**Physical Sciences II**

**Reading Comprehension**

**1. THE SPIRIT OF CHEMICAL SCIENCES**

Everything on the Earth consists of a great variety of chemical elements and compounds. Only an insignificant part of terrestrial matter is in the form of elemental substances, namely: the noble gases, the platinum metals, carbon in its various forms, and that is about all. Possibly, a very long time ago the clot of cosmic matter which finally became our planet, consisted all of only the atoms of almost hundred chemical elements. Hundreds, thousands, millions of years passed.Conditions changed. The atoms reacted with one another. The gigantic laboratory of nature began to operate. During its long evolution nature, the chemist, learned to prepare all kinds of substances, from the simple water molecule to infinitely complex proteins. The evolution of globe and of life on it is due largely to chemistry.The great diversity of chemical compounds owes its existence to processes called chemical reactions. They are true to the spirit of chemical science, and its principal subject matter. It is impossible to estimate even approximately, the number of chemical reactions that occur in the world, say, in the course of only one second.

For instance, for a person to pronounce the word “second”, many chemical processes must occur in their brain. We speak, think, enjoy ourselves, or worry, and all these reactions are backed by millions of chemical reactions, but there is also an immense number of chemical reactions that we do observe daily, just off hand, without stopping to think of them.We put a slice of lemon into a cup of strong tea and the tea becomes pale. We strike a match and a stick of wood bursts into flame and turns into charcoal. These are all chemical reactions. The primeval man who learned to light a fire was the first chemist. He accomplished the first chemical reaction, that of combustion. And this reaction is most necessary, the most important one in the history of mankind. It gave our distant ancestors the heat to warm their dwellings on cold days. In our time it has opened the way to outer space by propelling rockets weighing many tons into the sky.

The legend of Prometheus who gave fire to the people is at the same time the legend of the first chemical reaction.When simple or complex substances interact with each other, they usually let us know about it. Drop a piece of zinc into a solution of sulphuric acid. Immediately, gas bubbles begin to rise from it and after some time the metal disappears. The zinc dissolves in the acid liberating hydrogen. Or light a lump of sulphur, it burns with a bluish flame and you can smell the asphyxiating odour of sulphur dioxide, the chemical compound which forms when sulphur combines with oxygen. Moisten anhydrous copper sulphate, a white powder, with water, and it immediately turns blue. The salt combines with the water to form crystals of blue vitriol. Substances of this kind are called crystal hydrates.Do you know what quenching of lime is? Water is poured on quicklime and the result is slaked lime. Though the substance does not change colour, it can easily be seen that a reaction has occurred, because when lime is quenched, a great deal of heat is liberated. The primary and invariable condition of all chemical reactions is that they are accompanied by the liberation or absorption of thermal energy. Themost mundane occurrences of our everyday life are composed as a result of chemical reactions and it would indeed light the curious corners of young minds to ponder over the everyday nature of chemical sciences, to hold a careful lens to its many wonders instead of solely confining it to the laboratories.

**Read the passage and Answer the questions that follow:**

1. What is meant by the phrase ‘quenching of lime’?

2. According to the author of the passage, who is the first chemist?

3. What happens when you light a lump of sulphur?

4. Which chemical reaction does the author credit the primeval man of having learnt it.?

5.Match the Following:

(i) Terrestrial - Freedom

(ii) Primeval - Death

(iii) Combustion - Land

(iv) Asphyxiation - Heat

(v) Liberated - Ancient

**2. PRINCE OF MATHEMATICIANS**

Johann Carl Friedrich Gauss is now and again alluded to as the "Prince of Mathematicians", and the "greatest mathematician sinceantiquity" for his contributions to number theory, geometry, probability theory, geodesy, planetary astronomy, the theory of functions, and potential theory (including electromagnetism). He has had a striking impact on numerous fields of arithmetic and science and is positioned as one of history's most compelling mathematicians. During his lifetime he made critical commitments to pretty much every territory of mathematics, astronomy and statistics. Gauss was a child prodigy. There are numerous anecdotes concerning his precocity as a kid, and he made his first ground breaking mathematical discovery while still a teenager. At only three years of age, he adjusted a blunder in his dad’s finance counts, and he was taking care of his dad's records consistently by the age of 5. When Gauss was still at grade school, his instructor requested his class to include all the numbers from 1 to 100, accepting that this undertakingwould involve them for a long time. He was stunned when youthful Gauss, following a couple of moments thought, recorded the appropriate response 5050. The educator couldn't see how his student had determined the whole so rapidly in his mind, however the eight-year-old.Gauss brought up that the issue was quite basic.He had added the numbers in pairs - the first and the last, the second and the second to last and so on, etc., seeing that 1+100=101, 2+99=101, 3+98=101 ... so the total would be 50 lots of 101, which brings to 5050.It is amazing that a youngster still in grade school had found this technique for adding summing sequences of numbers, obviously Gauss was an exceptional kid. Luckily his abilities were found, and he was allowed to learn at college. By his twenties, Gauss had made revelations that would shape the eventual fate of science.While the story may not be completely evident, it is a mainstream story for maths instructors to tell since it shows that Gauss had a characteristic understanding into science. Instead of playing out an incredible accomplishment of mental number juggling, Gauss had seen the structure of the issue and utilized it to locate an alternate route to an answer.Gauss might have utilized his technique to add all the numbers from 1 to any number - by pairing off the first number with the last, the second number with the second to last, and so on, he only had to multiply this total by half the last number, just one swift calculation.

