
The first step in planning for vocabulary instruction is to identify the words students are expected to learn. Suggestions to guide them in this decision-making process are:
– select words that are common and useful for students to remember. Prepare a list of words that students will find and use frequently, which represent common knowledge (Marinak, Moore, Henk, Tomasetti, 2000).
– identify words that are essential for understanding a selected text (ibid.).
Another requirement for a successful vocabulary acquisition is to know whether a word/ words, or a term/ terms students are required to understand is/ are crucial for them, or if understanding them only contributes for them as an additional information. When academic demands require a deep level of understanding the terms, it is important for the students to be able to form the sentences on their own by using the newly acquired words, to see connections between new and prior knowledge, and to apply word meanings across contexts (Baker et al., 1999).

7.2 General guidelines for teaching vocabulary/terminology

- It is helpful to keep in mind several general principles that facilitate acquisition of new vocabulary.
- Teach new words in the context of a meaningful subject-matter lesson and facilitate student discussion that requires students to use the new word (Ellis, Farmer, 2002).

- Ensure that students hear the correct pronunciation of the word and practice saying it aloud. Hearing the syllable structure and stress pattern of the word facilitates its storage in memory (Fay, Culter, 1977).
- Teach word parts – root words, base words, prefixes, and suffixes that students will encounter frequently (Jones, 2014).
- Teach words in related clusters to help students understand how words are related and interrelated (Marinak, et al., 2000).
- Identify examples/applications and no examples/no applications related to the meaning of the new word (Ellis, 2002).
- Help students connect new vocabulary to something with which they are already familiar (Ellis, 2002).
- Create opportunities for students to paraphrase the definition of a new term so that they can identify the main idea associated with the term and recognize specific bits of information (Ellis, 2002).
- Offer students the opportunity to acquire new vocabulary using a variety of learning modalities or formats that actively engage them in the learning process (Ellis, 2002). After you have strategically selected vocabulary words for instruction and determined the appropriate instructional goals for chosen terms, it is time to identify instructional strategies.

7.3 Methods and techniques in teaching special vocabulary

Method is a set of assumptions dealing with the nature of language, learning and teaching. It is an overall plan for systematic presentation of language based on a selected approach (Richards, Rodgers 2001). The term *teaching method* refers to the general principles, pedagogical and management strategies used for classroom instruction. Choice of a teaching method depends on educational philosophy, classroom demographic, subject area(s) and school mission statement. Using only one method is not a perfect option, but a combination of more methods has proven to be an efficient way for learning and teaching a foreign language.

Commonly, there are several techniques concerning teaching vocabulary. The main aim of English teachers is to teach students new vocabulary they will remember. It needs to be learnt, acquired, practised and revised to prevent students from forgetting. Techniques employed by educators depend on some factors, such as content, time availability, and its value for the learners (Takač, 2008). Educators usually combine more than one technique, instead of employing one single technique. Educators, furthermore, are suggested to employ planned vocabulary presentation as various as possible (Pinter, 2006).

Here are some techniques of teaching vocabulary as stated by Brewster, Ellis, and Girard (1992):

a. Using objects.

Names of many things can be taught by showing actual objects. It gives real experience and sense to the learners. Our memory for objects and pictures is very reliable and visual techniques can act as cues for remembering words (Takač, 2008).

b. Drawing and using illustrations and pictures.

For students, drawing can be a fun way to present and explain vocabulary. It is not necessary that an educator is an expert in drawing pictures accurately. You can even have students do their own drawings. Drawings can be used to explain the meaning of things, actions, qualities, and relations (Brewster, Ellis, and Girard, 1992). There are many dictionaries using illustrations or pictures. The list of pictures includes posters, flashcards, wall charts, magazine pictures, board drawings, stick figures and photographs. Visual support helps learners understand the meaning and helps to make the word more understandable and memorable (Brewster, Ellis, and Girard, 1992).

c. Mime, expressions, and gestures

Klippel (1994) implies that mime or gesture is useful if it emphasizes the importance of hand and facial expression in communication. Many words can be presented and demonstrated by mime, expressions, and gestures. Several studies have emphasized the role of gestures in second language (L2) acquisition (Gullberg, 2008). Educators tend to exaggerate using gestures (Cafferty, Stam, 2008), especially when addressing young learners and/or beginners. Teaching gestures appear in various ways: hand gestures, facial expressions, pantomime, body movements, etc. This teaching strategy is quite relevant for comprehension (Gullberg, de Bot, 2010).

d. Guessing from context.

Guessing from context as a way of dealing with unfamiliar vocabulary in unedited selections has been suggested widely by L1 and L2 reading specialists (Dubin, 1993). There are two types of contexts:

The first type is the context within the text, which includes morphological, semantic and syntactic information in a specific text, the second one is the general context, or non-textual context, which is the background knowledge the reader has about the subjects being read. Learning from context not only includes learning from extensive reading, but also learning from taking part in a conversation, and learning from listening to stories, films, television or the radio (Nation, 2001).

There are many clues' learners can use to establish meanings for themselves, such as illustrations, similarity of spelling or sound in the mother tongue, and general knowledge (Walters, 2004).

Many teaching tools for monolingual or bilingual teaching and learning vocabulary and terminology could be used: pictures, exercises, videos, songs that can change the learners' mood, can positively influence their motivation, support listening skills and pronunciation and provide pleasure for vocabulary learning. In case of monolingual teaching terminology at the beginning of the process through the pictures, exercises, games, videos from various subject fields the educators might use YouTube videos (for example: English animals, drinks, sports terminology, IT terminology etc.)

available at British council or generally available at:

https://learnenglishteens.britishcouncil.org/vocabulary/a1-a2-vocabulary/animals,

http://learnenglishteens.britishcouncil.org/grammar-vocabulary/vocabulary-exercises/drinks,

https://www.youtube.com/watch?v=EubqKQJVykI&list=PLB5FA6386429DAA17 , https://www.youtube.com/watch?v=HaPCvDqaVg0&list=PLB5FA6386429DAA17 .

Jeremy Harmer considers music a powerful stimulus for language learning. He sees the song as one of the tools for teaching listening. Before getting started the trying to speak a foreign language, i tis recommended to spend some time tuning the learner´s ears to its sounds via a song (Harmer, 1991, 242-45). The text of each song is a source of new vocabulary/terminology in a specific and meaningful context, topic, and subject field. Each song reflects the age differences and individual approach to the students. Vocabulary and terminology phrases introduced in this way are easier to remember and are stored in the learners' memory for a longer period of time. Sports Terminology songs is a good example for practicing it, e.g. https://learnenglishkids.britishcouncil.org/en/songs/the-busy-buzz-song

Playing games is an integral part of learning and acquiring knowledge in childhood. The games not only increase motivation, but they are also one of the most important ways of learning. When learners understand the meaning of each term, the fixation phase occurs.

Some of the games and other entertaining activities are presented in this publication to make the learning of the terms of natural sciences easier. They are recommended to be used especially in the phase of repetition and fixation. Pupils can match and join the English terms with their definitions by playing bingo, domino, by listening

to songs, they can create conceptual maps, complete crossword puzzles as well as play memory game. The problem of an English teacher is lack/ non-existence of a bilingual Slovak-English or English-Slovak dictionary of natural sciences.
Preparing and using didactic games helps motivate the learners. They not only check and repeat what they already know, but further develop their knowledge as well as skills. The games are based on matching pairs.
Here is a list of popular games and activities which can be used to present new vocabulary by non-traditional teaching activities:

Bingo

A popular activity is *Bingo*. The educator prepares specific cards with the terms (a different term on each card plus the symbols on another set of cards) and gives them to students. Then the educator asks students one by one to match the words with the pictures/ photos of correctly transcribed terms. Students carefully follow whether the corresponding term occurs on their card. If they find it, they create pairs of the term plus a corresponding task. The winner is the student / pair or group who has paired all the cards and shouts − Bingo first (Dolz, English File poster).
Another way how to play *Bingo* is by using small cards placed on a large rectangular playing card. By matching relevant terms, relationships, graphs, or definitions, the learners finally come to a pattern. The aim of the game is to find the pairs, put them together and fill the whole surface of the playing card. None of the two different statements could be matched to one concept. The game can be played in groups or by an individual. The aim of the game is to quickly and correctly assemble a pattern whose shape is predetermined. Bingo requires a precise understanding of the terms, concepts, and statements it contains.

Domino

This game is based on the Domino children's game, contains two numbers, one on the right side and the other on the left one. The aim of the game is to match the same numbers, terms together to create the longest possible row.
The domino presented in this publication contains numbers and units of physics quantities. The goal of this game is to match the statements related to one another. The dominoes connected in this way form a strip or circle.
Crossword puzzle
The learners acquire new terminology in a funny way to complete the terms and expressions, find connections and relationships between the words. This activity is

suitable for creating a pleasant, relaxed atmosphere during a lesson. It avoids stress of a possible failure of the learner.

Memory game
This game could be used in the motivation phase. It is recommended to be played in pairs. Each set of cards can be focused on practicing terminology of a different subject field, e.g., physics, chemistry, biology as well as other domains of natural sciences.

Term shopping
It is another way of improving students 'awareness and usage of appropriate term meaning. The educator prepares a poster with terms from a corresponding area/ subject field which are to be practised by the learners. A possible beginning of this game is the sentence − "Yesterday, I went shopping and I bought…" – now, say a term - or "I went for a walk, and I saw…" – now, say a term. The students take turns, each of them repeats what they have heard previously and adds one more term from the same field that is being practised (Lee, English File poster, 2001)

Password
This is a name of quite a funny activity. The educator chooses the specific term being used as a password of the day. No student is allowed to leave the classroom without saying the password correctly. Learners can also check whether they are able to transcribe selected "password words" correctly.

Songs
Music can be a great way to connect the students. Even the learners who are not fluent enough in English are often able to quote the lyrics of popular songs, which makes this material an ideal resource for teaching the students correct grammar structures, or vocabulary. On the other hand, some of the texts include incorrect grammar or inappropriate vocabulary, so the educator must carefully select them as a suitable teaching material. Songs contain authentic language (which need not always be considered positive), are entertaining, motivating, and are also a funny way of learning a foreign language. After having introduced the song, the educator is supposed to allow the learners to watch and listen to the song more times to become familiar with it. Before listening to the song, the educator clearly explains what they expect from the students to do regarding the text. While listening to the song, the educator can stop the recording in regular intervals for the learners to make notes, order the pictures, answer the questions, or fill in the blanks (according

to the activities required). After listening, the learners do some additional activities using worksheets: write the missing words in a gapped song, put the jumbled lines of a song in the correct order, circle, or tick pictures of the objects included in the song, complete the gaps, match half-lines, give true/false statements.

Guess what?
This is an entertaining activity, when the educator shows images, flashcards, maps, models, objects of laboratory equipment, or diagrams to challenge the students to guess the topic/ subject field the terminology of which is about to be presented to the learners by the educator at a specific foreign language lesson.

Brainstorming
Before getting started this activity, the educator presents an overview of the topic of the lesson as well as the basic vocabulary connected to it. The students draw mind maps on the board with the words, expressions and/ or terms trying to find certain connections between the vocabulary and the topic to be discussed.

Pair work
One of a high amount of the activities suitable for the pair work could also be targeting training and practicing new or newly acquired vocabulary. The educator gives each student cards with new words, terms, or expressions. The learners explain the words/ expressions to one another in a pair. They can use a dictionary if they need to. To conclude the relevant educational results, checking and feedback from the educator as well as from the rest of students in the group/ class is required. Other possible activities include a so-called Chinese whisper, graphic organizers, note-taking, miming, or many other activities found on the internet/ using various foreign-language applications/ competitions. It depends only on the educator which of the activities they consider the most appropriate owing to the learners´ age, level of knowledge, and the educational objective.

Gap filling
The educator gives pupils a worksheet and asks them to fill in the blanks as they are listening to the passage. Another activity that pupils can do to better their critical thinking is erasing parts of the text and then asking students to fill in the blanks with phrases they remember (**disappearing words**).

