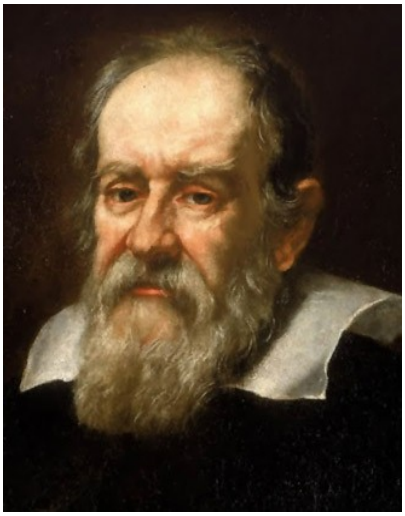
PHYSICS AND CHEMISTRY
4º ESO
Exercises in English

UNIT 1: KYNEMATICS

1) BIOGRAPHY: GALILEO GALILEI



Galileo was an italian physicist, mathematician, astronomer and philosopher born in the 16th century. His achievements include improvements to the telescope and consequent astronomical observations, and support for Copernicanism, that means the hypothesis of the Sun being in the centre of the universe.

The motion of uniformly accelerated objects was studied by Galileo. He understood the importance of a recent discover, the telescope. His contributions to observational astronomy include the telescopic confirmation of the phases of Venus, the discovery of the four largest satellites of Jupiter (named the Galilean moons in his honour), and the observation and analysis of sunspots. Galileo also worked in applied science and technology, inventing an improved military compass and other instruments.

He enrolled at the University of Pisa for a medical degree. He did not complete this degree, but instead studied mathematics. Being inspired by the artistic tradition of the city and the works of the Renaissance artists, Galileo acquired an aesthetic mentality.

When his father died, he was entrusted with the care of his younger brother, Michelagnolo.

He moved to the University of Padua, teaching geometry, mechanics, and astronomy. During this period Galileo made significant discoveries in both pure fundamental science (for example, kinematics of motion and astronomy) as well as practical applied science (for example, strength of materials and improvement of the telescope). His multiple interests included the study of astrology, which at the time was a discipline tied to the studies of mathematics and astronomy.

Galileo considered his theory of the tides to provide the required physical proof of the motion of the earth. For Galileo, the tides were caused by the sloshing back and forth of water in the seas as a point on the Earth's surface speeded up and slowed down because of the Earth's rotation on its axis and revolution around the Sun.

Galileo defended heliocentrism, and claimed it was not contrary to those Scripture passages. He took Augustine's position on Scripture: not to take every passage literally, particularly when the scripture in question is a book of poetry and songs, not a book of instructions or history. Due to his support to heliocentrism, he was tried by the Inquisition, found "vehemently suspect of heresy", forced to recant, and spent the rest of his life under house arrest. It is said that in a low voice, he said: “And nevertheless, it moves”.

Questions:

1) Why is he considered one of the greatest scientists ever?

2) Why was he tried by the Inquisition?

3) How did he deffend himself?

4) Why did he say: “And nevertheless, it moves”?

2) DEFINITIONS

1) Try to define these words without looking up the dictionary:
a) Astronomy:

b) Hypothesis:

c) Physics:

d) Discovery:

3) THE RIGHT OPTION

Choose the right words:

A satellite is an object which has been **located / placed** into **orbit / trajectory** by human endeavour. Such objects are sometimes called artificial satellites to distinguish them from natural satellites such as the Moon. History's first artificial satellite, the Sputnik 1, was **launched / fired** by **the Soviet Union / the USA** in 1957. Since then, thousands of satellites have been launched into orbit around the Earth; also some satellites, notably space stations, have been launched in parts and **mounted / assembled** in orbit. A few space probes have been placed into orbit around other bodies and become artificial satellites to the Moon, Mercury, Venus, Mars, Jupiter, Saturn and the Sun. Satellites are used for a large number of **proposals / purposes**. Common types include military and **civilian / civil** Earth observation satellites, communications satellites, **navigation / navigating** satellites, weather satellites, and **investigation / research** satellites.

4) PHRASE ORDER

Arrange these phrases:

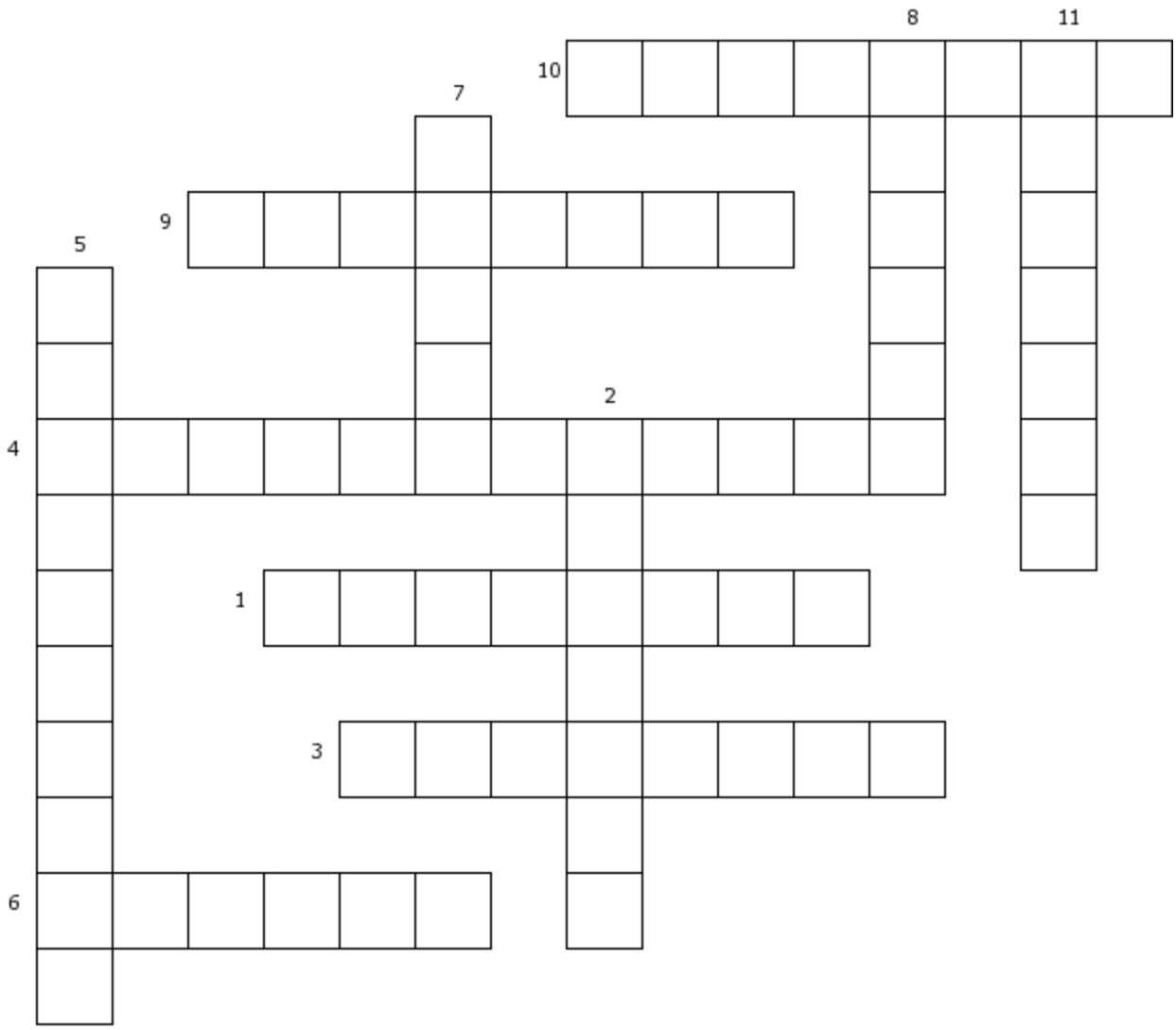
a) is The in of an with respect to motion position object time. change the

b) mechanics is for the motion of objects. Classical used describing macroscopic

c) is a branch of to the of motion. Kinematics classical devoted study mechanics

d) everything in the is like a rubber Essentially, universe stretching band.

5) CROSSWORDS



Write in English:

1) DISMINUIR
2) PROMEDIO
3) RECTA
4) ACELERACIÓN
5) TRAYECTORIA
6) RADIO
7) SISTEMA DE REFERENCIA (….. OF REFERENCE)
8) MOVIMIENTO
9) AUMENTAR
10) DINÁMICA
11) TRANSFORMAR UNIDADES

6) COLUMNS

Match both columns:

A	Constant	H	The curved line that something follows
B	Velocity	I	Segment of a curve
C	Acceleration	J	The distance to the origin
D	Position	K	Staying at the same level
E	Arc	L	The speed at which something moves
F	Trajectory	M	Shortest distance between two points
G	Displacement	N	Rate of change of velocity with time

7) FILL IN THE BLANKS

systems straight vector forces motion specify reference branch chosen particle

Kinematics is the …..... of classical mechanics that describes the …..... of bodies (objects) and …..... (groups of objects) without consideration of the …..... that cause the motion. To …..... the position of a point, three things must be considered: the …..... point (often called the origin), distance from the reference point and the direction in space of the …..... line from the reference point to the …..... If the position …..... of the particle (relative to a given reference frame) changes with time, then the particle is said to be in motion with respect to the …..... reference frame.

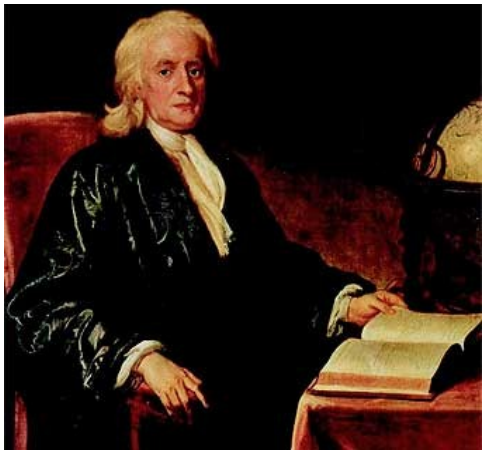
8) QUESTIONS

a) Kinematics is very useful for military purposes and in astronautics. Can you say why?

b) Write the name of seven modes of transport and what makes it move.

c) Write some devices or phenomena based on Newton's third law.