Quiz

The educator asks the students to prepare a set of questions that another student will have to respond to. They can prepare a multiple-choice quiz, short-answer questions, or true and false statements.

Some activities that could be entertaining and useful for presenting and acquiring specialised terminology are demonstrated in this chapter. Creative and flexible educators vary teaching materials and methods to reach what they expect from the students. The materials used for motivating students to learn a foreign language should be relevant and the goals set achievable. It is best if the selected activities are challenging and inspiring.

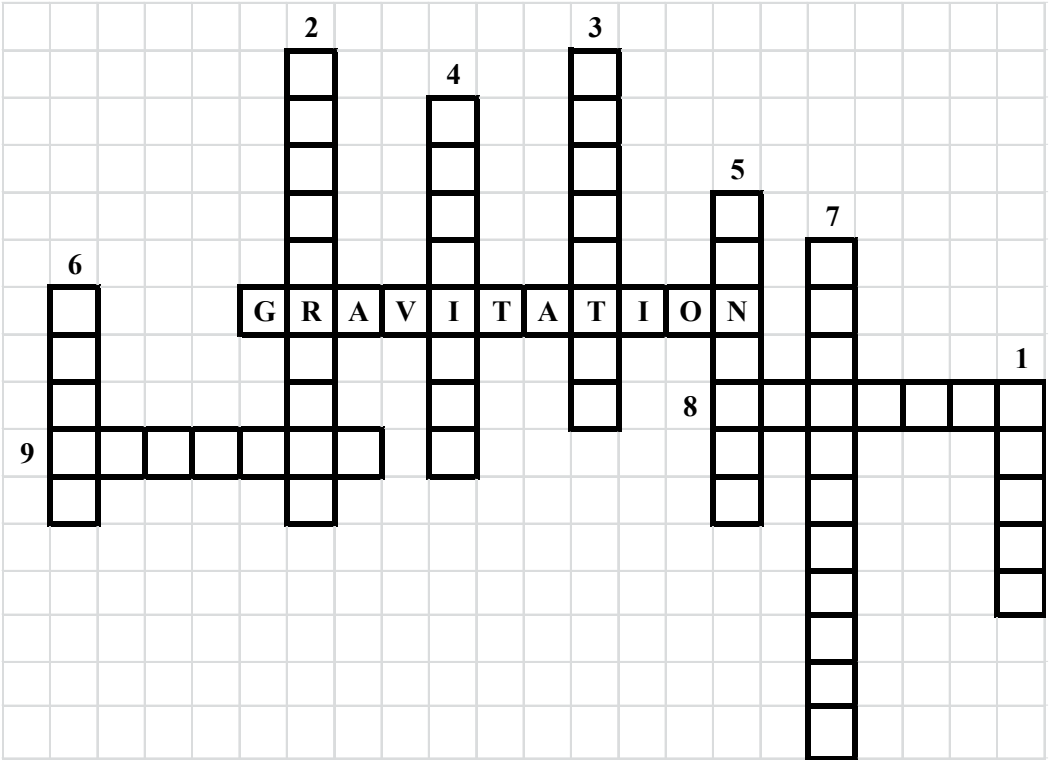
Good educators aim at inspiring, challenging, and motivating their students to make the best possible progress in learning. Besides, providing learners with regular feedback is also crucial and considered extremely effective in achieving success in the educational process. The educator´s fundamental goal is to prepare fluent, self-confident graduates who can use their knowledge in the future career. Particularly, teaching and learning foreign languages have their own specifics. Not only new cultural, historical, or geographical facts, but also mastering both productive and receptive skills, correct grammar, rich vocabulary with notional as wells as specialised words (terms) and correct pronunciation contribute to the learner´s fluency and to achieving success in the overall educational process.

Most of the English non-native learners see pronunciation as one of the most difficult aspects in learning English. Teaching "correct", the most accurate pronunciation to non-native English learners should also be an inevitable part of the educational process targeting foreign language learning. Training the most accurate and imitating the most authentic pronunciation should also be a part of terminology lessons. (Instructional sheet 20 offers some ideas how to check pronunciation of the learners in an entertaining, funny way.)

8 INSTRUCTIONAL SHEETS FOR EDUCATORS

8.1 SHEET 1: Thermal physics-crossword puzzle

FIELD	PHYSICS – THERMAL PHYSICS
AIM	TEACHING VOCABULARY/TERMINOLOGY - ENERGY
TASK	CROSSWORD PUZZLE
INTERACTION	INDIVIDUAL WORK/ GROUP WORK
DURATION	15 minutes
MATERIALS	instructional sheet 1, interactive blackboard, blackboard, chalk, pencil, paper
INSTRUCTIONS	Complete the crossword puzzle. Use the clues to make meaningful words.

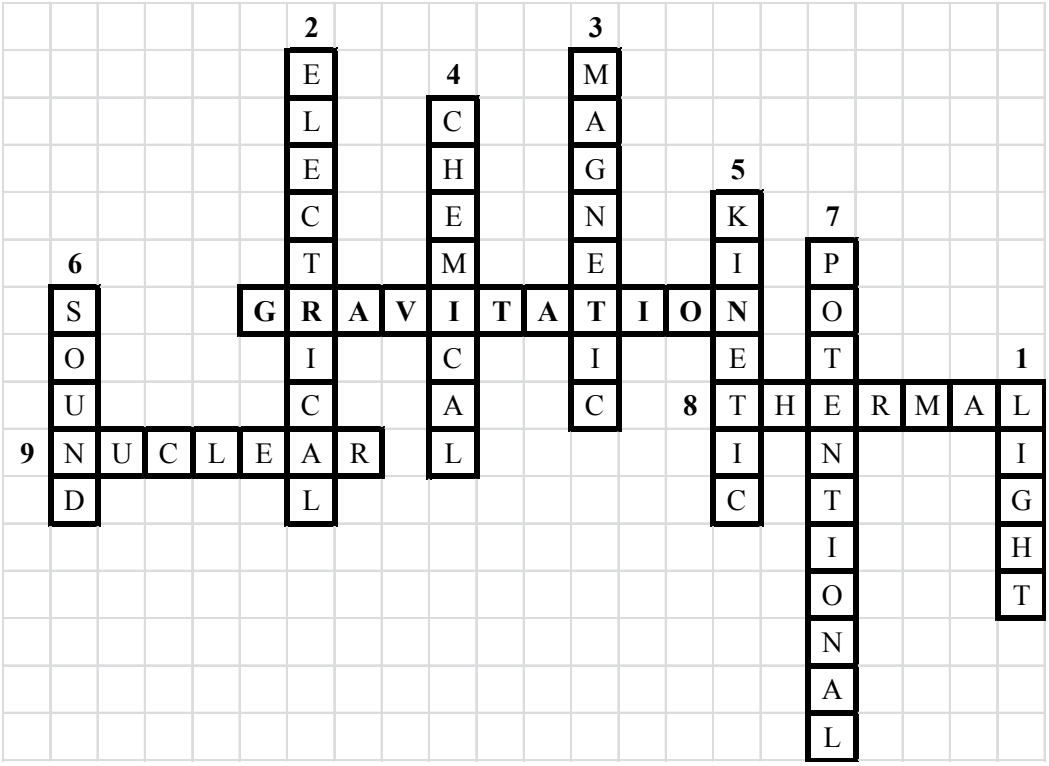


VERTICALLY:

1 An energy which conveys illumination and heat
2 The energy due to the flow of charged particles
3 The potential energy of magnet
4 An energy which is stored in food, fuel and batteries
5 Energy within moving objects
6 Energy caused by an object's vibrations
7 Energy an object has because of its position

HORIZONTALLY:

8 A form of kinetic energy which is related to temperature
9 The energy stored in the nuclei of atoms



8.2 SHEET 2: Physics. Mechanics. BINGO

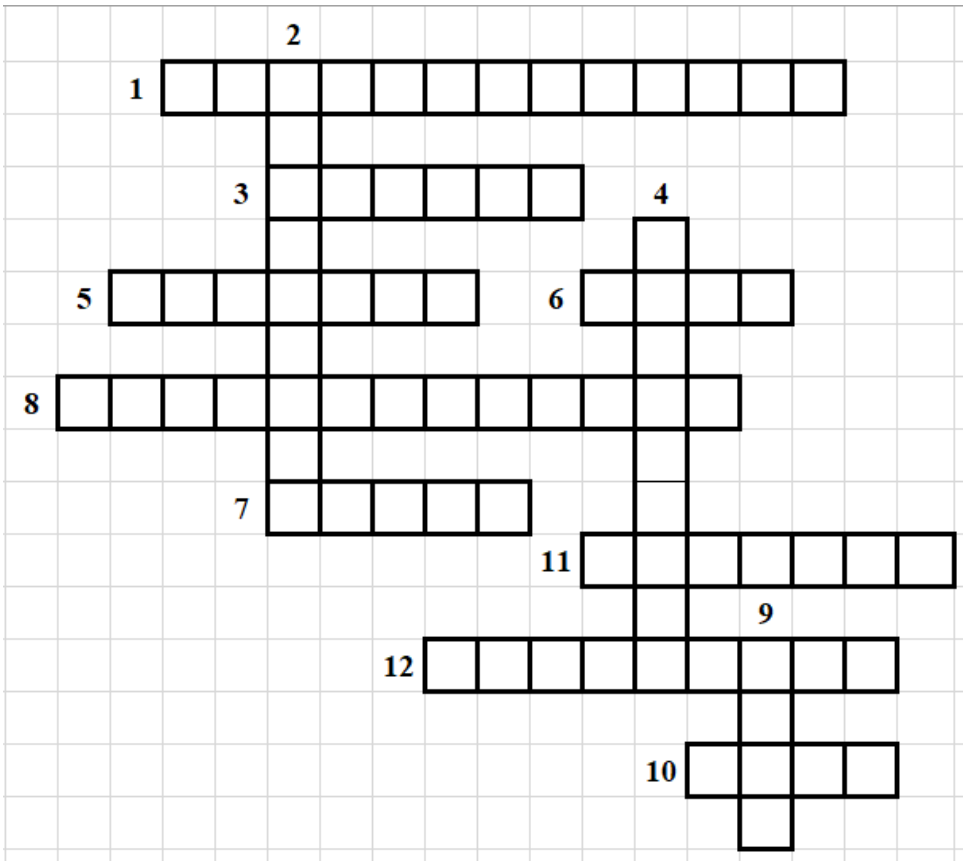
FIELD	PHYSICS - MECHANICS
AIM	TEACHING VOCABULARY/TERMINOLOGY - MECHANICS
TASK	BINGO: MATCHING – TRANSLATION EQUIVALENTS
INTERACTION	INDIVIDUAL WORK/ PAIR WORK
DURATION	10 minutes
MATERIALS	instructional sheet 2, scissors
INSTRUCTIONS	Find and pick up the pairs of cards - match translation equivalents. After having matched all the pairs, the winner shouts “bingo “.

BINGO		
Average speed	Physical quantity	Unit of measuremen
tLength	Trajectory of motion	Unit of length
Meter per second	Inclined plane	Car
Stop watch	Time	tape measure
Do an experiment	Valuecal	culation
Velocity	Velocity formula	acceleration
Science	Wheel	simple machines
force	kilometer per hour	linear acceleration

BINGO		
Priemerná rýchlosť	Fyzikálna veličina	Fyzikálna jednotka
Dĺžka	Dráha pohybu	jednotka dĺžky
Meter za sekundu	Naklonená rovina	Auto
Stopky	Čas	meracie pásmo
Robiť pokus	Hodnota	výpočet
Rýchlosť	v = s/t	zrýchlenie
veda	koleso	jednoduché stroje
sila	kilometer za hodinu	rovnomerné zrýchlenie

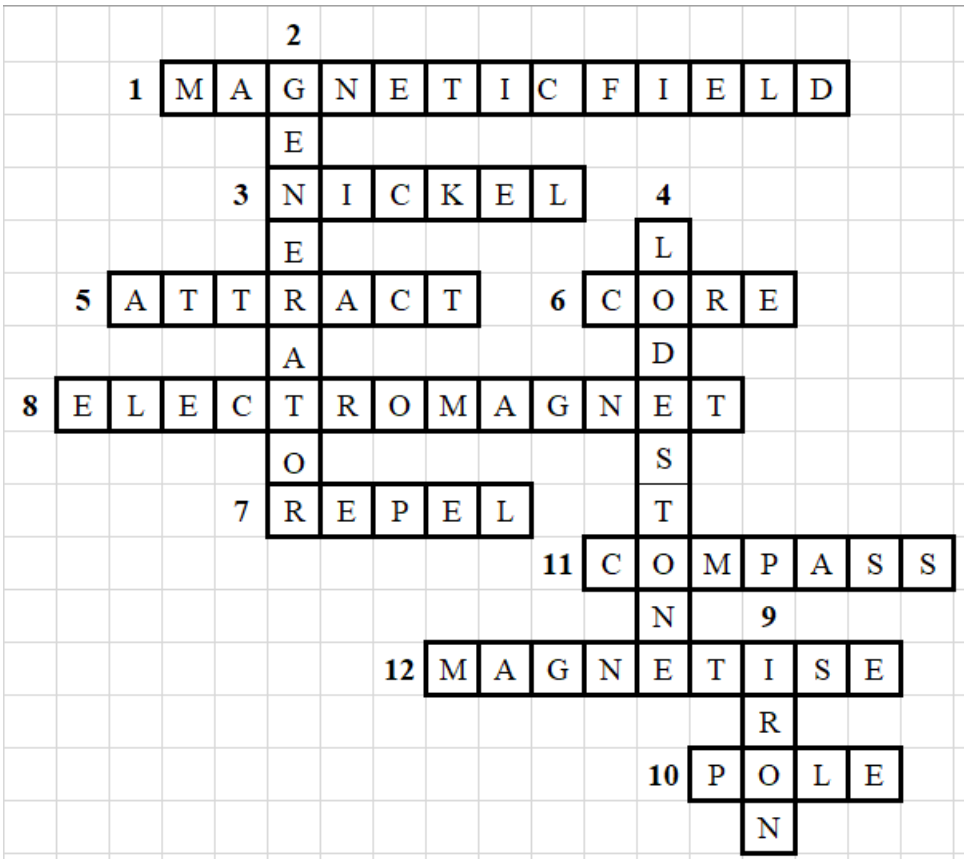
8.3 SHEET 3: Physics. Magnetic subfield. Crossword puzzle

FIELD	PHYSICS – MAGNETIC SUB FIELD
AIM	TEACHING VOCABULARY/TERMINOLOGY – MAGNETIC SUB FIELD
TASK	CROSSWORD PUZZLE – MAGNETIC FIELD
INTERACTION	INDIVIDUAL WORK/ GROUP WORK
DURATION	15 minutes
MATERIALS	instructional sheet 3, interactive blackboard, blackboard, chalk, pencil, paper
INSTRUCTIONS	Complete the crossword puzzle. Use the clues to make meaningful words.



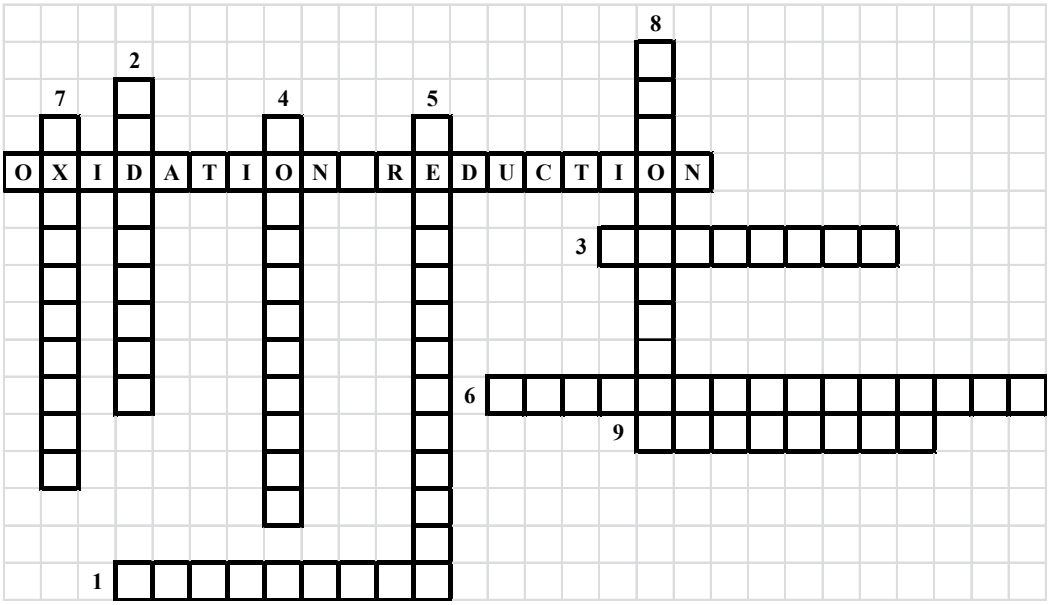
VERTICALLY:
2. A device that uses a magnet to produce electricity
4. A piece of magnetite.
9. Strong, hard metal used as material for construction (Fe).

HORIZONTALLY:
1. Field Area around magnet.
3. Magnetic metal often uses in jewellery (Ni).
5. Pulled together.
6. The metal bar in the middle of an electromagnet.
7. Liked poles pushed apart.
8. A temporary magnet formed by an electric current.
10. End of a bar magnets where magnetic force is the strongest.
11. Instrument that shows the direction of magnetic north.
12. To make an object magnetic.


2
1 MAGNETICFIELD
E
3 NICKEL
4
E
L
5 ATTRACT
6 CORE
A
D
8 ELECTROMAGNET
O
S
7 REPEL
T
11 COMPASS
N
9
12 MAGNETISE
R
10 POLE
N

8.4 SHEET 4: Chemistry. Chemical reactions. Crossword puzzle

FIELD	CHEMISTRY
AIM	TEACHING VOCABULARY/TERMINOLOGY – CHEMICAL REACTIONS
TASK	CROSSWORD PUZZLE – TYPES OF CHEMICAL REACTIONS
INTERACTION	INDIVIDUAL WORK/ GROUP WORK
DURATION	15 minutes
MATERIALS	instructional sheet 4, interactive blackboard, blackboard, chalk, pencil, paper
INSTRUCTIONS	Complete the crossword puzzle. Use the clues to make meaningful words.



VERTICALLY:

2 Process whereby a reactant in chemical reaction gains one or more electrons.

4 Chemical reaction in which a single product is produced from two or more reactants.

5 Chemical reaction in which a single reactant is converted into two or more simpler substances.

7 Chemical reaction in which energy is released as the reaction occur.

8 Chemical reaction in which a continuous input of energy is needed for the reaction to occur.

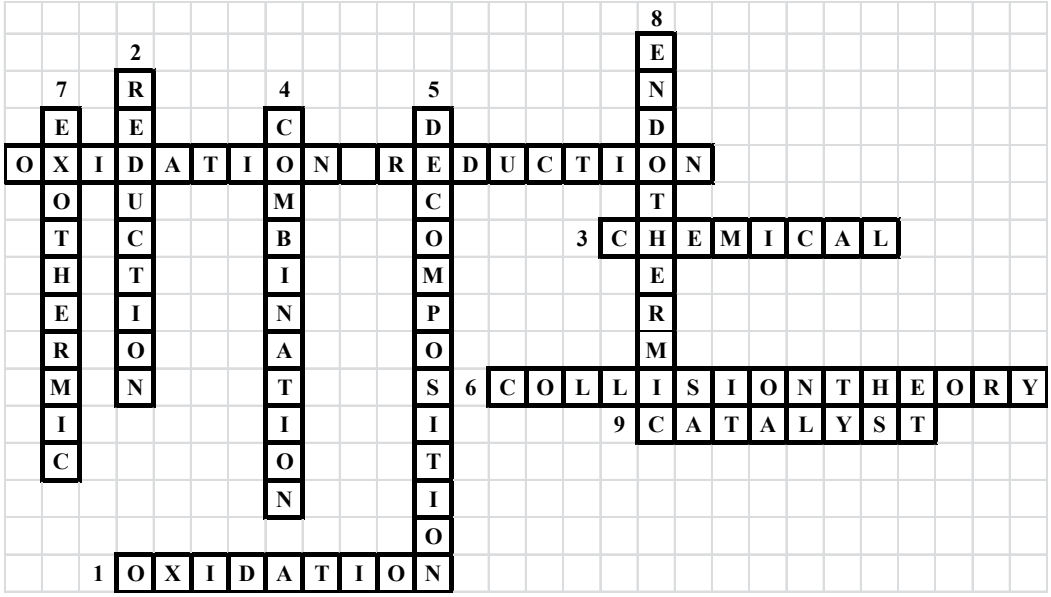
HORIZONTALLY:

1 Process whereby a reactant in chemical reaction loses one or more electrons.

3 At least on new substance is produced as a result of a chemical change.

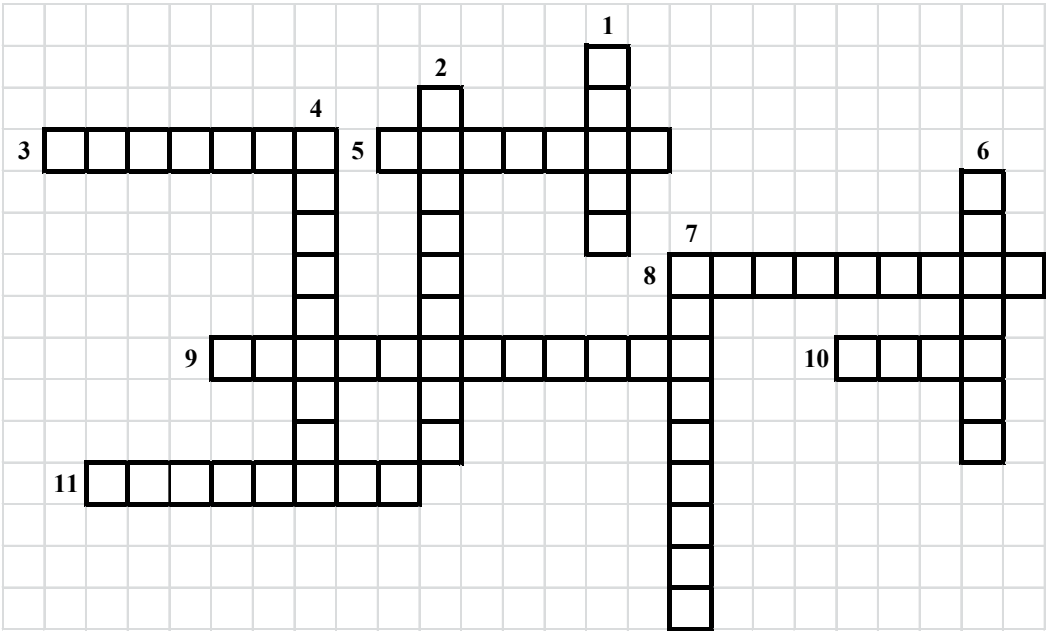
6 Set of statements that give the conditions necessary for a chemical reaction to occur.

9 Substance that increases the rate of a chemical reaction without itself undergoing any permanent chemical change.



8.5 SHEET 5: Chemistry. Chemical processes. Crossword puzzle.

FIELD	CHEMISTRY
AIM	TEACHING VOCABULARY/TERMINOLOGY – CHEMICAL PROCESSES
TASK	CROSSWORD PUZZLE – TYPES OF CHEMICAL PROCESSES
INTERACTION	INDIVIDUAL WORK/ GROUP WORK
DURATION	15 minutes
MATERIALS	instructional sheet 5, interactive blackboard, blackboard, chalk, pencil, paper
INSTRUCTIONS	Complete the crossword puzzle. Use the clues to make meaningful words.