UNIT 2: DYNAMICS



1) BIOGRAPHY: ISAAC NEWTON.

Isaac Newton is one of the greatest scientist in the history of science. He was born on the 17th century.
He was a physicist, mathematician, astronomer, philosopher and theologian.

His most famous work, Philosophiae naturalis principia mathematica, is a treatise on classical mechanics. In this work, Newton described the universal gravitation and the three laws of motion. Newton showed that the motions of objects on Earth and of celestial bodies are governed by the same set of natural laws. Newton himself often told the story that he was inspired to formulate his theory of gravitation by watching the fall of an apple from a tree.

Newton built the first practical reflecting telescope and developed a theory of colour based on the observation that a prism decomposes white light into the many colours that form the visible spectrum.

In mathematics, Newton shares the credit with Leibniz for the development of differential and integral calculus. He also demonstrated the generalised binomial theorem, developed Newton's method for approximating the the roots of a function, and contributed to the study of power series.

Newton was also highly religious. Newton was a monotheist who believed in biblical prophecies but was Antitrinitarian. Newton wrote more on religion than he did on natural science. In the 1690s, he wrote a number of religious tracts dealing with the literal interpretation of the Bible.

He was also a member of the Parliament of England but, according to some accounts his only comments were to complain about a cold draught in the chamber and request that the window be closed.

Activity: write questions for these answers:
a) A theologian.

b) The decomposition of light into its components.

c) By watching the falling of an apple.

d) More than on natural science.

e) A cold draught in the chamber and a window to be closed.

2) DEFINITIONS

Try to define these words without looking up the dictionary:

a) Scientific law:

b) Interaction:

c) Collision:

d) Prism:

3) THE RIGHT OPTION

Choose the right words:

A force is **all / any** influence that causes an object to undergo a change in speed, a change in direction, or a change in **sense / shape**. A force has **both / two** magnitude and direction, making it a vector **quantity / amount**. Sir Isaac Newton **thought / sought** to describe the motion of all objects using the concepts of inertia and force, and **if / in** doing so he found that they **obey / obbey** certain conservation laws. Generally speaking, **investigators / researchers** involved in dynamics study how a physical system might develop or alter **over / after** time and study the causes of those changes. A force can be a **push / pushing** or a **pull / pulling**, and it causes an object's state of motion to **change / undergo.**

4) PHRASE ORDER

Arrange these phrases:

a) a is ends. and rope Tension it tight both keeps at

….....

b) a a at and leather lead vacuum, fall same the time. In ball

….....

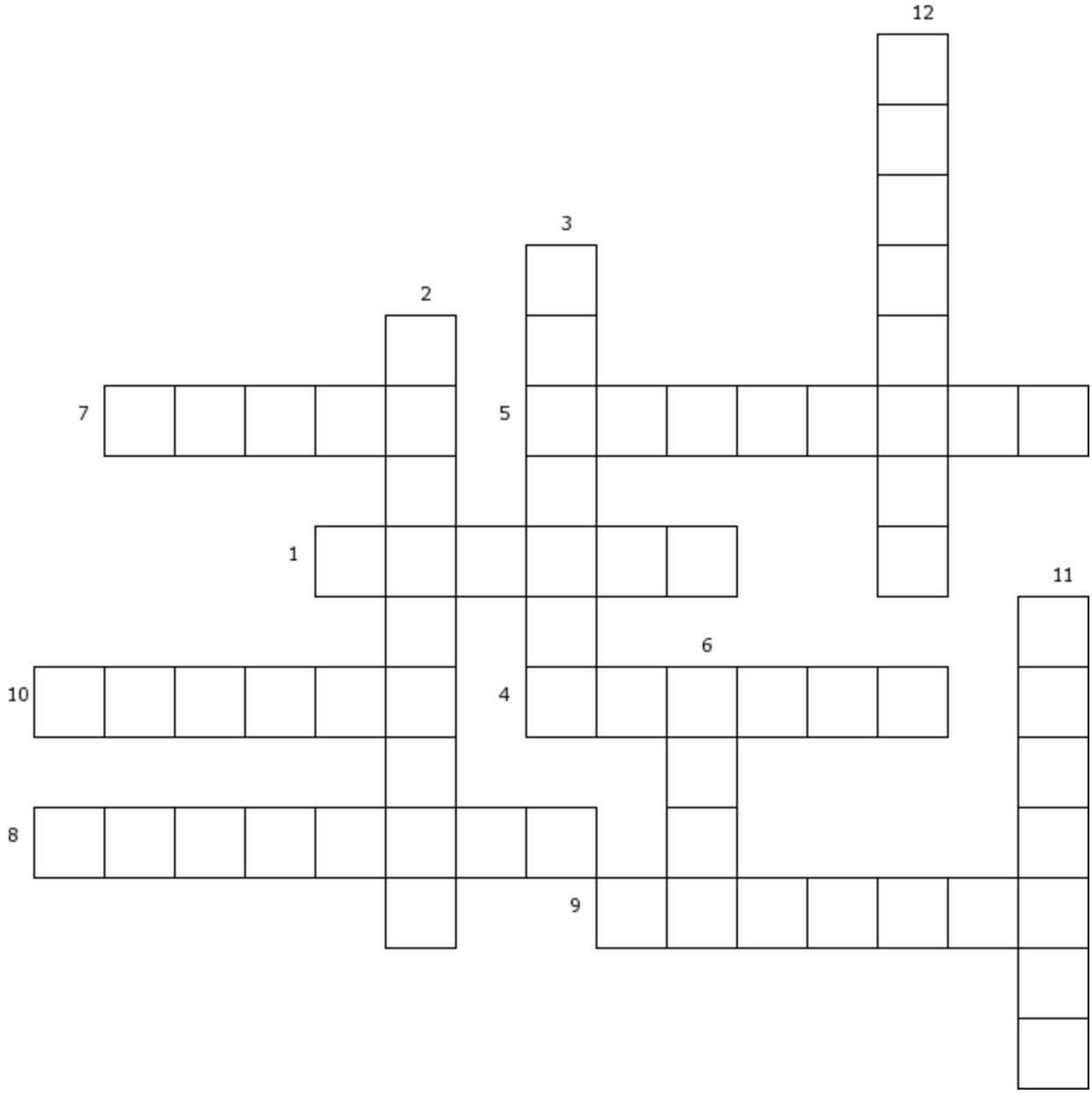
c) on of of Some work principle pendulus. the constancy clocks

….....

d) acceleration on height. The gravity depends latitude and of

….....

5) CROSSWORDS



Write in English:

1) POLEA

2) RESULTANTE

3) MÓDULO

4) MUELLE

5) DINÁMICA

6) REPOSO

7) FUERZA

8) EMPUJE

9) COMPRIMIR

10) PESO

11) GRÁFICO (ADJ.)

12) ROZAMIENTO

6) COLUMNS

Match both columns:

A	Collision	H	To become shorter
B	Stretch	I	Physical power
C	Vector	J	Force produced against an area
D	Force	K	Something with size and direction
E	Escalar	L	Two objects come together with exchange of energy
F	Pressure	M	Something with magnitude and no direction
G	Compress	N	To become longer

7) FILL IN THE BLANKS

depth submerged results bottom column overlying weight otherwise equivalent Thus upwards

In a …..... of fluid, pressure increases with …..... as a result of the weight of the …..... fluid. …..... a column of fluid, or an object …..... in the fluid, experiences greater pressure at the …..... of the column than at the top. This difference in pressure …..... in a net force that tends to accelerate an object …..... The magnitude of that force is equal to the difference in the pressure between the top and the bottom of the column, and is also …..... to the …..... of the fluid that would …..... occupy the column.

8) DEBATE

a) Should we continue spending money on space travel or dedicate it to charities?

b) Why do you think research and development is so important for some companies? What kind of companies?

c) At the ends of a pulley there is a monkey and a bunch of bananas with the same weight as the monkey. What happens if the monkey goes up?

UNIT 3: WORK, ENERGY AND POWER

1) BIOGRAPHY: JAMES PRESCOTT JOULE

Joule was a British physicist from the 19th century, who is the author of the mechanical theory of heat and to whose honor the unit of energy and work in the International System is called joule.

He was born into a family dedicated to the manufacturing of beer. He had a shy and humble character. He had private lessons at home by the famous chemist John Dalton. Dalton encouraged him to scientific research.

Joule studied several aspects of magnetism, mostly those ones related to magnetization of iron because of electric currents, which took him to the invention of the electrical engine. But the most productive area of his investigation was energy and its transformation. There are several physicist who contributed to the establishment of the principle of conservation of energy, but Joule was the one who gave solidness to this principle. There is a law with his name which establishes that the heat of an electrical current is proportional to resistance and the square intensity. After numerous experiments, he obtained the numeric value of the mechanical equivalent of heat: 1 cal = 4'18 J. This way, the relation between work and heat was firmly established, which was useful to the subsequent development of stadistic thermodynamics.

He published an article about the kinetic theory of gases. He was Lord Kelvin's assistant and they discovered together the so-called Joule-Thomson effect which referred to the cooling down of an expanding gas. This made possible later the licuefaction of gases.

Questions: try to make long sentences.

a) What famous scientist did Joule work together with?

….....

b) Why an international unit has his name?

….....

c) What did his family do?

….....

d) What experiment made him invent the electrical engine?

….....

e) How can a gas reach very low temperatures according to Kelvin?

….....