VERTICALLY:

1 Mixture of metals

2 Destruction of a material by chemical reaction with substances in the environment

4 Material made from two or more different materials (made up of several parts)

6 Limited in size or extent

7 Natural resource or source of energy that is not depleted by use such as water, wind...

HORIZONTALLY:

3 Non-metal solid with the high melting point, made of clay

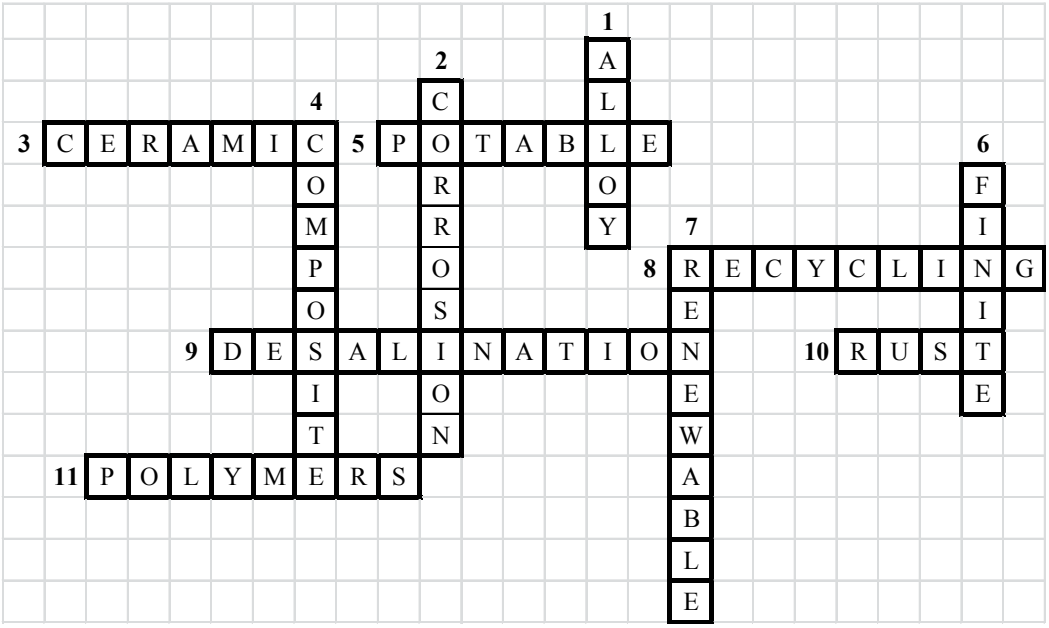
5 Water that is safe to drink

8 The action or process of converting waste into reusable material

9 Process of removing dissolved substances from seawater

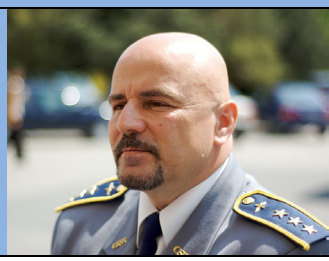
10 Corrosion involving iron and oxygen

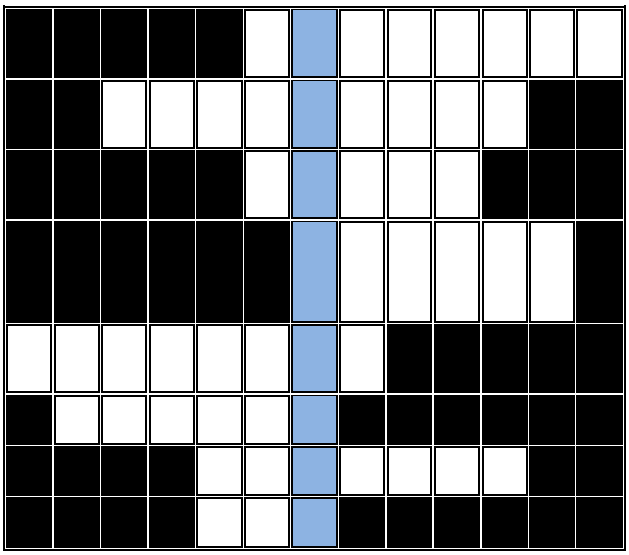
11 Often plastic, made of monomers



8.6 SHEET 6: Physics. Space.

FIELD	PHYSICS - SPACE
AIM	TEACHING VOCABULARY/TERMINOLOGY – SPACE
TASK	CORRECTING MISTAKES, FILLING BLANKS, CROSSWORD PUZZLE, PROOFREADING
INTERACTION	INDIVIDUAL WORK/ GROUP WORK/ PAIR WORK
DURATION	15 minutes
MATERIALS	instructional sheet 6, interactive blackboard, blackboard, chalk, pencil, paper
INSTRUCTIONS	Fill in the blank spaces. If you find a grammar mistake, correct it. Then complete the crossword puzzle. Use the clues to make meaningful words.

P H Y S I C A L C R O S S W O R D	
	IVAN BELLA was born 25.5.1964 in Brezno. He is slovak _____.



Small, planet like objects found mai between Mars and Jupiter.

Made up of the hydrosphere, lithosp and the atmosphere – where all life

Largest of the Inner planets in the s system.

Made up of icy dust particles and fr gases, they look like bright balls, wi long tails.

Gas that composes 78% of the Earth atmosphere.

A space entirely devoid of matter.

Force that pulls objects toward each

The star round which the earth orbit

■	■	■	■	■	A	**S**	T	E	R	O	I	D
■	■	B	I	O	S	**P**	H	E	R	E	■	■
■	■	■	■	■	E	**A**	R	T	H	■	■	■
■	■	■	■	■	■	**C**	O	M	E	T	S	■
N	I	T	R	O	G	**E**	N	■	■	■	■	■
■	V	A	C	U	U	**M**	■	■	■	■	■	■
■	■	■	■	G	R	**A**	V	I	T	Y	■	■
■	■	■	■	S	U	**N**	■	■	■	■	■	■

Small, planet like objects found mai between Mars and Jupiter.

Made up of the hydrosphere, lithosp and the atmosphere – where all life

Largest of the Inner planets in the s system.

Made up of icy dust particles and fr gases, they look like bright balls, wi long tails.

Gas that composes 78% of the Earth atmosphere.

A space entirely devoid of matter.

Force that pulls objects toward each

The star round which the earth orbit

8.7 SHEET 7: Chemistry. Laboratory equipment

FIELD	CHEMISTRY
AIM	TEACHING VOCABULARY/TERMINOLOGY – LABORATORY EQUIPMENT
TASK	FILLING BLANKS, CROSSWORD PUZZLE, NAMING THE OBJECTS
INTERACTION	INDIVIDUAL WORK/ GROUP WORK/ PAIR WORK
DURATION	15 minutes
MATERIALS	instructional sheet 7, interactive blackboard, blackboard, chalk, pencil, paper
INSTRUCTIONS	Fill in the blank spaces. If you find a mistake, correct it. Then complete the crossword puzzle. Use the clues to make meaningful words. Write correct terms for the objects in the pictures.

C h e m i c a l c r o s s w o r d	
What is it?	------- ----- contains various minerals (Calcium, Magnesium), such as salts and sulphur compounds. It may be classified as "still" or "sparkling" according to the presence or absence of added gases. It is used or consumed at their spring sources.

			M	I	C	R	O	S	C	O	P	E
		P	**I**	P	E	T	T	E				
	F	U	**N**	N	E	L						
G	L	O	V	**E**	S							
	B	U	R	**N**	E	R						
		S	T	**A**	N	D						
			F	**L**	A	S	K					

mikroskop
pipeta
lievik
rukavice
horák
stojan
banka

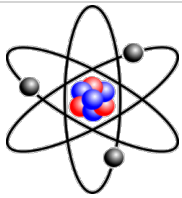
	W	E	I	G	H	T		hmotnosť
C	**A**	L	E	S				váhy
E	**T**	R	I	D	I	S	H	Petriho miska
B	**E**	A	K	E	R			kadička
D	**R**	O	P	P	E	R		kvapkadlo

8.8 SHEET 8: Physics. Electricity and circuits.

FIELD	PHYSICS – ELECTRICITY AND CIRCUITS
AIM	TEACHING VOCABULARY/TERMINOLOGY – ELECTRIC CURRENT
TASK	MATCHING ITEMS – PICTURES AND DEFINITIONS
INTERACTION	INDIVIDUAL WORK/ PAIR WORK/ GROUP WORK
DURATION	30 minutes
MATERIALS	instructional sheet 8, scissors
INSTRUCTIONS	Pick a pair – match the pictures with the definitions.

ELECTRIC CURRENT

1



Atom

ELECTRIC CURRENT

1

It is the smallest unit of matter that can take part in a chemical reaction and which cannot be broken down chemically into anything simpler.

ELECTRIC CURRENT

2

Metal

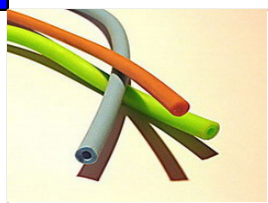
ELECTRIC CURRENT

2

This material is good electric conductor. We make cable from this material.

ELECTRIC CURRENT

3



Elektric nonconductor

ELECTRIC CURRENT

3

This material is not good electric conductor (gum, plastic material).

ELECTRIC CURRENT

4

Magnetite

ELECTRIC CURRENT

4

The mineral, has the highest iron ore content.

ELECTRIC CURRENT

5

Electric bulb

ELECTRIC CURRENT

5

It was invented by Thomas Alva Edison. It is made from glass. It changes electric current to light.

ELECTRIC CURRENT

6

ELECTRIC CURRENT

6

A container consisting of one or more cells, in which chemical energy is converted into electricity and used as a source of power.

ELECTRIC CURRENT

7

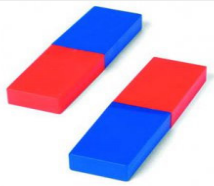
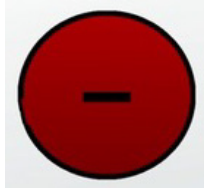
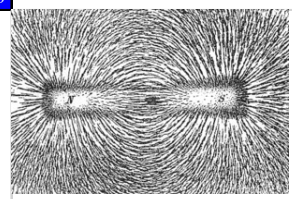
ELECTRIC CURRENT

7

Storage battery - a battery (or cell) used for storing electrical energy.

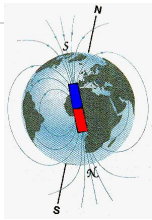
ELECTRIC CURRENT

8

ELECTRIC CURRENT	ELECTRIC CURRENT	ELECTRIC CURRENT
8 VOLTMETER - an instrument for measuring electric potential in volts.	9 	9 AMPERMETER - an instrument for measuring electric currents in amperes.
ELECTRIC CURRENT	**ELECTRIC CURRENT**	**ELECTRIC CURRENT**
10  **Magnet**	10 A piece of iron or other material attracting other iron-containing objects (pins...).	11  **Compass**
ELECTRIC CURRENT	**ELECTRIC CURRENT**	**ELECTRIC CURRENT**
11 It is an instrument which helps people to find their way from one place to another.	12  **ELECTRON**	12 A stable subatomic particle with a charge of negative electricity, found in all atoms.
ELECTRIC CURRENT	**ELECTRIC CURRENT**	**ELECTRIC CURRENT**
13  **CAMERA**	13 A device for recording visual images in the form of photographs.	14  **CALCULATOR**
ELECTRIC CURRENT	**ELECTRIC CURRENT**	**ELECTRIC CURRENT**
14 Something used for making mathematical calculations.	15 	15 Magnetic field lines

ELECTRIC CURRENT

16



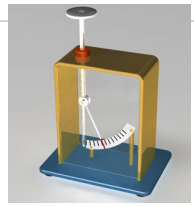
ELECTRIC CURRENT

16

Earth's magnetic field

ELECTRIC CURRENT

17



ELECTROSCOPE

ELECTRIC CURRENT

17

An instrument for detecting and measuring electricity, especially as an indication of the ionization of air by radioactivity.

ELECTRIC CURRENT

18

ELECTRICAL FUSE

ELECTRIC CURRENT

18

It is an electrical safety device that operates to provide overcurrent protection of an electrical circuit.