2) DEFINITIONS

1) Try to define these words without looking up the dictionary:

a) Energy

b) Work

c) Power

d) Inclined plane

3) THE RIGHT OPTION

Choose the right words:

A force is called **conservative/ concerver** when the **correspondient/ corresponding** work does not depend on **trayectory/ trajectory** but on the initial and final points. Work and energy can transform **inversely/ reciprocally**, that is the reason **because/ why** they share the same unit. In Physics, there are many times in which the same **conclusion/ conclussion** is reached by using different points of view. That is what happens in some problems: the result is the same, no matter if it is used the point of view of Kinematics, Dynamics or Work and Energy. If you look **by/ around** you, you can see changes everywhere: the wind **moves/ blows**, plants grow up, animals move to and **fro/ up**, machines and tools do several tasks. All this can be done by means of energy. All the types of energy come directly or **undirectly/ indirectly** for the sun. For instance, eolic energy comes from the sun because the sun heats up the Earth's surface **in/ at** different temperatures and causing different pressures, which at the same time **provokes/ becomes** the wind.

4) PHRASE ORDER

Arrange these phrases:

a) is a heat plane horizontal dragged object and An released. by is

….....

b) is a goes heavy shot up. and log against system bullet A the

….....

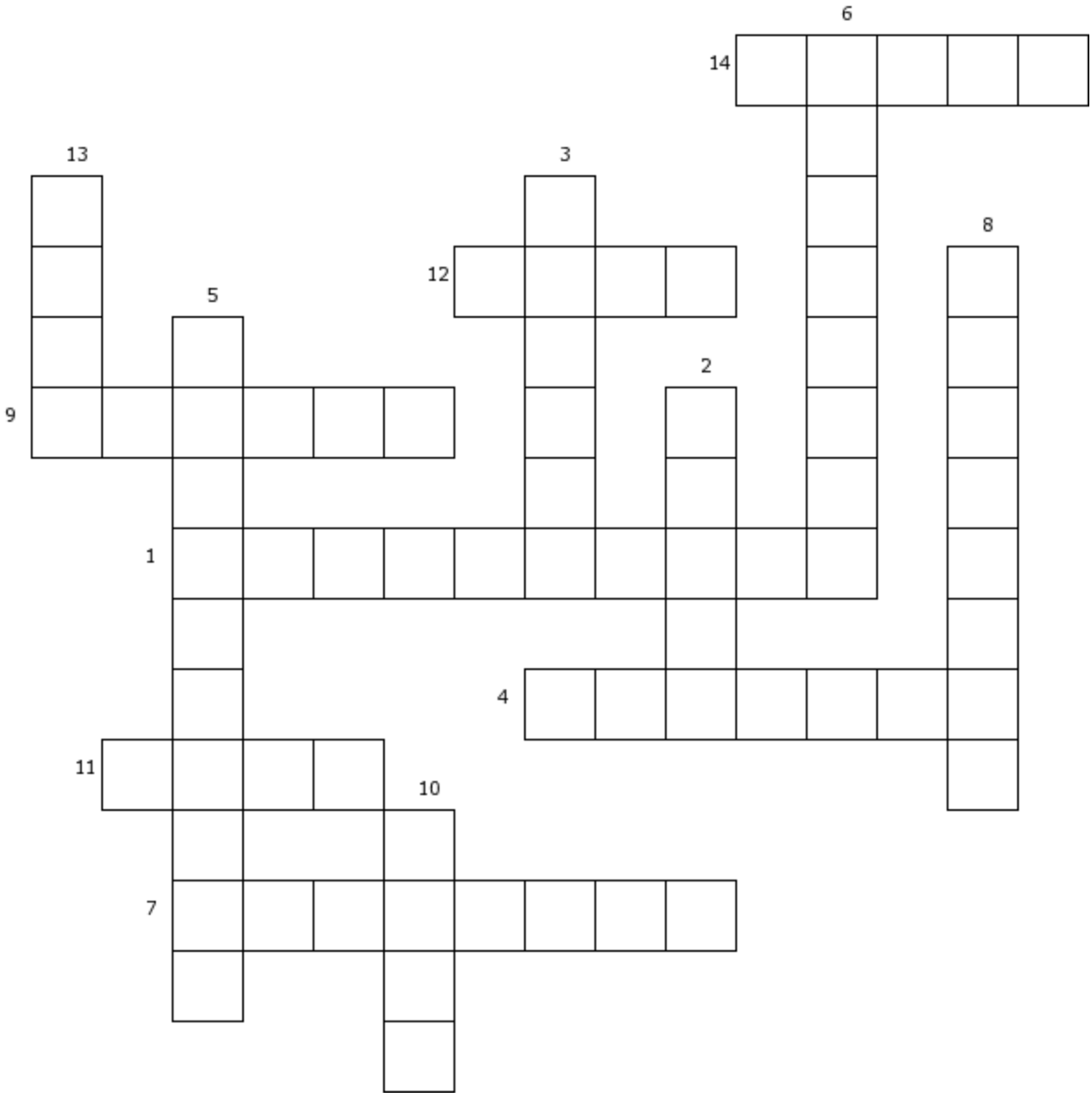
c) can is neither nor Energy transformed. it only created be destroyed,

….....

d) in a a starts friction surface moving body coefficient. A with certain

….....

5) CROSSWORDS



Write in English:

1) HIPOTENUSA

2) JULIO

3) COSENO

4) PROMEDIO

5) MECÁNICO (adj.)

6) OPUESTO (adj.)

7) CONTIGUO

8) INCLINADO

9) ENERGÍA

10) VATIO

11) SENO

12) TRABAJO

13) LADO

14) POTENCIA

6) COLUMNS

Match both columns:

A	Watt	H	Work per second
B	Cosine	I	Unit of work in the International System
C	Power	J	Medium value
D	Work	K	Adjacent side over hypotenuse
E	Sine	L	Unit of power in the International System
F	Average	M	Opposite side over hypotenuse
G	Joule	N	Transformed energy

7) FILL IN THE BLANKS

quality kind opposite up moving atoms entirely performance degrades converts may work matter

Everything that surrounds us is made …..... of …..... or energy. Matter is formed by …..... and energy is something that keeps everything …..... Energy …..... be transformed in any other type of energy or …..... The transformation of work into energy has a good …....., but not quite the …..... In the energetic transformations, energy …....., that is to say, it loses …..... In all the transformations of energy, part of the energy …..... into heat. Heat is a form of degraded energy. Any form of energy can be …..... transformed into heat but heat cannot be transformed completely in any other …..... of energy.

8) QUESTIONS

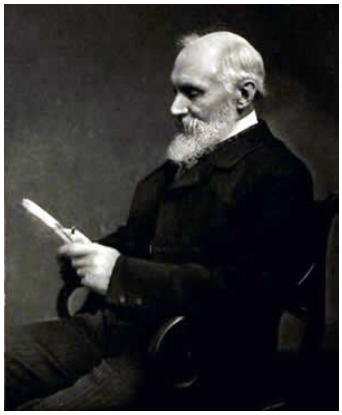
a) Are no friction systems possible?

b) Why does velocity increase when an object falls, from the point of view of energy?

c) Can energy be stocked?

UNIT 4: HEAT AND TEMPERATURE

1) BIOGRAPHY: WILLIAM THOMSON KELVIN (LORD KELVIN)



He was a British physicist and mathematician born in the 19th century. He is usually known as Lord Kelvin. He went to Cambridge, where he got a degree and won an award. When he was 22 years old, he was appointed head of department in the University of Glasgow.

In the England of those times, experimental studies did not have great success. Nevertheless, his position inspired to scientists for more than half a century. One of his first studies was trying to determine the age of Earth. He met Joule during a scientific meeting held in Oxford. Running those times, Joule was carrying out his experiences and presented the heat as a form of energy, which became the first principle of thermodynamics. Kelvin was one of the first researchers who agreed with Joule. Joule's ideas on the nature of heat made a remarkable influence on Kelvin and this made him create a thermodynamic scale for temperature, independent from the used apparatus and the substances. The scale of temperature and the themometer have his name in his honor.

Kelvin presented to the Royal Society of Edimburgh the “Dynamical theory of heat”, in which is mentioned the dissipation of energy and takes part in the second principle of thermodynamics. The dynamical theory of heat along with the principle of conservation of energy was accepted by all the scientific community.

This wise man owes his popularity to his improvement of the transmissions of submarine communications cable. He debated the mathematical theory of the cable's signals and the factors that made the transmission difficult. As an aknowledgement for the services in transatlantic telegraphy, he obtained the tithe of “lord”.

He invented several instruments and made great contributions to navigation. He was modest and looked like shy, but he always showed a big kindness with his pupils and he fell proud when he was able to help the humblest researcher.

Activity: write questions for these answers:

a) Head of department in the University of Glasgow.
….....
b) Trying to determine the Earth's age
….....
c) The heat as a form of energy.
….....
d) The “Dynamical theory of heat”.
….....
e) The improvement of the transmission of submarine communications cable.
….....

2) DEFINITIONS

1) Try to define these words without looking up the dictionary or your book:

a) Heat

b) Temperature

c) Thermal equilibrium

d) Decomposition

3) THE RIGHT OPTION

Choose the right words:

Heat flows **spontaneously / espontaneously** only from systems of **highest / higher** temperature to systems of **lower / lowest** temperature. The first law of thermodynamics requires **what / that** the energy of an isolated system is **conserved / conversed**. Heat transfer is **an irreversible / a reversible process**, which leads to the systems coming closer to mutual thermodynamic equilibrium. Joule characterized the terms **latent / beating** heat and sensible heat as components of heat each affecting distinct physical **phenomena / phenomenae**, namely the potential and **kinetic / cinetic** energy of particles, respectively. Latent heat is the heat released or **absorbed / absorved** by a chemical substance during a change of state, **e.g./ i.e.** without a change in temperature. Sensible heat, in contrast to latent heat, is the heat exchanged with the sole effect of change in temperature. Specific heat is defined as the **cuantity / amount** of energy that has to be **transferred / released** to or from one unit of mass to change the system temperature by one degree.

4) PHRASE ORDER

Arrange these phrases:

a) of a the of particles. substance average varies The speed with temperature the

….....

b) of the temperature. properties materials Many on depend physical

….....

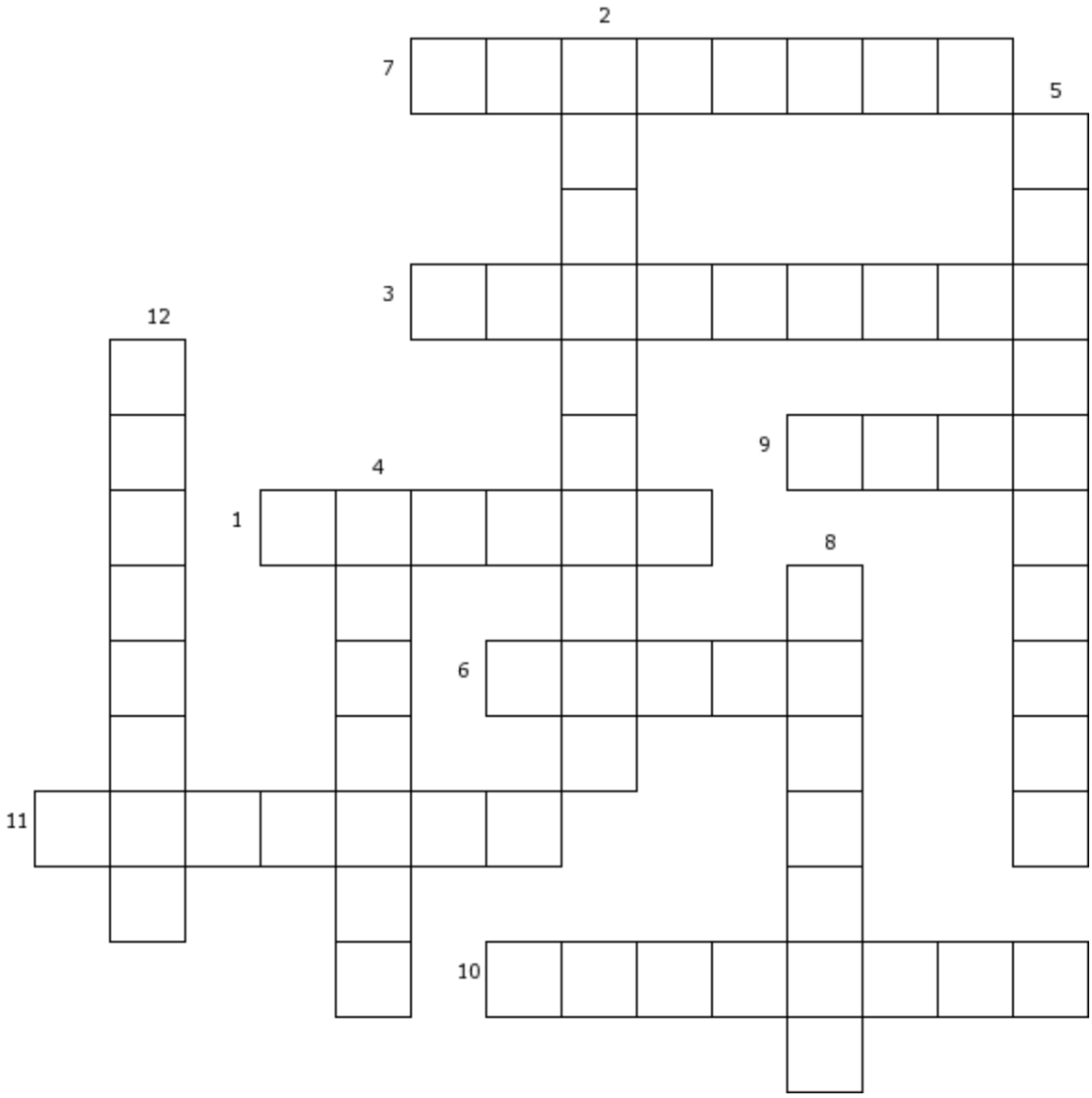
c) as the the increase. increases motion Temperature energy and kinetic

….....

d) of system. cooling removing The thermal from process energy involves a

….....

5) CROSSWORDS



Write in English:

1) LISO

2) CONDUCCIÓN

3) RADIACIÓN

4) FUSIÓN

5) CONVECCIÓN

6) RUGOSO

7) DISMINUIR

8) TÉRMICO

9) ONDA

10) INFRARROJO

11) EBULLICIÓN

12) AISLANTE

6) COLUMNS

Match both columns:

A	Wave	H	Better in liquids and gases
B	Conduction	I	It may occur in the vacuum
C	Conductor	J	It does not transmit heat well
D	Microwave	K	Better in solids
E	Radiation	L	It transmits heat quite well
F	Isolator	M	A metal is a good one
G	Convection	N	Distortion of the space

7) FILL IN THE BLANKS

increases phenomenologically work flow application energy constant statistical molecules states decrease law

Entropy is a thermodynamic property that can be used to determine the …..... not available for …..... in a thermodynamic process. It ir related with the order or disorder of …..... of the system. In classical thermodynamics, the concept of entropy is defined …..... by the second …..... of thermodynamics, which …..... that the entropy of an isolated system always …..... or remains …..... The second law of thermodynamics states that in general the total entropy of any system will not …..... other than by increasing the entropy of some other system. It follows that heat will not …..... from a colder body to a hotter body without the …..... of work to the colder body. Thermodynamics may be classified in classical and …..... Pressure, density, and temperature tend to become uniform over time.

8) QUESTIONS

a) Explain why there is a limit in recheable low temperatures.

….....

b) Explain the kinds and uses of thermometers.

….....

c) Why does water boil sooner on the top of a mountain if it is not cold?

….....

UNIT 5: LABORATORY

1) BIOGRAPHY: WILHELM CONRAD RÖENTGEN

He was born in the 19th century in Prussian. His father was a textile trader. They moved to the Netherlands. He entered the technical School of Utrecht. He was expelled for an affair in which he did not take part: he was accused of having made a caricature of one of his teachers.

Pretty soon he showed his interest for basic sciences, mainly Physics, maybe because of the influence of his teachers. He graduated and worked as August Kundt's assistant. He still did not obtain an academic job in the University, as he did not pass the exams in Latin and Greek.

He finally obtained the post of professor in the University of Strasbourg. He worked on the specific heat of gases and the rotation of the light polarization plane in crystals. It was one of his most productive eras from the point of view of science. He finally obtained the professorshipof of Physics in Würzwug. He was offered the same post in Utrecht, where he was not been admitted previously, but he refused.

When he was experimenting on cathode ray, he observed the phenomenon of fluorescence in some salts. This action disappeared when the current was off. He repeated the experiemnt because he was more in favor of experimenting than of thinking. He sooned realized that those rays (which he called X-rays or Röentgen rays) got through different types of materials, like paper, wood, a thin sheet of aluminium but not lead. By experimenting with these rays, he was able to see the bones of his hands and he had the idea of printing this image. This is how the first radiography was born. The experiment soon appeared in the press.

He continued working on the medical applications of the X-rays but, mostly on the physical applications. He obtained awards all his life for being the discoverer of the X-rays, which reached the top with the Nobel Prize in 1901. X-rays were used everywhere until it was found that it was a dangerous radiation and were limited to medical applications.

Activity: answer these questions:

1) What is or what was Prussia?

….....

2) How did he discover the X-rays?

….....

3) Why did he refuse the professorship of Physics in Utrecht?

….....

4) What were the features of the new rays?

….....

5) Why did X-rays were less used everywhere?

….....

2) DEFINITIONS

1) Try to define these words without looking up the dictionary:

a) Glassware

b) Desiccator

c) Barometer

d) Container

3) THE RIGHT OPTION

Choose the right words:

A laboratory is **a facility / an installation** that provides **controlling / controlled** conditions in which scientific **research / investigation**, experiments and measurements may be **realized / performed**. Lab is the informal name for laboratory. The look of the lab varies depending on its type: chemistry lab, physics lab, metallurgy lab, biology lab, geology lab, etc. Modern labs almost always contain at least one computer workstation for **date / data** collection and **analysis / analises**. In the labs for scientific research, the scientific **metode/ method** is followed, which has these steps: observation of the **phenomenon / phenomenom**, thinking of hypothesis, analysis in the lab, presentation of the **conclussions / conclusions**. The analysis in the lab implies making multiple measurements. First, the factors that **make / take** part in the phenomenon must be **identified / identyfied**. Secondly, one factor must change and the others must be constant to watch the **effect / efect** on the main factor.