ELECTRIC CURRENT

19

NEUTRON

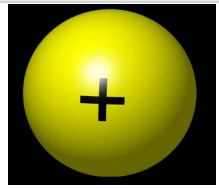
ELECTRIC CURRENT

19

A subatomic particle of about the same mass as a proton but without an electric charge.

ELECTRIC CURRENT

20



PROTON

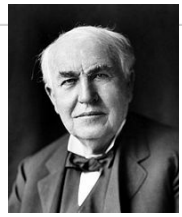
ELECTRIC CURRENT

20

A stable subatomic particle occurring in all atomic nuclei, with a positive electric charge equal in magnitude to that of an electron.

ELECTRIC CURRENT

21



THOMAS ALVA EDISON

ELECTRIC CURRENT

21

He was an American inventor and businessman, who developed for example electric power generation, mass communication.

ELECTRIC CURRENT

22

Alessandro VOLTA (1745–1827)

ELECTRIC CURRENT

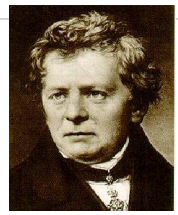
22

He was an Italian physicist, chemist, and pioneer of electricity and power who is credited as the inventor of the electric battery.

ELECTRIC CURRENT

23

André Marie AMPÈRE (1775–1836)

ELEKTRICKÝ PRÚD	ELECTRIC CURRENT	ELECTRIC CURRENT
23	24	24
He was a French physicist and mathematician who was one of the founders of the science of classical electromagnetism.	 George Simon OHM (1787-1854)	He found that there is a direct proportionality between the potential difference (voltage) applied across a conductor and the resultant electric current.

8.9 SHEET 9: Mathematics. Calculations. Conversion of units.

FIELD	MATHEMATICS – CALCULATIONS - CONVERSION OF UNITS
AIM	TEACHING VOCABULARY/TERMINOLOGY – LENGTH CONVERSION
TASK	DOMINO: MATCHING THE UNITS OF LENGTH
INTERACTION	INDIVIDUAL WORK/ PAIR WORK
DURATION	10 minutes
MATERIALS	instructional sheet 9, scissors
INSTRUCTIONS	Pick a pair - convert one unit to another of the same quantity and match the pairs.

20 mm	**2 km**	**2 000 m**	**2 dm**
200 mm	**300 dm**	**30 m**	**30 km**
30 000 m	**4 000 mm**	**400 cm**	**40 000 mm**
400 dm	**500 m**	**0,5 km**	**5 mm**
0,5 cm	**5 dm**	**0,5 m**	**80 dm**
8 m	**80 cm**	**0,8 m**	**2 cm**

8.10 SHEET 10: Mathematics. Domino. Matching units of mass

FIELD	MATHEMATICS – CALCULATIONS - CONVERSION OF UNITS
AIM	TEACHING VOCABULARY/TERMINOLOGY – MASS CONVERSION
TASK	DOMINO: MATCHING THE UNITS OF MASS
INTERACTION	INDIVIDUAL WORK/ PAIR WORK
DURATION	10 minutes
MATERIALS	instructional sheet 10, scissors
INSTRUCTIONS	Pick a pair - convert one unit to another of the same quantity and match the pairs.

40 kg	4 600 kg	4,6 t	7 000 g
7 kg	7 q	700 kg	6 t
6 000 kg	5 000 mg	5 g	8 000 kg
8 t	8 500 g	8,5 kg	7,5 kg
7 500 g	3 000 g	3 kg	200 mg
0,2 g	20 t	20 000 kg	40 000 g

8.11 SHEET 11: Chemistry. Domino. Matching terminology equivalents

FIELD	CHEMISTRY – CHEMICAL ELEMENTS
AIM	TEACHING VOCABULARY/TERMINOLOGY – CHEMICAL ELEMENTS
TASK	DOMINO: MATCHING TERMINOLOGY EQUIVALENTS OF CHEMICAL ELEMENTS
INTERACTION	INDIVIDUAL WORK/ PAIR WORK
DURATION	10 minutes
MATERIALS	instructional sheet 11, scissors
INSTRUCTIONS	Find and pick up the pairs of cards - match translation equivalents.

Iron	Nikel	Nickel	Meď
Copper	Zlato	Aurum	Kyslík
Oxygen	Hydrogen	Vodík	Nitrogen
Dusík	Carbon	Uhlík	Striebro
Argentum	Chlór	Chlorine	Ortuť
Mercury	Silicium	Kremík	Železo

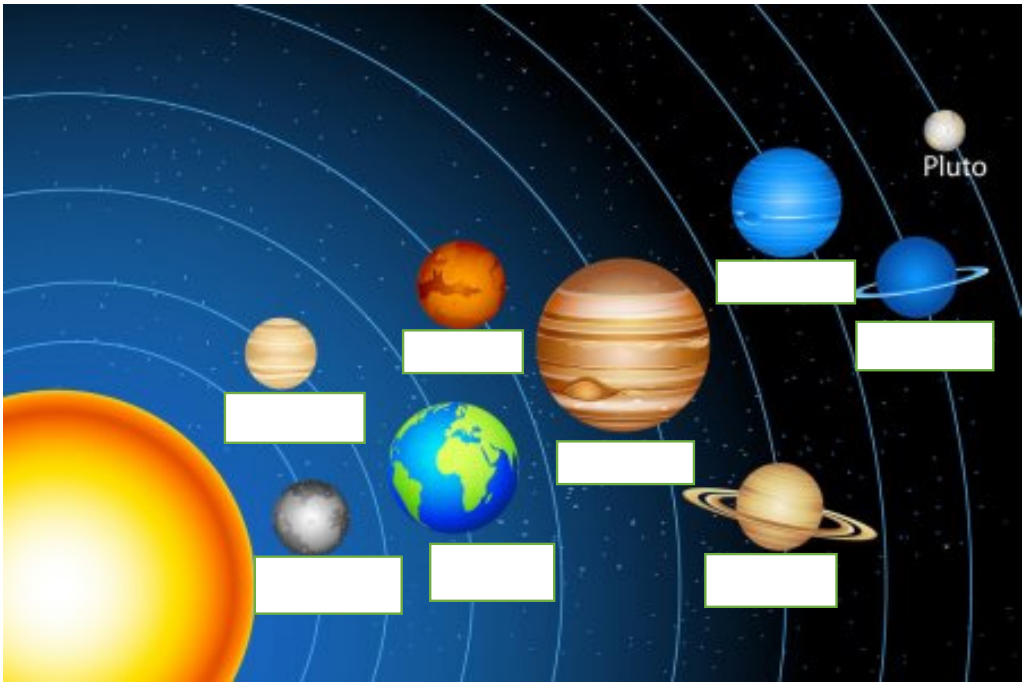
8.12 SHEET 12: Physics. Astronomy.

FIELD	PHYSICS – APPLIED PHYSICS: ASTRONOMY
AIM	TEACHING VOCABULARY/TERMINOLOGY – ASTRONOMY: THE SOLAR SYSTEM
TASK	FILLING BLANKS, COMPLETING THE PICTURE, ANSWERING QUESTIONS
INTERACTION	INDIVIDUAL WORK/ PAIR WORK/ GROUP WORK
DURATION	20 minutes
MATERIALS	instructional sheet 12, a pen, an interactive board
INSTRUCTIONS	At first, try filling the blank space next to each planet in the picture without looking at the options above. If you need some help, fill in the blank spaces next to each planet using the options above the picture. Then answer both the open and the cloze questions.

The Solar system

Write these words in the brackets in the correct order: (Jupiter, Uranus, Earth, Mars, Mercury, Neptune, Venus, Saturn).

_____



2. Answer these questions:

How many planets are in our Solar system? _____

Which planet is the smallest? _____

Could humans live on The Mercury? _____

Which planet has super-hot atmosphere? _____

Which planet is covered in water? _____

Which planet have a third of Earth's gravity? _____

Which planet has 79 moons? _____

Which planet has rings? _____

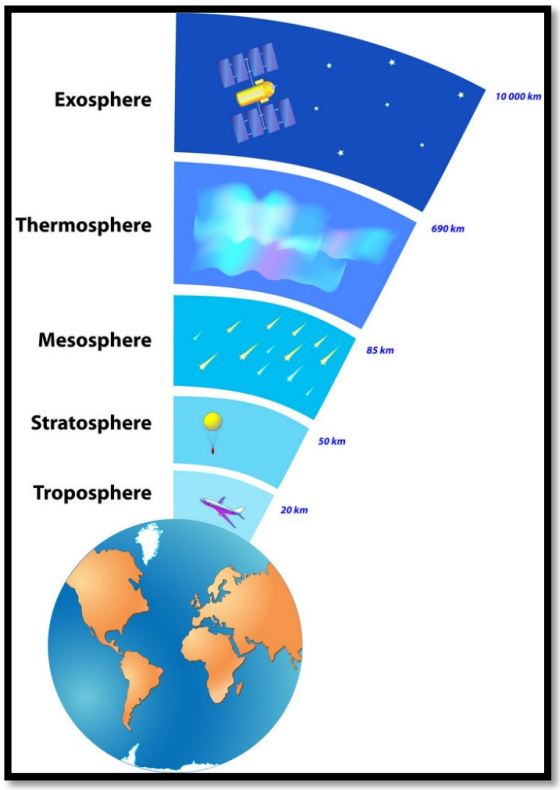
Which planet is an ice giant? _____

Which planet is the windiest? _____

8.13 SHEET 13: Atmospheric Physics. Filling blanks.

FIELD	PHYSICS – ATMOSPHERIC PHYSICS
AIM	TEACHING VOCABULARY/TERMINOLOGY – ATMOSPHERIC PHYSICS: THE ATMOSPHERE
TASK	FILLING BLANKS, COMPLETING THE PICTURE (PENCIL-AND-PAPER TEST)
INTERACTION	INDIVIDUAL WORK/ PAIR WORK/ GROUP WORK
DURATION	25 minutes
MATERIALS	instructional sheet 13, a pen, an interactive board
INSTRUCTIONS	Fill in the blank spaces in the sentences choosing the correct words from the options above the picture. To complete exercise 2, select the correct option and put down the appropriate word on the line.

The atmosphere

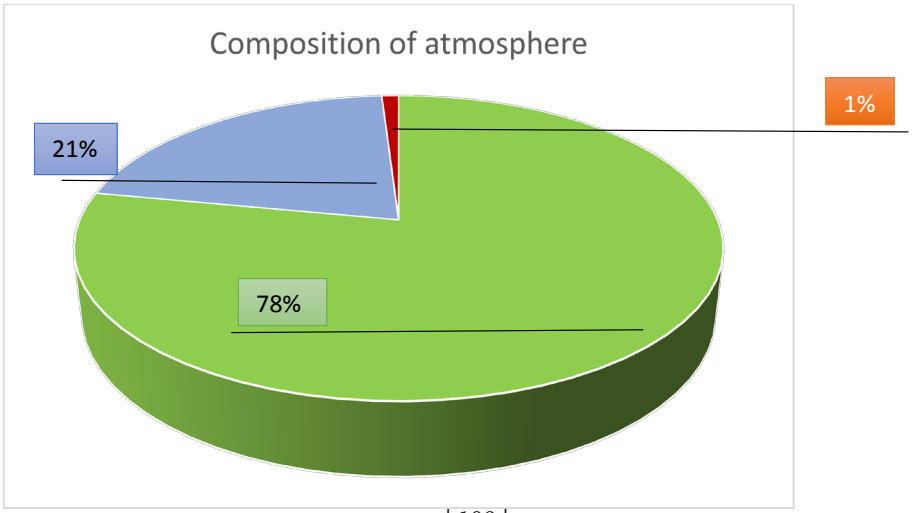


1.Fill in the text with appropriate words from the box:

thinner, ultraviolet, life, heat, earth, carbon dioxide, industrial, gravity, greenhouse effect

The _____ is surrounded by its atmosphere, a blanket of gases that enables _____ to exist on the planet. This layer has no definite outer edge, gradually becoming_____ until it merges into space, but over 80 percent of atmospheric gases are held by_____ within about 20 kilometres of the Earth's surface. The atmosphere blocks out much harmful _____ solar radiation, and insulates the Earth against extremes of temperature by limiting both incoming solar radiation and the escape of re-radiated_____ into space. by the _____. Greenhouse gases are: methane, _____ _____, nitrous oxide and fluorinated gases. These gases are produced by electric power station, transportation fuels, _____ processes and agricultural production.