4) PHRASE ORDER

Arrange these phrases:

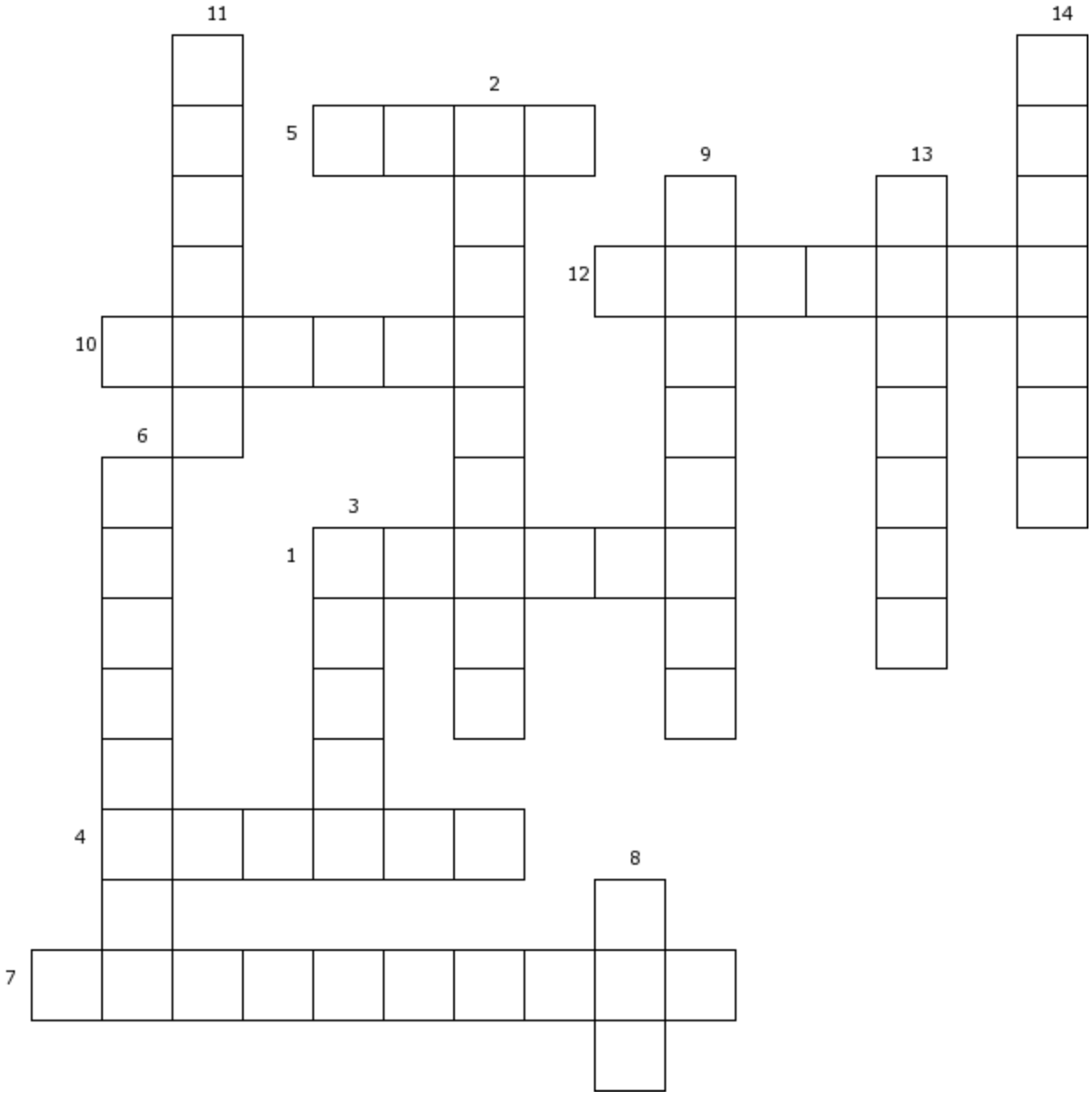
a) flasks. funnels are Buchner together filtering with used
….....

b) are present. labs, In materials hazardous many
….....

c) of of waste. An important is the aspect treatment laboratories
….....

d) are in laboratories. adequate The reproduced most conditions
….....

5) CROSSWORDS



Write in English:

1) EMBUDO

2) AFILADOR

3) MATRAZ

4) VASO DE PRECIPITADO

5) MASCARILLA

6) CRISOL

7) DESECADOR

8) VARILLA

9) TIERRA PIPA

10) MORTERO

11) TRÍPODE

12) PIPETA

13) TAPÓN

14) BURETA

6) COLUMNS

Match both columns:

A	Tongs	H	It is used to do a vacuum filtration
B	Safe tubes	I	It is used to measure the melting point of a substance
C	Burette	J	It is useful to grab things
D	Spot plate	K	It measures volumes of liquids with small precision
E	Thiele	L	It is useful to do chemical reactions at a small scale
F	Buchner funnel	M	It measures volumes of liquids with great precision
G	Measuring cylinder	N	It is used to avoid the splashing

7) FILL IN THE BLANKS

spectrometer sample acidity spectroscope potentiometer scales spectroscope index resonance matter smoke measuring colorimeter difraction glassware chromatographic electrolitic calorimeter analytical

Apart from the …., in the laboratory several …. instruments are used and …. machines. The …. is used for weighing, the …. to measure the electromagnetic radiation that comes from …. interaction, …. to measure the specific heat, …. for the voltage, …. device to separate mixtures of substances, …. to measure the concentration of a solution, mass …. to identify the composition of a …., refractometer to measure the refractive …., pH meter to measure the …. of a solution, …. cell to separate substances, X-ray …. machine to identify substances, ultraviolet and infrared …. to identify substances, nuclear magnetic …. machine to identify substances, and substances detectors like gas detector, …. detector, carbon dioxide sensor, oxygen sensor and many more.

8) QUESTIONS

a) Name the material you would use to do a distillation

….

b) Name the material you would use to do a volumetry

….

c) Express how you would prepare a solution

….

UNIT 6: FORMULATION AND NOMENCLATURE

1) BIOGRAPHY: CARL WILHEM SCHEELE

He was a Swedish chemist from the 18th century. After working in a chemist's in several Swedish cities, he set up his own chemist's in Köping, city where he stayed the rest of his life. Before that, he had started his studies about chemical combustion, in which he discovered the existence of oxygen in the air and he found the conclusion that that element, which he called “fire air” was a component of heat and light. He was able to obtain oxigen from several oxides before the English chemist Joseph Priestley, who has usually the credit for discovering the oxigen.

In 1774, he defined chlorine as dephlogisticated marine acid and he dedicated the following years to isolate organic compounds as glycerine and the acids: tartaric, formic, uric and lactic, demonstrating that the previous one was the acid component of sour milk. He discovered the properties and composition of hydrogen cyanide and the acids citric, malic, oxalic and galic.

He also found several oxidation states of iron and a method to obtain phosphorus from the bones. His writings were published after his death in the volume “Compilation of Carl Wilhem Scheele's articles”.

His death was a little absurd. He had the bad habit of tasting every new element or compound he discovered, and he discovered hydrogen cyanide and mercury.

Activities: answer these questions:

1) How did he discover the element oxigen?

….....

2) How did he obtain oxigen?

….....

3) What chemicals did he synthesize?

….....

4) What is the main component of sour milk?

….....

5) How did he die?

….....

2) DEFINITIONS
Try to define these words without looking up the dictionary:

a) Nomenclature

b) Formula

c) Formulation

d) Metal

3) THE RIGHT OPTION

Choose the right words:

A mineral is an element or a **substance / compound** that has been formed as a result of geological processes, which has a **caracteristic / characteristic** chemical composition, a highly ordered atomic **structure / estructure** and specific physical properties. **By / In** comparison, a rock is an **aggregation / aggregate** of minerals and does not have a specific chemical composition. Minerals **range / arrange** in composition from pure elements and simple salts to very **complex / difficult** silicates with thousands of known forms. The study of minerals is called mineralogy. A crystal structure is the **orderly / ordered** geometric spatial arrangement of atoms in the internal structure of a mineral. Normally, the crystal has an internal and an external arrangement, and both are the **same / opposite**. Even when the mineral grains are too small to see or are irregularly shaped, the underlying crystal structure is always **periodic / periodical** and can be determined by X-ray diffraction. Crystal structure greatly influences **a / those** mineral's physical properties. **Though / Through** diamond and graphite have the same composition (both are pure **calcium / carbon**), graphite is very soft, while diamond is the hardest of all known **elements / minerals**.

4) PHRASE ORDER
Arrange these phrases:

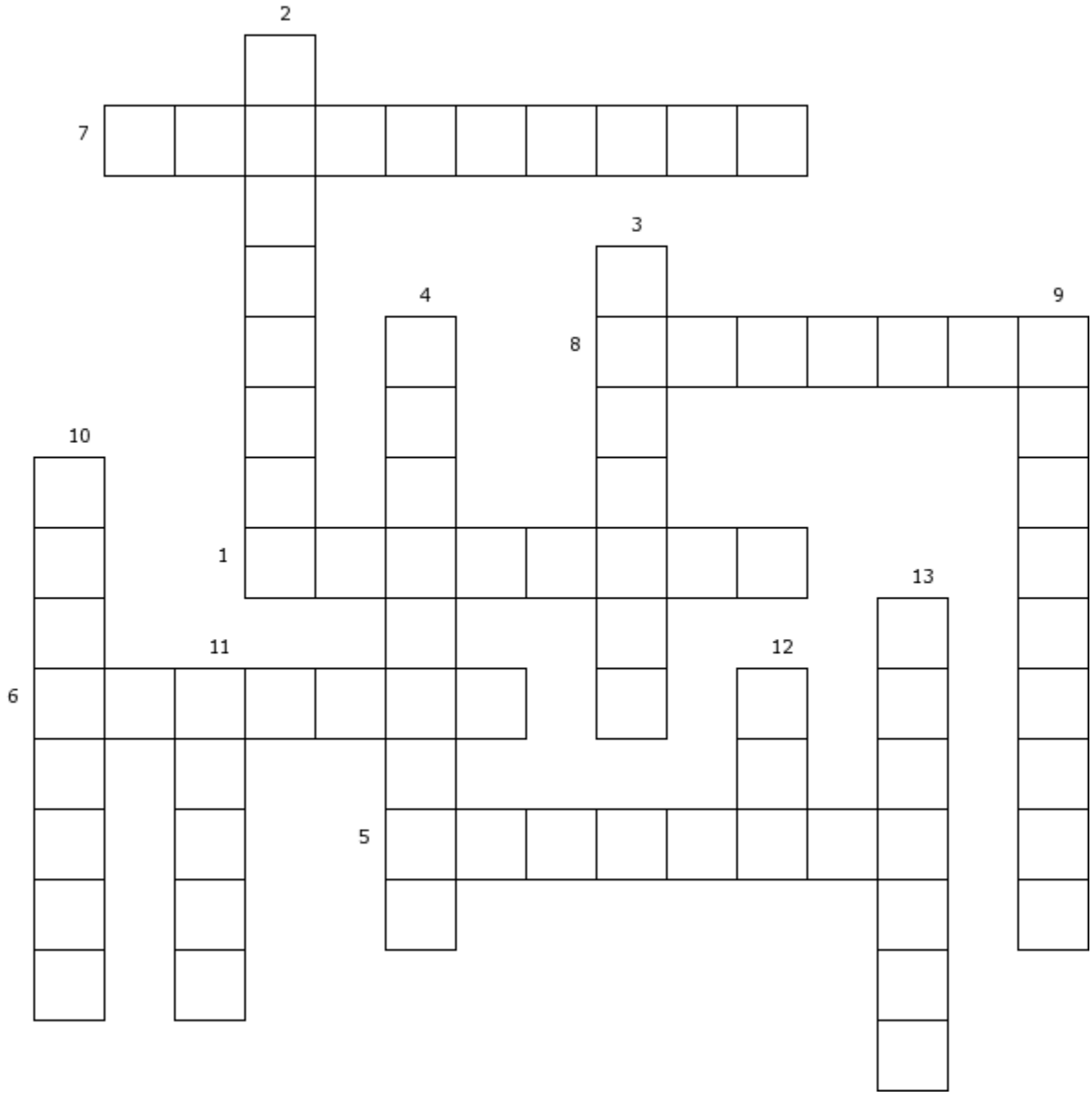
a) of and Chemistry. Pure Union Applied International
….....

b) are named. in compounds ways be which can There different
….....

c) is the of in a compound. hypothetical number The an element charge oxidation
….....

d) is to in a bond. Electronegativity electrons attract tendency the
….....

5) **CROSSWORDS**



Write in English:

1) ESCANDIO

2) HALÓGENOS

3) HIDRURO

4) ALCALINOS

5) INTERCAMBIAR

6) OXOÁCIDO

7) CALCÓGENOS

8) YTRIO

9) SEMIMETAL

10) CROMO

11) ÓXIDO

12) ESTAÑO

13) VALENCIA

6) COLUMNS

Match both columns:

A	Salt	H	Hydrogen in first position
B	Stock	I	Compound with the group O_2
C	Hydride	J	Hydrogen and oxigen are joined
D	IUPAC	K	It uses valences
E	Hydroxide	L	It uses prefixes
F	Peroxide	M	Hydrogen at the en
G	Acid	N	A metal and a non-metal are joined

7) FILL IN THE BLANKS

Tecnecium phosphorus chlorine inert synthesized dietary provoked magnesium radioactive part Iron crust carbon sand oxygen tiny

Actually, 118 elements have been discovered or …....., but many of them are presented in a …..... proportion on the Earth's surface. The most abundant element is …....., as much in …..... matter as in life form. The second most abundant one is silicon, as the …..... and the rocks are made of silicon. There are also …..... elements which desintegrate and are disappearing from the Earth's …..... . …....., for instance, has existed from very long ago but its rapid disintegration has …..... its complete disappearance from our planet. In living beings, the second most abundant element is …....., in a mass percentage. There are several elements which are part of life but take …..... in a very little amount. Nevertheless, these elements are fundamental for life. They are called …..... minerals. …..... is part of hemoglobin, needed to deliver oxigen in blood; …..... is part of the bones and of the DNA; …..... is esential for the transmission of the nervous current and …..... for the production of hydrochloric acid in the stomach.

8) QUESTIONS

a) Explain how a formula is written.

…..

b) Explain how a compound is named in IUPAC.

…..

c) Explain the importance of using formulas and names in Chemistry.

UNIT 7: CHEMICAL CALCULUS

1) BIOGRAPHY: ANTOINE-LAURENT DE LAVOISIER

French chemist of the 17th century who is considered the father of modern chemistry. He was adviced by his family to study Law but he adquired good fundamentals in scientific matter and also a solid humanistic education.

He obtained a degree in Law in Paris though his activity was directed to scientific research. He got a golden medal from the French Academy of Sciences for an essay about street light for great cities. He produced a minearalogical of France with the help of a famous geologist. He presented a series of articles about the analysis of water samples. He was accepted by the Academy and became its director and treasurer. His wife translated his work into English.

He researched the role of the air in the reactions of combustion. He maintained that sulphur and phosphorus put on weight because they absorbed air while lead lost weight as it lost air in the combustion. From Priestley's works, he deduced that there was an air which did not take part in combustions (nitrogen) and an air which did (oxigen). Lavoisier's works were against the theory of phlogiston, which said that the phlogiston was gained or lost in combustions.

Along with other scientists, he published “Annals of Chemistry”, monographic publication dedicated to new chemistry. He also published “Chemistry elementary treatise”. From this book, it is remarkable the formulation of a first statement of the law of conservation of matter, which is Lavoisier's principal achievement. He also researched about fermentation and animal breathing. He concluded that breathingis a kind of oxidation reaction similar to the combustion of carbon.

He was also a prominent figure of the French society of his time. He had moderate ideas, but being near Ferme Générale's ideas, he got the enmity of revolutionay Marat and he was condemned to death in the guillotine.

Activities: find the questions for these answers:

a) His activity was directed to scientific research.

….....

b) Street light for great cities.

….....

c) The theory of phlogiston.

….....

d) He did it along with other scientists.

….....

e) Because he adhered to a controversial character in Frech Revolution.

….....

2) DEFINITIONS

1) Try to define these words without looking up the dictionary:

a) Calculations

b) Quantitative aspect

c) Fertilizer

d) Quotient

3) THE RIGHT OPTION

Choose the right words:

Most of the **calculations / calculus** in Chemistry are based on atomic masses and **proportions / percentages**. More complicated calculations, like **derivatives / derivates** and integrals, are usually related to Physics, **more / rather** than Chemistry. There are several formulas on the **state / estate** variables of gases, but the formula of the ideal gas, even **through / though** not to precise, is quite simple and that is the key of its **utility / usefulness**. The **precision / precission** in chemistry is not so **high / low** as that one in Physics, but it is important and it is also important the **absolute / relative** error, that is the error percentage a **measurement / measure** has. In the work of a laboratory, some times chemical calculations are needed in the **development / develop** of an experience. **The others / Other times**, the qualitative aspect of the experiment is predominant but, in **most / more** cases, the qualitative and the quantitative points of views are **bear / borne** in mind.

4) PHRASE ORDER

Arrange these phrases:

a) of on their structure. depend properties The composition substances and

….....

b) is in the empirical first the obtained formula The lab. one

….....

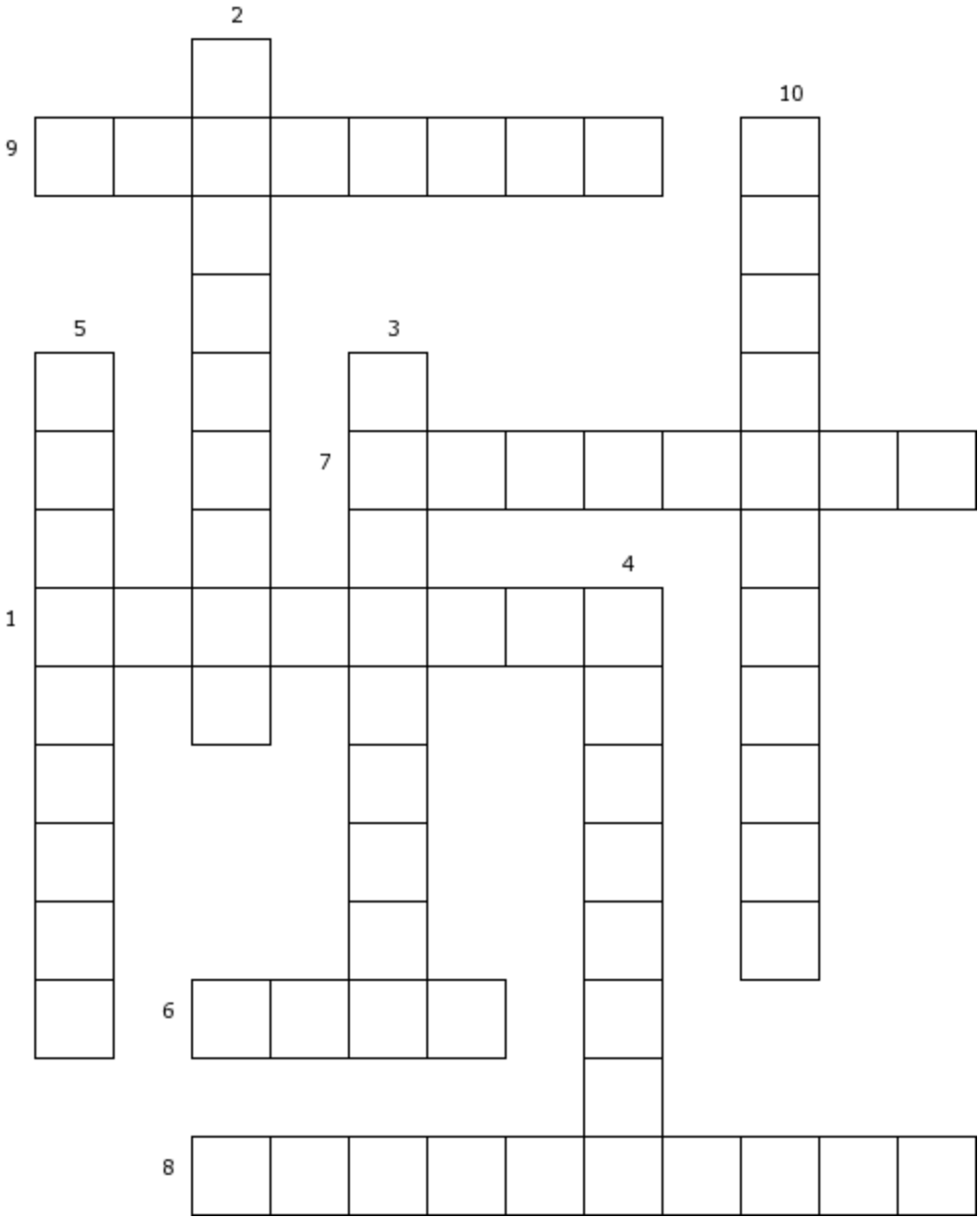
c) are multiplications. quotients Conversion cross preferred over

….....

d) of is the moles. particles related The number number of to

….....