2. Write these words (oxygen, nitrogen, other gases) on the lines:



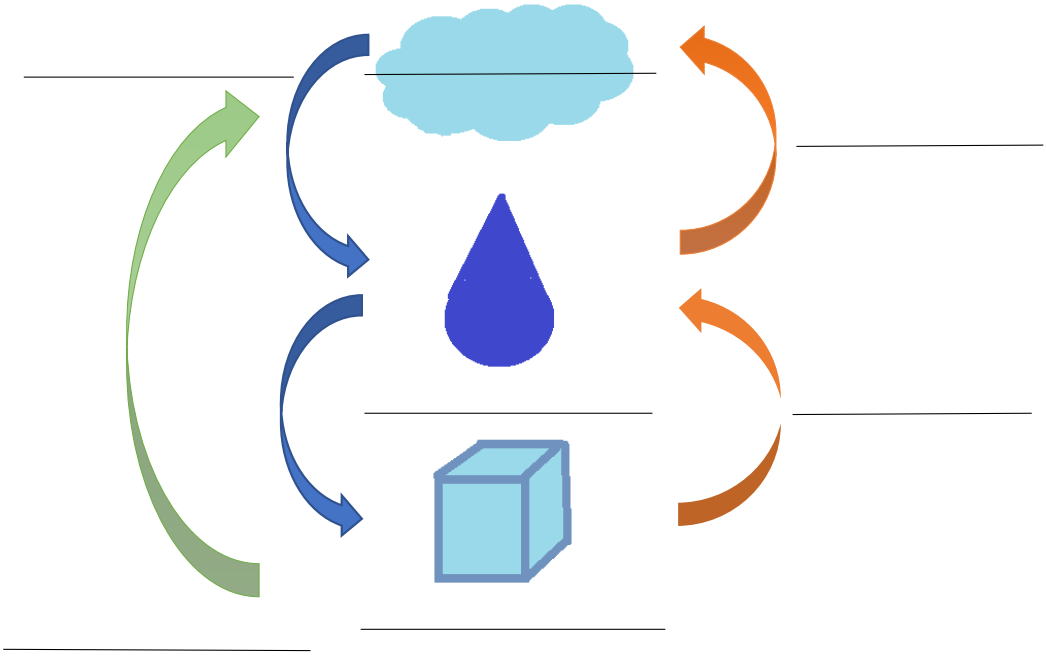
8.14 SHEET 14: Chemistry. Matter and change

FIELD	CHEMISTRY – MATTER AND CHANGE
AIM	TEACHING VOCABULARY/TERMINOLOGY – THE STATES OF MATTER
TASK	MATCHING, FILLING BLANKS
INTERACTION	INDIVIDUAL WORK/ PAIR WORK/ GROUP WORK
DURATION	15 minutes
MATERIALS	instructional sheet 14, a pen, an interactive board
INSTRUCTIONS	In exercise 1, select the correct option and put down the appropriate word on the line. In exercise 2, fill in the blank spaces in the sentences choosing the correct words from the options above the pictures.

States od matter

1. **Write appropriate word from the box on each line:**

sublimation, solid, gass, liquid, condensation, evaporation, freezing, melting



2. **Fill in the text with appropriate words from the box below:**

shape, cooled, freezing point, a liquid, boiling point, steam

The solid state od water, ice, forms when liquid water is _____. Ice cubes are rigid, with a definite _____ and volume.

When the temperature of a substance rises above its_____ _____ , it melts to become a _____.

Above its _____ _____, a substance will become a gass. When heated sufficiently, liquid water turns to _____.

8.15 SHEET 15: Chemistry. Chemical reactions. Designating the objects

FIELD	CHEMISTRY – CHEMICAL REACTIONS AND LABORATORY EQUIPMENT
AIM	TEACHING VOCABULARY/TERMINOLOGY – CHEMICAL REACTIONS AND LABORATORY EQUIPMENT
TASK	FILLING BLANKS, DESIGNATING THE OBJECTS
INTERACTION	INDIVIDUAL WORK/ PAIR WORK/ GROUP WORK
DURATION	20 minutes
MATERIALS	instructional sheet 15, a pen, an interactive board
INSTRUCTIONS	Fill in the blank spaces in the sentences choosing the correct word from the options above the text. In exercise 2, write the correct terms for the objects of laboratory equipment in the pictures.

Chemical reactions and lab equipment

1. **Fill in this text with appropriate words from the box:**

Heat, shape, substances, exothermic, speed, bonds, symbols, size

A chemical reaction takes place whenever _____ between atoms are broken or made. In each case, atoms or groups of atoms rearrange, making new _____ (products) from the original ones (reactants). Reactions may take years, or only an instant. A reaction usually involves a change in energy. An _____ reaction is a type of reaction, in which heat is given off. Typical example is burning. The making of new bonds between atoms releases energy as _____. The rate (_____) of a reaction is determined by many different factors, such as temperature, and the _____ and _____ of the reactants. To describe and keep track of reactions, internationally recognized chemical _____ and equations are used.

2. **Write terms under each picture:**

_____ _____ _____

_____ _____ _____

8.16 SHEET 16: Geology. Mineralogy. Filling blanks

FIELD	GEOLOGY - MINERALOGY
AIM	TEACHING VOCABULARY/TERMINOLOGY – GEOLOGY: MINERALOGY
TASK	FILLING BLANKS
INTERACTION	INDIVIDUAL WORK/ PAIR WORK/ GROUP WORK
DURATION	15 minutes
MATERIALS	instructional sheet 16, a pen, an interactive board, pictures/ photographs/ models of minerals
INSTRUCTIONS	Fill in the blank spaces in the sentences choosing the correct word from the options above the text. The pictures under the text could also be used as prompts to help you.

Minerals

1.Complete the text with appropriate words from the box:

symbol, Cu, properties, C, elements, gold, substance, two, silver

A mineral is a naturally occurring _____ that has a characteristic chemical composition and specific physical_____. A rock is an aggregate of minerals and need not have a specific chemical composition. Minerals are made up of _____ (substances that can not be broken down chemically into simpler substances), each of which can be represented by chemical_____. Minerals can be divided in to _____main groups: native elements and compounds. Native elements are made up of a pure element. Examples include copper (_____), _____(Ag), carbon (____) and _____(Au). Compounds are combinations of two or more elements.

Native elements:

Gold (Au) Copper (Cu) Graphite (C) Diamond (C)




Compounds:

Sulphides: **Oxides:**

GALENA (PbS) **PYRITES (FeS_2)** **ONYX ($SiO2$)** **MAEMATIT (Fe_2O_3)**




Halides: **Carbonates:**

GREEN FLUORITE (CaF_2) **HALITE (Salt NaCl)** **CALCITE ($CaCO_3$)**



8.17 SHEET 17: Biology. Photosynthesis. Gap filling

FIELD	BIOLOGY - PHOTOSYNTHESIS
AIM	TEACHING VOCABULARY/TERMINOLOGY – BIOLOGY - PHOTOSYNTHESIS
TASK	GAP FILLING, COMPLETING THE PICTURE
INTERACTION	INDIVIDUAL WORK/ PAIR WORK/ GROUP WORK
DURATION	15 minutes
MATERIALS	instructional sheet 17, a pen, an interactive board
INSTRUCTIONS	Fill in the blank spaces in the sentences choosing the correct word from the options above the text. In exercise 2, fill in the gaps in the picture using the options above the picture which are connected with photosynthesis.

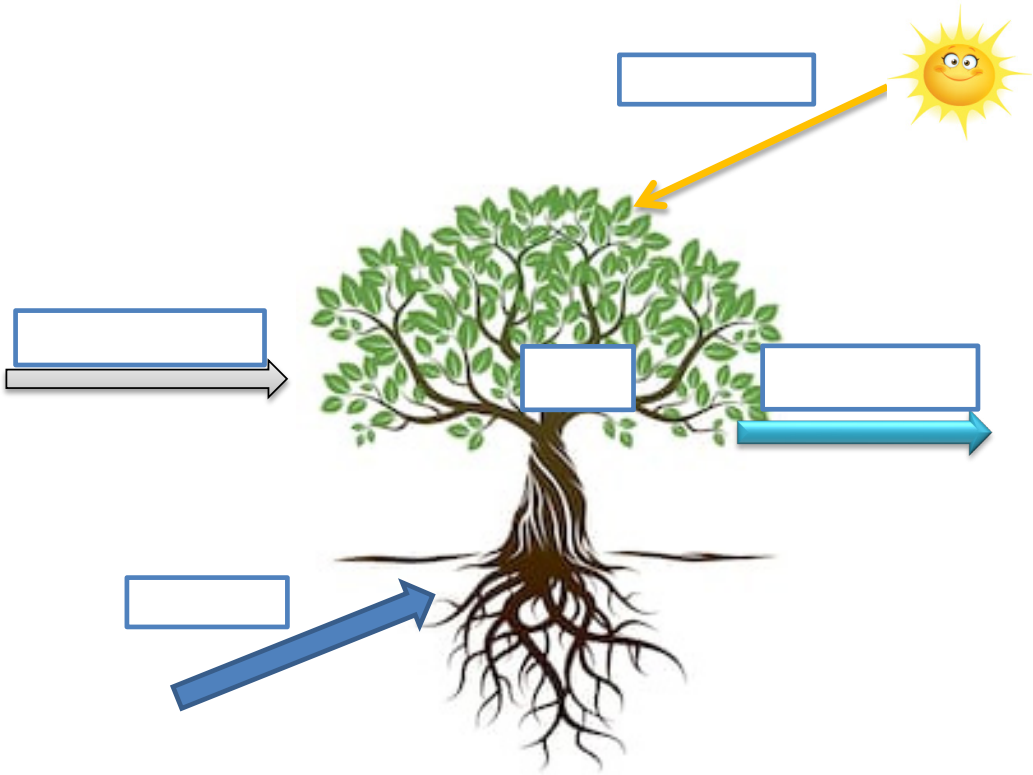
Photosynthesis worksheet

1.Fill in the gaps with the words from the box:

food, plants, chemical energy, sugar, Carbon dioxid, chlorophyll, leaf, Oxygen, alive, water

Photosynthesis is a process by which _____make _____**.** Plants use the energy from sunlight to produce _____**.** The conversion of unusable sunlight energy into usable _____ _____, is associated with the actions of the green pigment _____. It happens in the _____ cells, with the help of chloroplasts. _____ _____ from the air, _____ from the roots gives us _____. The oxygen we absolutely must have to stay _____.

2. Fill in the boxes with these words: Oxygen, sunlight, Carbon dioxid, sugar, water



8.18 SHEET 18: Physics. Kinetics. Simple machines

FIELD	PHYSICS – KINETICS: KINEMATICS
AIM	TEACHING VOCABULARY/TERMINOLOGY – KINEMATICS: SIMPLE MACHINES, MECHANICS, DYNAMICS
TASK	GAP FILLING, OBJECT NAMING, READING PLUS LISTENING COMPREHENSION, READING FOR GIST, SKIMMING, SCANNING
INTERACTION	INDIVIDUAL WORK/ PAIR WORK/ GROUP WORK
DURATION	25 minutes
MATERIALS	instructional sheet 18, a pen, an interactive board, song recording, a recorder
INSTRUCTIONS	Listen to the song. Then read the text, listen to the song again (as many times as the learners need) and fill in the blank spaces in the sentences according to the song lyrics. In exercise 2, name the objects in the pictures.

SIMPLE MACHINES

1. **Complete the text with the words from the song:**

A long time ago,

even before phones with computer screens

people had to solve all kinds of problems.

So, they invented Simple machines!

How to move things from _____.

This kind of problem is a pretty big deal.

Do you have to stick and something round?

Oh hey, it's _____that moves around a wheel.