5) CROSSWORDS



Write in English:

1) ANTERIOR

2) RECIPIENTE

3) EMPÍRICO

4) DISOLUCIÓN

5) COMPONENTE

6) MOL

7) MOLARIDAD

8) PORCENTAJE

9) COCIENTE

10) CUALITATIVO

6) COLUMNS

Match both columns:

A	Mole	H	Process of dissolving
B	Container	I	Referred to the amount of each thing it has
C	Qualitative	J	Solvent and solute
D	Empirical	K	Recipient
E	Dissolution	L	Related to the Avogadro constant
F	Solution	M	Referred to the things it has
G	Quantitative	N	Based on the experience

7) FILL IN THE BLANKS

complement methodologies developed range apply efficient structures being drugs accurate accurate assist solving theoretical paths

Computational chemistry is a branch of chemistry that uses principles of computer science to …..... in …..... chemical problems. It uses …..... chemistry, incorporated into …..... computer programs, to calculate the …..... and properties of molecules and solids. While its results normally …..... the information obtained by chemical experiments, it can in some cases predict …..... unobserved chemical phenomena. It is widely used in the design of new …..... and materials. The computer time and other resources (such as memory and disk space) increase rapidly with the size of the system …..... studied. Computational chemistry methods …..... from highly …..... to very approximate. In theoretical chemistry, algorithms and computer programs are …..... to predict atomic and molecular properties and reaction …..... for chemical reactions. Computational chemistry, in contrast, may simply …..... existing computer programs and …..... to specific chemical questions.

8) QUESTIONS

a) Explain how you calculate a molecular mass from the atomic masses.

…..

b) Explain what an ideal gas is.

…..

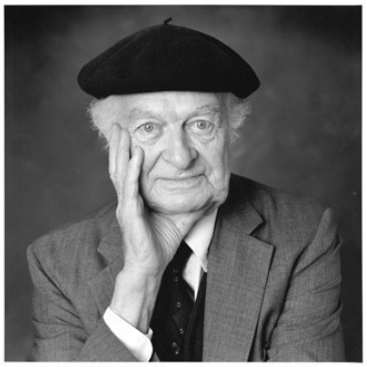
c) Write one aplication of the calculations in solutions.

…..

d) Explain the difference between solving and diluting.

…..…

UNIT 8: CHEMICAL REACTIONS



1) BIOGRAPHY: LINUS CARL PAULING

American chemist from the 20th century. He got a degree in chemical engineering in the State University of Oregon. He did his PhD on Physical Chemistry in the Californian Institute of Technnology. He colaborated with some famous scientists in Europe: Sommerfeld, Bohr, Schrödinger and Bragg.

He was one of the first scientists to apply the principles of Quantum Mechanics to explain the phenomena of X-ray difraction in crystals. To describe the ability of the atom of carbon to form four bonds, he introduced the concept of hybrid orbital in which the electrons are displaced from their original positions because of their mutual repulsion. He also identified the hybridation of ions surrounding a central ion in the group of compounds called the coordination complexes. He proposed the concept of resonance to explain some structures. He introduced the empirical concept of electronegativity, which measures the attraction of a nucleus and the electrons of the chemical bond.

Pauling's theories on the chemical bond are collected in his work “The nature of chemical bond and the structure of molecules and crystals”, one of the books with a greater influence in the 20th century. He worked in colaboration with the biologist Max Delbrück to study the antigen-antibody reactions. He also worked with the American chemist Robert B. Corey to recognize the helicoidal structure of certain proteins.

En 1954 he was rewarded with the Nobel Prize in Chemistry for his creditable scientific work. In later years, he obtained more Nobel Prizes por his pacifist militancy and his remarkable opposition to the proliferation of nuclear weapons. He also published the book “Cancer and vitamin C”.

Activities: answer these questions:

a) Explain what a PhD is.

….....

b) How did he explain the phenomena of X-ray difraction in crystals?

….....

c) How can the atom of carbon form four similar bonds?

….....

d) What does antigen-antibody reactions consist of?

….....

e) What awards did he get?

….....

2) DEFINITIONS

1) Try to define these words without looking up the dictionary:

a) Decomposition

b) Synthesis

c) Scientific law

d) Reactant

3) THE RIGHT OPTION

Choose the right words:

Normally, the **pressure / temperature** is not constant in a chemical reaction. Apart **of / from** a substances change, in chemical reactions there is a **equilibrium / balance** of energy between reactants and products. If reactants have **more / less** energy than products, the reaction is said to be exothermic. **In / On** the contrary, if reactants have **more / less** energy than products, the reaction is said to be endothermic. Chemical **chinetics / kinetics** is the branch of chemistry which studies the reaction **rate / velocity**. This rate depends on the nature of the reactants, the physical state of the reactants, the concentration, the temperature, the pressure and the presence of a **catalyst / catalizer**, which is a substance that **speeds up / accelerates** the rate of a chemical reaction but remains chemically **inchanged / unchanged** afterwards.

4) PHRASE ORDER

Arrange these phrases:

a) of of steps. sequence Reactions consist a often individual

….....

b) the of to a product. chemical The chemistry branch synthesis certain tries obtain that is

….....

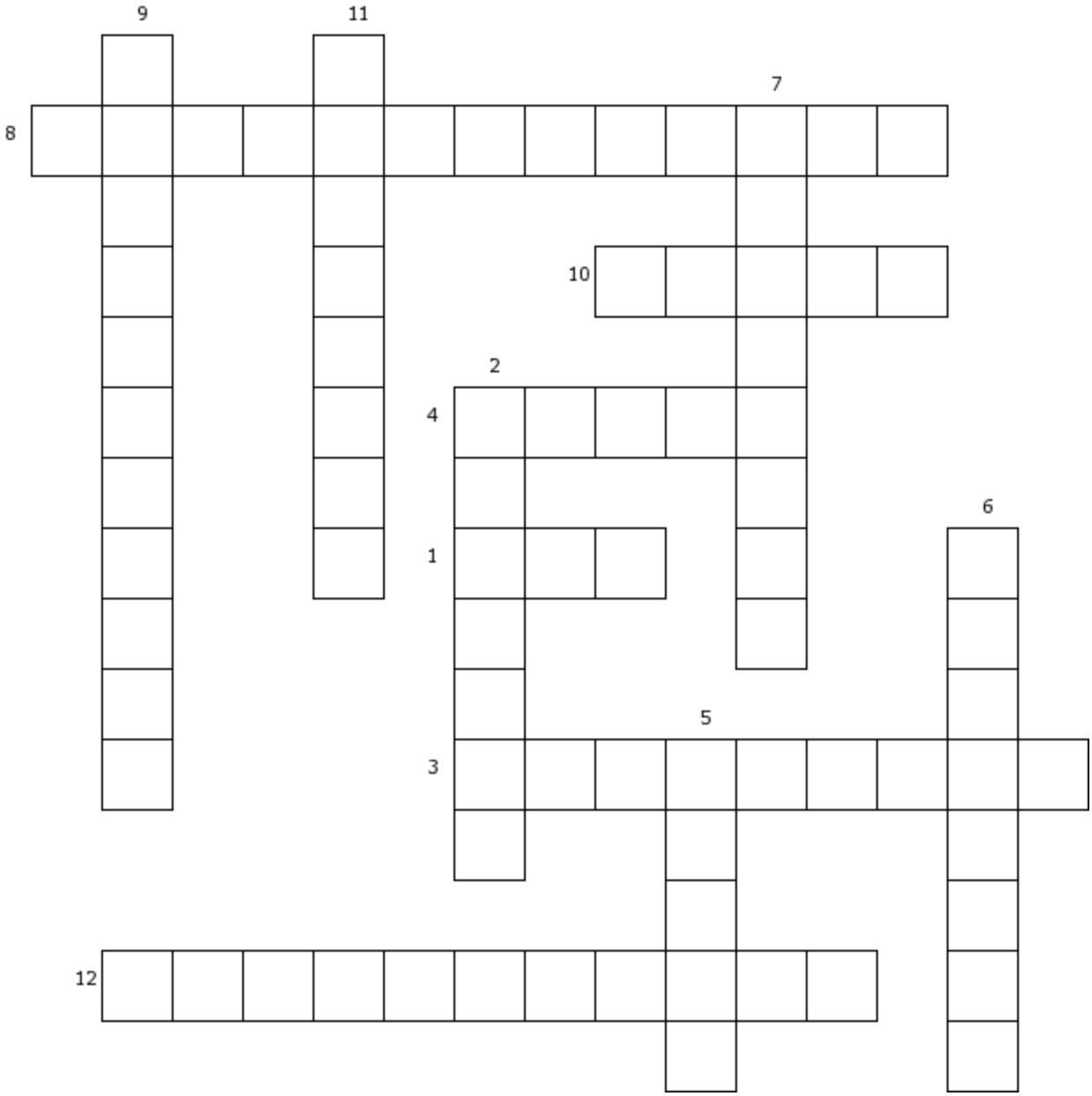
c) are that is do directions. and chemical Most they reversible, reactions run both can in

….....

d) are thermodynamics. reactions laws determined by of the Chemical

….....

5) CROSSWORDS



Write in English:

1) LEY

2) LIBERAR

3) SÍNTESIS

4) REACCIONAR

5) ENSAYO

6) DEFINIDO

7) INFLAMACIÓN

8) CORRESPONDIENTE

9) CASUALIDAD

10) IÓNICO

11) REACTIVO

12) PRECIPITADO

6) COLUMNS

Match both columns:

A	Mass	H	Compound obtained
B	Reactant	I	It is usually not constant in a chemical reaction
C	Ignition	J	They break and they form in a chemical reaction
D	Precipitate	K	It is constant in a chemical reaction
E	Temperature	L	Compound in the act of reaction
F	Product	M	Combustion
G	Bonds	N	Solid at the bottom

7) FILL IN THE BLANKS

reactants oxides oxygen flameless Earth periods yields oxidant burning exothermic flame interest common fireplace result

Combustion is probably the most …..... chemical reaction on …..... Combustion or …..... is the …..... chemical reaction between a fuel and an …..... The release of heat can …..... in the production of light in the form of either glowing or a …..... Glowing, smouldering or smoldering is the slow, low-temperature, …..... form of combustion, It is what happens in the …..... in the last …..... of combustion. Fuels of …..... often include organic compounds (especially hydrocarbons) in the gas, liquid or solid phase. Combustions may be complete or incomplete. It is incomplete when not all the amount of …..... are burned. When a fuel is burnt, the corresponding …..... are obtained. For example, the combustion of hydrocarbons …..... water vapor and carbon dioxide. If it is incomplete, there is a proportion of hydrocarbon in the combustion gases, which are the gases obtained in the burning. Incomplete combustion will occur when there is not enough …..... to allow the fuel to react completely.

8) QUESTIONS

a) Explain what happens in a chemical reaction.

….....

b) Write some substances that react between them.

….....

c) Write some substances that do not react between them.

….....

d) Write some substances which react with almost nothing.

UNIT 9: ORGANIC CHEMISTRY

1) BIOGRAPHY: ELIAS JAMES COREY

American chemist born in the 20th century. Corey is the creator of the so-called retrosynthetic synthesis, which makes possible to deduce in a reverse way the needed chemical reactions to yield a certain molecule. Apart from the obtention of several substances with a pharmacological interest, he has obtained some enzimes which speed up the synthesis reactions. His discoveries were awarded with a Nobel prize in 1990.

He belonged to an emigrant Lebanese family dedicated to the world of commerce. He was brought up by his parents because of the soon death of his father. In 1945 he started studying Science in the MIT (Massachusetts Institute of Technology), where the work in the laboratory made him specialized in organic chemistry. He got the degree and the PhD to years later and a year after this, he was the laboratory assistant in the University of Illinois.

His first researches were about the molecular orbital theory. He worked on the synthesis and structure of substances and he got the charge of permanent professor in Chemistry. He got a grant from the Guggenheim foundation to go to the University of Harvard, where he got the professorship in chemistry in 1959.

Being in Europe and visiting the department of the Swedish chemist Karl Bergström, he started studying the prostaglandin. He developed the retrosynthetic analysis by using computers, new methods of synthesis, reaction mechanisms, robots and molecular catalysts, advances in organometallic chemistry and enzimology.

Activities: find questions for these answers:

a) Retrosynthetic synthesis.
….....

b) A Nobel Prize.
….....

c) The world of commerce.
….....

d) In organic chemistry.
….....

e) A grant to go to Harvard.
….....

2) DEFINITIONS

1) Try to define these words without looking up the dictionary:

a) Functional group

b) Haloalkane

c) Organic compound

d) Tetracovalence of the carbon

3) THE RIGHT OPTION

Choose the right words:

Organic chemistry is a subdiscipline **within / into** chemistry involving the scientific study of the structure, properties, composition, reactions, and preparation (by **synthesis / syntheses** or by other means) of **carbon-based / based-carbon** compounds, and their **derivatives / derivates**. These compounds may contain any number of other elements, including **hydrogen / hidrogen**, **nytrogen / nitrogen**, **oxygen / oxigen**, the halogens as well as **fosforus / phosphorus**, **silicium / silicon**, and **sulfur / sulphur**. The range of application of organic compounds is **enormous / grandisimous**. They are important **constituents / contitujents** of many products including plastics, drugs, petrochemicals, food, explosives, and paints. They form the basis of almost all **terracheous / earthly** life processes (with very **few / fews** exceptions). Physical properties of organic compounds typically of interest include both quantitative and qualitative **features / featurings**.

4) PHRASE ORDER

Arrange these phrases:

a) of be total. may The partial an oxidation organic compound or

….....

b) bonds. conjugated Aromatic double contain hydrocarbons

….....

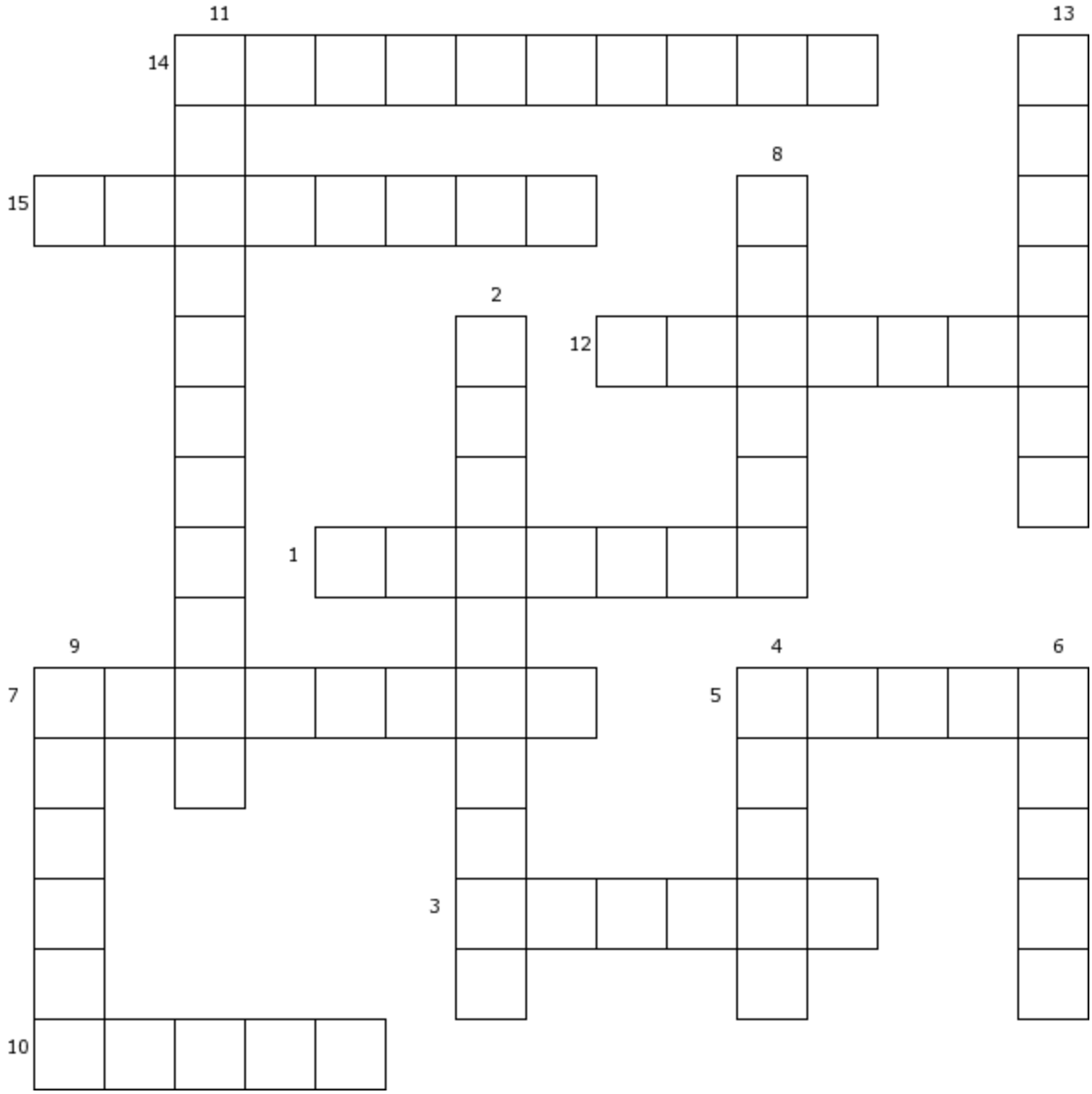
c) are a football. shape Fullerenes of with the compounds

….....

d) has chemistry. analytical Organic inorganic even chemistry techniques than more

….....

5) CROSSWORDS



Write in English:

1) ALCOHOL

2) FUNCIONAL

3) ALQUENO

4) AMINA

5) AMIDA

6) ÉTER

7) AROMÁTICO

8) METILO

9) ALCANO

10) ÉSTER

11) HIDROCARBURO

12) NITRILO

13) BENCENO

14) HALURO DE ALQUILO

15) ALDEHIDO

6) COLUMNS

Match both columns:

A	Alkyne	H	Very low reactivity
B	Aromatic	I	Double bond
C	Alcohol	J	Group – C O –
D	Alkane	K	Group – C H O
E	Alkene	L	Containing benzene
F	Aldehyde	M	Triple bond
G	Ketone	N	Group – O H

7) FILL IN THE BLANKS

elastomers bottles covalent paints biomolecules diving macromolecule ubiquitous monomers windows sewage isolator biopolymers fishing ranges bags

Two of the most important types of organic molecules or compounds are polymers and …..... A polymer is a large molecule (….....) composed of repeating structural units (….....). These sub-units are typically connected by …..... chemical bonds. They play an essential and …..... role in everyday life. This role …..... from familiar synthetic plastics and …..... to natural …..... such as nucleic acids and proteins that are essential for life. Cellulose, which is the main constituent of wood and paper, is a polymer. Synthetic polymers which surround us are, for instance, neoprene (in …..... suits), nylon (in …..... lines), PVC (polyvinyl chloride, in …..... pipes), silicone (in ….....), polystyrene (as an …..... in double walls), polyethylene (in plastic …..... and water ….....), polyester (in ….....) and many more.

8) QUESTIONS

a) Are organic compounds harder or softer than inorganic compounds? Why?
….....
b) A lot of organic compounds have smell? Why?
….....
c) Why are there many more organic compounds than inorganic compounds?
….....
d) Why most organic compounds are flammable?
….....