How to get from low _____.

This kind of problem is hurting your brain.

Can you make a ramp that is on a slant?

Oh hey, it's an_____!

How to lift something off _____.

You can do it I will make you a believer!

Get a fulcrum that stays and a bar that moves.

Put them together and hey!

It's _____!

How to move something really_____.

Higher than your head, no its not silly.

You will need a rope and a wheel

Put them together and hey!

It's _____!

How to break something _____.

You will need a tool with a sharp edge.

Look at these two inclined planes.

Add some force and hey!

It's _____!

How to hold something _____.

This is a job you might need to do.

Take this metal shaft, with spiral threads.

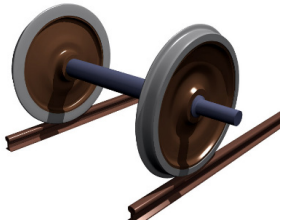
Turn it round and round and hey!

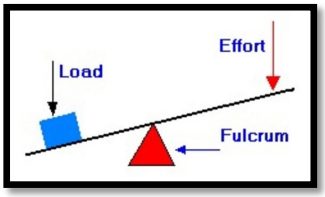
It's _____!

A long long time ago, and even today, and all the time that's in between people have to solve all kinds of _____.

So, we use _____!

2. **Label these pictures:**





8.19 SHEET 19: Physics. Hydrology. Water cycle

FIELD	PHYSICS – HYDROLOGY: WATER CYCLE
AIM	TEACHING VOCABULARY/TERMINOLOGY – HYDROLOGY, CLIMATOLOGY, ECOLOGY
TASK	READING COMPREHENSION, GAP FILLING, SPEAKING
INTERACTION	INDIVIDUAL WORK/ PAIR WORK/ GROUP WORK
DURATION	20 minutes
MATERIALS	instructional sheet 19, a pen, an interactive board
INSTRUCTIONS	Read the text and fill in the missing information (words/ expressions/ terms). Then discuss the water cycle – the picture under the text can help you with the appropriate terminology.

Water cycle

Fill in the gaps:

Water goes up

Water comes down

Water _____!

Round and round and round and round and

Water cycle!

Well, you know there is water _____

But did you know it's also in the air?

The sun heats the water – of this I am sure

And it becomes a _____ we call water vapor!

The sun heats the water – of this I am sure

And it becomes a gas we call water vapor!

Water vapour travels up, listen everyone

It's a little process we call _____!

Water cycle!

Round and round and round and round

So, the vapour goes up and gets _____ in the sky,

And turns back into water up there so high,

These tiny water drops from into clouds

That keep growing and making bigger clouds!

Clouds are made from _____, listen everyone

It's a little process we call…

_____!

Water cycle!

Round and round and round and round

So, the clouds keep forming with more and more drops

Getting bigger and heavier like it won't stop

But then what happens, do you think you know?

The drops start falling as a_____ or snow!

The water comes back down, listen everyone

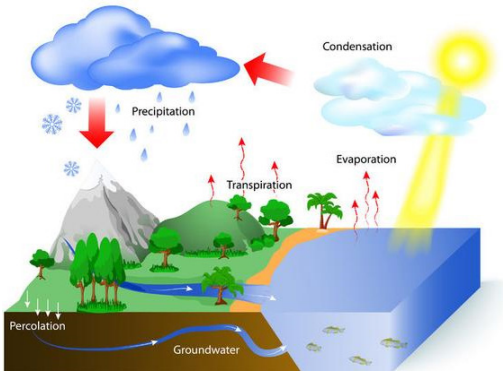
It's a little process we call….

_____!

Water cycle!

Round and round and round and round

_____!



8.20 SHEET 20: Pronunciation specifics in science terminology

FIELD	PRONUNCIATION SPECIFICS IN SCIENCE TERMINOLOGY
AIM	TRAINING AND PRACTICING PRONUNCIATION
TASK	BINGO: MATCHING PHONEMES WITH THEIR TRANSCRIPTION SYMBOLS
INTERACTION	THE WHOLE GROUP/ CLASS ACTIVITY
DURATION	20 minutes
MATERIALS	instructional sheet 20, a pen, a list of words
INSTRUCTIONS	The educator prepares a list of the terms from any natural science discipline the students are familiar with in advance. The words must include all the transcribed sounds from the cards the educator plans to use at the lesson. At an English lesson, the educator reads out the words/ terms at least twice. The students cross off the sound picture when they hear the corresponding sound. The student who crosses off all the pictures on their card shouts Bingo! That student is the winner. Afterwards, it is recommended for the students to pronounce the words themselves to find out whether their pronunciation of the words/ terms is correct.

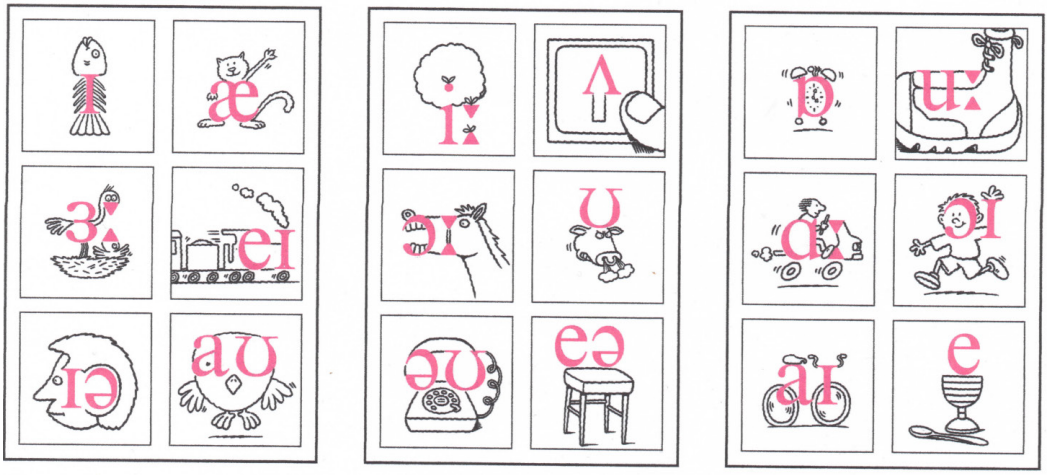


Figure 1: DOLZ, C. English File (3rd edition). OUP, 2001, LEE, A. English File (3rd edition). OUP, 2001.

GENERAL RECOMMENDATIONS FOR USING THE INSTRUCTIONAL SHEETS:

Get everything ready in advance, before the lesson starts, and the learners arrive.
Photocopy and give out one sheet/ card to a student or to a pair/ group of learners.
Each game should have fair rules and a well-defined goal in advance. Learners need guidance and assistance for playing and they also need to know exactly how the game is played and what their tasks are.
Give clear instructions, explain and demonstrate how the activity/ game works, what its rules are to avoid misunderstanding so that the learners are not confused.
Try to create games as simple as possible so that the learners understand the rules, strategies, and procedures. Start with simple vocabulary, just words, specialised terms, not sentences. Sentences could be introduced gradually when the learners understand the language.
Make sure that all the learners are involved all the time.

Other recommendations for practice:

Use real-world examples to illustrate the terms.
Make sure the terms are relevant to the students' interests.
Use a variety of teaching methods to keep the students engaged.
Provide opportunities for the students to practice using the terms.

- Emphasize that this is not only a game, but a learning experience too.
- Introduce games only if the learners respect your authority. This helps prevent discipline problems and helps the educator keep control. It is very important that students know their boundaries.
- Vary competitive games with games that require cooperation. Competition is challenging for the learners of every age.
- Teach learners the language related to playing games and encourage them to use it while playing.

Songs can be selected to suit the needs and interests of the students. You should start your search for the right song on the internet. You can use youtube and a lot of other web sites.
At the beginning, it is a good idea to warm up for a song by providing some input. You could do this by using visuals of the main vocabulary items, for example you can practise vocabulary with flashcards, pictures, models, or real objects.
Use warm-up activities to help the learners prepare for what they are going to do and for the vocabulary and grammar structures in the text. It offers opportunity

for class discussion and interaction among students. This is the way for educators to find out what learners already know about the topic.

Do not forget to be creative and use a variety of methods to keep your students engaged.

CONCLUSION

Teaching terminology and being able to use it appropriately is one of the crucial educators´s skills in the educational process. Any users of the English language should be able to recognize what *a term* is and to use it properly. Improper using of terms can often cause breakdown in communication, so this problem cannot be underestimated.

At any stage of the current educational process, the educator should show their enthusiasm about teaching a specific subject. This is the best way to motivate students to learn. Besides, a pleasant, relaxed, and enjoyable friendly environment in the classroom is also important. The materials used should be relevant and goals achievable. It is the best way for motivating students to select the activities that are funny, short, and simple. Giving either positive or negative feedback to students is a very important part of achieving progress in the process of education. Creative and flexible educators vary their materials and methods to reach the educational goals what they set for the students. It does not matter how old learners of EFL are. Everybody, at any level, likes playing and entertainment. There are loads of activities in specialised textbooks, on the internet or in magazines focused on acquiring specialised terms. When focusing on teaching terminology, the educator ought to take into consideration similarities and differences in phonemic inventories of English and the students´ mother tongue, as well. Getting familiar with transcription and its written symbols (phonetic alphabet) used for representation of speech is one of important aspects in teaching pronunciation within terminology.

Nowadays, not only usual traditional techniques, classroom methodology and activities can be used in the process of raising terminology awareness when teaching languages. Due to the development of new technologies, educators are offered a huge number of methods for teaching and practising specialised terminology. Educators are supposed to give feedback to language learners all the time. They should bear in mind to lead their students towards comprehensibility, not perfection, but positive feedback, encouragement and motivation are necessary when students try to succeed. Using appropriate methods and activities for learners of foreign languages is important because educators must inspire, challenge, and motivate their students whether they are beginners, intermediate or advanced learners involved in the foreign language educational process.

BIBLIOGRAPHY

BAKER, S. K. – SIMMONS, D. C. – KAMEENUI, E. J. *Vocabulary Acquisition: Instructional and Curricular Basics and Implications.* Routledge, 1998.

BAKER, L. – WIGFIELD, A. Dimensions of Children´s Motivation for Reading and their Relations to Reading Activity and Reading Achievement. In: *Reading Research Quarterly*. Vol. 34, No. 4, pp. 452 – 477, 1999.

BREWSTER, J. – ELLIS, G. – GIRARD, D. *The Primary English Teachers Guide*. Penguin books, 1992.

BROWN, H. Douglas. *Principles of Language Teaching and Learning*. San Francisco State University, 2006.

CABRÉ, T.M. 1999. Terminology. Theory, methods and applications. Amsterdam/Philadelphia: John Benjamins Publishing Company, 1999. 247 p. ISBN 90 272 1634 7

CABRÉ, M. T.: 2003. *Theories of Terminology. Their description, prescription, and explanation*. John Benjamins Publishing Company. ISBN 09299971

CAFFERTY, S. G. – STAM, G. *Gesture*: *Second Language Acquisition and Classroom Research.* New York and London: Taylor and Francis group, 2008.

CÍBIKOVÁ, I.: 2012. *Terminologický manažment verejnosprávnej tematickej oblasti.* Vedecká monografia. Žilinská univerzita v Žiline. Edis-vydavateľstvo Žilinskej univerzity. 2012. ISBN 978-80-554-0559-9. 177 s.

CÍBIKOVÁ, I.: 2013. *Terminologická ne/gramotnosť a ne/kultúra na Slovensku*. In: Letná škola prekladu 12. Odkaz Antona Popoviča, zakladateľa slovenskej prekladovej školy – pri príležitosti 80. výročia jeho narodenia. 35. ročník. Zborník prednášok. Piešťany 18. – 20. októbra 2013. Bratislava: SSPUL, 2013. 82 – 100 p. ISBN 978-80-971262.2-3.

CÍBIKOVÁ, I. BOTKA, D. 2016.: Terminology in Nuclear and Electrical Engineering. Cooperation With Slovenské Elektrárne, an Enel Group Company. In: *Nová filologická revue* [elektronický dokument] : časopis o súčasných problémoch lingvistiky, literárnej vedy, translatológie a kulturológie : časopis o súčasnej lingvistike, literárnej vede, translatológii a kulturológii. – Banská Bystrica (Slovensko) : Univerzita Mateja Bela v Banskej Bystrici. Fakulta humanitných vied. – ISSN (online) 1338-0583. – Roč. 8, č. 2 (2016), s. 82-93 [online]

CÍBIKOVÁ, I. TREBICHALSKÁ, M. 2017.: *Terminography and Lexicography in Practice*. In: Nová filologická revue : časopis o súčasnej lingvistike, literárnej vede, translatológii a kulturológii. Banská Bystrica : Filozofická fakulta UMB v Banskej Bystrici - ISSN 1338-0583, Roč. 9, č. 2 (2017), [17 s.].

CÍBIKOVÁ, I., BOGNÁROVÁ, D. 2020. *Comparison of English/Slovak wind musical instruments terminology.* In: *Jazykovedné, literárnovedné a didaktické kolokvium L-8* [elektronický dokument] : zborník vedeckých prác a vedeckých štúdií.1. vyd. – Roč. L-8. – Bratislava (Slovensko) : Z-F LINGUA, 2020. – ISBN 978-80-8177-078-4, s. 21-43 [CD-ROM].

CÍBIKOVÁ, I. CHROMČÍKOVÁ,K. 2022.: *Latin in English/Slovak neurology terminology*. In: *Knowledge* [elektronický dokument] . – Skopje (Macedónsko) : Institute of Knowledge Management. – ISSN 1857-923X. – ISSN (online) 2545-4439. – Roč. 54, č. 3 (2022), s. 557-562 [online]

CÍBIKOVÁ, I. SIANTOVÁ, G., MITAĽOVÁ, K. 2022.: Specialised communication. Scientific and terminology literacy. In: *GRANT journal* [elektronický dokument] : European Grant Projects, Results, Research & Development, Science : Peer-Reviewed Scientific Journal. – Hradec Králové (Česko) : Magnanimitas akademické sdružení. – ISSN (online) 1805-0638. – ISSN (online) 1805-062X. – Roč. 11, č. 1 (2022), s. 45-54 [CD-ROM] [online]

CÍBIKOVÁ, I.: 2022. *Specialised translation.* English/Slovak introductory course book for Bachelor students. Vydanie prvé. Verbum: Praha, 2022. ISBN 978-80-88507-01-7

CÍBIKOVÁ, I. – PETRÁŠOVÁ, B.: 2023. *Teaching Terminology of Science.* In: INTED2023 Proceedings. Valencia. Spain. ISBN: 978-84-09-49026-4.ISSN: 2340-1079**.** Format: Electronic Conference Proceedings. DOI: 10.21125/inted.2023. Barcelona: IATED, 2023.

CÍBIKOVÁ, I. – HUDCOVIČOVÁ, M. 2022. *English and Slovak concept systems of whole numbers.* In: *Knowledge* [elektronický dokument] . – Skopje (Macedónsko) : Institute of Knowledge Management. – ISSN 1857-923X. – ISSN (online) 2545-4439. – Roč. 54, č. 3 (2022), s. 563-568 [online].

DUBIN, F. – OLSHTAIN, E. Predicting Word Meaningsfrom Contextual Clues. Evidence from L1 Readers. In: *Huckin, T. – Haynes, M – Coady, J. (Ed.) Second Language Reading and Vocabulary Learning*. Norwood Ablex Publishing Corporation, 1993.

ELLIS, N. C. Frequency Effects in Language Processing: A Review with Implications for Theories of Implicit and Explicit Language Acquisition. In: *Studies in Second Language Acquisition,* 24, pp. 143-188, 2002. https://doi.org/10.1017/S0272263102002024

FAY, D. – CUTLER, A. Malapropisms and the Structure of the Mental Lexicon. In: *Linguistic Inquiry*, 8.3.505-20, 1977.

DOLZ, C. English File (3rd edition). OUP, 2001.

GULLBERG, M. Gestures and Second Language Acquisition. In: *Robinson, P. – Ellis, N.* (Eds.), *Handbook of Cognitive Linguistics and Second Language Acquisition.* Routledge, 2008.

GULLBERG, M. – de BOT, K. *Gestures in Language Development*. Amsterdam/Philadelphia: John Benjamins Publishing Company, 2010.

HARMER, J. In: *Nurna, T. Improving English Skills through Songs*. Retrieved from https://www.academia.edu/13219589/Improving_English_Skills_through_Song

HATTIE, J. *Visible Learning for Teachers*. New York/ London: Routledge, 2012.

HAŠKOVÁ, A. – LUKÁČOVÁ, D.: 2023. *Content analysis of the subject of tehnology at basic schools in Slovakia within the context of the upcoming education reform*. In: TEM Journal,12(3), vol. 12, issue 3, 2023, s. 1566 - 1574. ISSN 2217-8309, DOI: 10.18421/TEM123-38, A

HAŠKOVÁ, A. – LUKÁČOVÁ, D.: 2022. *Curricular reform as a means to upgrade technology education at lower secondary schools in Slovakia*. In: Education and Self-Development Vol. 17, č. 4/2022, s. 83 - 93, ISSN 1991-7740, DOI: 10.26907/esd.17.4.07

HAŠKOVÁ, A. – LUKÁČOVÁ, D.: 2022. *Discussion of the intentions of curricular reform in Slovakia in the context of teaching technology in primary schools*: Konkretizácia zámerov kurikulárnej reformy na Slovensku v kontexte výučby techniky na základných školách. In: Journal of Technology and Information Education, 1/2022, Volume 14, Issue 1, s. 1 - 16. ISSN 1803-537X, eISSN 1803-6805. DOI: 10.5507/jtie.2022.007

HAŠKOVÁ, A. – DANKO, F.: *Výzvy a inovácie vo vyučovaní technických predmetov z pohľadu ich učiteľov.* In: Pohledy na středoškolského učitele odborných předmětů, s. 51 – 70. Praha: VŠE, 2020. ISBN 978-80-87570-48-7

HORECKÝ, J. 1956. Základy slovenskej terminológie. Bratislava: Vydavateľstvo Slovenskej akadémie vied, 1956. 148 p.

JONES, S. Understanding Terminology Relationships. In: *Language Arts*. Vol. 91, No.5, pp. 344 - 351, 2014.

JURČACKOVÁ, Z. 2002. Terminológia: Základné zásady, metódy a ich aplikácia. Bratislava: Centrum vedecko-technických informácií SR, 2002. 72 p. ISBN 80-85165-85-6.

KLIPPEL, F. *Language Program Evaluation*. Cambridge: Cambridge University Press, 1994.

KUDASHEV, I. 2013. Quality assurance in terminology management. Recommendations from the TermFactory project [online]. Helsinki: University of Helsinki, Palmenia Centre for Continuing Education, Kouvola, 2013. 248 p. ISBN 978-952-10-7757-9 [cit.2022-09-20]. Available at: < https://puolukka.rd.tuni.fi/projectglossary/download/QA_in_TM_Kudashev.pdf>

LEE, A. English File (3rd edition). OUP, 2001.

MARINAK, B. A. – HENK, W. A. – MOORE, J. C. – TOMASETTI, B. W. A Reading Lesson Observation Framework for Elementary Teachers, Principals, and Literacy Supervisors. In: *The Reading Teacher*, Vol. 53, No. 5, pp. 358 – 369, 2000.

MARZANO, R. J. *The Art and Science of Teaching*. Alexandria, VA: ASCD, 2007.

NATION, I. S. P. *Learning Vocabulary in Another Language*. Cambridge: Cambridge University Press, 2001.

PAVLÍKOVÁ, S. *Teaching Vocabulary/ Terminology*. Záverečná práca RŠ. Trnava: UCM, 2020.

PETRÁŠOVÁ, B. *Phonetics and Phonology. Segmental Aspects*. Trnava: UCM, 2023.

PINTER, A. M. *Teaching Young Language Learners*. Oxford: Oxford University Press, 2006.

PORUBSKÝ, Š. et al.: 2014. *Škola a kurikulum – Transformácia v slovenskom kontexte*. (School and curriculum – Transformation in the Slovak context), Vydavateľstvo Univerzity Mateja Bela v Banskej Bystrici, Belianum.

RICHARDS, J. - RODGERS, T. *Approaches and Methods in Language Teaching.* Cambridge: Cambridge University Press, 2001.

SAGEDER, D. 2010. Terminology Today: A Science, an Art or a Practice? Some Aspects on Terminology and Its Development. In: Brno Studies in English [online]. 2010, vol. 36, no. 1, p. 123-134. ISSN 0524-6881 Available at: <https://digilib.phil.muni.cz/bitstream/handle/11222.digilib/105092/1_BrnoStudiesEnglish_36-2010-1_9.pdf?sequence=1>

STEFANIAK, K. 2017. Terminology work in the European Commission: Ensuring high-quality translation in a multilingual environment. [online]. In: SVOBODA, T. – BIEL, Ł. – ŁOBODA, K. Quality aspects in institutional translation. Berlin: Language Science Press, 2017. p. 109–121. ISBN 9783946234838 Available at: https://www.researchgate.net/publication/323006368_Terminology_work_in_the_EuropeaE_Commission_Ensuring_high-quality_translation_in_a_multilingual_environment>

TERMIUM PLUS: The Government of Canada's terminology and linguistic data bank. [online]. [cit.2022-03-19]. Available on: <https://www.btb.termiumplus.gc.ca/tpv2alpha/alpha-eng.html?lang=eng>

UNESCO. 2005. Guidelines for Terminology Policies. Paris: UNESCO, 2005. 39 p. [online]. [cit. 2022-09-20]. Available at: http://www.unesco.org/new/en/communication-and-information/resources/publications-and-communication-materials/publications/full-list/guidelines-for-terminology-policies-formulating-and-implementing-terminology-policy-in-language-communities/

TAKAČ, V. P. – SINGLETON, D. *Vocabulary Learning Strategies and Foreign Language Acquisition*. Canada: Multilingual Matters Ltd, 2008.

WALTERS, J. Teaching the Use of Context to Infer Meaning: A Longitudinal Survey of L1 and L2 Vocabulary Research. In: *Language Teaching*, Vol. 37, No 4, pp. 243 – 252, 2004.

Internet Sources:

Vocabulary. Animals. Britishcouncil.org Available at: Britishcouncil.org <https://learnenglishteens.britishcouncil.org/vocabulary/a1-a2-vocabulary/animals>, [online].

Vocabulary. Drinks. Britishcouncil.org. Available at: <http://learnenglishteens.britishcouncil.org/grammar-vocabulary/vocabulary-exercises/drinks>, [online].

<https://www.youtube.com/watch?v=EubqKQJVykI&list=PLB5FA6386429DAA17>

<https://www.youtube.com/watch?v=HaPCvDqaVg0&list=PLB5FA6386429DAA17>

<https://learnenglishkids.britishcouncil.org/en/songs/the-busy-buzz-song>

Crosswords: Available at: https://puzzlemaker.discoveryeducation.com/

https://eduworld.sk

https://eurydice.eacea.ec.europa.eu/sk/national-education-systems/slovakia/slovensko

https://slovakaid.sk

https://www.ase.org.uk/resources/science-teacher-education

https://www.edweek.org/teaching-learning-science

https://www.minedu.sk

https://www.saia.sk

https://www.scienceinschool.org

https://www.statpedu.sk/files/articles/dokumenty/statny-vzdelavaci-program/isced3.pdf

https://www.stem.org.uk

https://www.teachfirst.org.uk/teach-science

https://zs.besst.sk/en/about-besst

Bilingual education in Slovakia on the background of transformation of education system (researchgate.net)

Figure 1: DOLZ, C. English File (3rd edition). OUP, 2001, LEE, A. English File (3rd edition). OUP, 2001.

Terminology standards:

ISO 704: 2009. Terminology work – Principles and methods

ISO 1087-1:2000. Terminology work — Vocabulary — Part 1: Theory and application

ISO 22128:2008. Terminology products and services

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