**Read the passage and Answer the questions that follow:**

1. Why do we consider Gauss the ‘Prince of Mathematicians’?

2. What happened when Gauss was at grade school?3. How did young Gauss solve the maths problem?4. What are all the fields that Gauss has contributed to, as a mathematician?

5. What is Gauss most famous for?

**3. THE FATHER OF MODERN CHEMISTRY**

Antoine-Laurent Lavoisier, a meticulous experimenter, revolutionized chemistry. He established the law of conservation of mass, determined that combustion and respiration are caused by chemical reactions with what he named “oxygen,” and helped systematize chemical nomenclature, among many other accomplishments. The son of a wealthy Parisian lawyer, Lavoisier completed a law degree in accordance with family wishes. His realinterest, however, was in science, which he pursued with passion while leading a full public life. On the basis of his earliest scientific work, mostly in geology, he was elected in 1768, at the early age of 25, to the Academy of Sciences, France’s most elite scientific society. A few years later he married Marie-Anne Pierrette Paulze. Madame Lavoisier prepared herself to be her husband’s scientific collaborator by learning English to translate the work of British chemists like Joseph Priestley and by studying art and engraving to illustrat Antoine-Laurent’s scientific experiments.

In 1775, Lavoisier was appointed a commissioner of the Royal Gunpowder and Saltpetre Administration and took up residence in the Paris Arsenal. There he equipped a fine laboratory, which attracted young chemists from all over Europe to learn about the “Chemical Revolution” then in progress. He meanwhile succeeded in producing more and better gunpowder by increasing the supply and ensuring the purity of the constituents-saltpetre (potassium nitrate), sulphur, and charcoal, as well as by improving the methods of granulating the powder. Characteristic of Lavoisier’s chemistry was his systematic determination of the weights of reagents and products involved in chemical reactions, including the gaseous components, and his underlying belief that matter, identified by weight, would be conserved through any reaction which is known as the law of conservation ofmass. Among his contributions to chemistry associated with this method were the understanding of combustion and respiration as caused by chemical reactions with the part of the air that he named “oxygen,” and his definitive proof by composition and decomposition that water is made up of oxygen and hydrogen.His giving new names to substances, most of which are still used today, was an important means of forwarding the Chemical Revolution, because these terms expressed the theory behind them. In the caseof Oxygen, from the Greek meaning “acid-former,” Lavoisier expressed his theory that oxygen was the acidifying principle.

He considered 33 substances as elements-by his definition, substances that chemical analyses had failed to break down into simpler entities. Lavoisier, a political and social liberal, took an active part in the events leading to the French Revolution, and in its early years he drew up plans and reports advocating many reforms, including the establishment of the metric system of weights and measures. Despite his eminence and his services to science and France, he came under attack as a former farmer-general of taxes and was guillotined in 1794. A noted mathematician, Joseph-Louis Lagrange, remarked of this event, “It took them only an instant to cut off that head, and a hundred years may not produce another like it.”

**Read the passage and Answer the questions that follow:**

1. What was Lavoisier’s formal education?

2. How did Lavoisier devise a better form of gunpowder?

3. What is the origin of the term ‘Oxygen’?

4. Why was Lavoisier guillotined?

5. What was Antoine Lavoisier most famous for?

**4. DIGITAL COMPETENCE FOR ACADEMIC AND PROFESSIONAL LIFE**

Our era has come to see the vital importance of digital technology in our daily lives. It allows us to unlock a huge collection of information and communication data. Each kind of task – be it a regular task or a job specific task – requires digital proficiency or literacy. Digital literacy can be defined as “the ability to use digital technology, communications tools, and or networks to access, manage, integrate, evaluate, and create information in order to function in a knowledge society”. The execution of a successful approach for the advancement of digital literacy skills is known to include multiple components that tackle hurdles for explicit demographics such as: attitude, age, socio-economic status, language, and regional availability of resources. In order to increase digital literacy levels, strategies must be targeted and implemented, where necessary for specific populations and situations keeping an account of different obstacles. There is a technological transformation with the increasing use of internet access. Therefore, technology transforms the mode or platform in which we converse and process knowledge. A substantive growth in execution of information and communications requires improvement in quality of life and development by preparing people for a knowledge society. Therefore networking is here to reside and education has no alternative but embrace it.

Over the last few decades, the concepts digital competence and digital literacy have been used more frequently, and are used synonymously although they have distinct origins and meanings. Sometimes they are used to underpin each other, such as the EU framework of key competencies for all citizens where digital competence as one of eight key competencies is defined as follows: “Digital competence involves the confident and critical use of Information Society Technology (IST) for work, leisure and communication. It is underpinned by basic skills in ICT: the use of computers to retrieve, assess, store, produce, present and exchange information, and to communicate and participate in collaborative networks via the Internet”. In 2013, the European Commission published a Digital Competence Framework based on five areas and 21 competences, which include the notion of digital literacy. At a systemic level policy documents often emphasize the need to invest in digital skills enhancement for economic growth and competitiveness. Furthermore, it has been argued that in our interconnected world “sustainable development and social cohesion depend critically on the competencies of all of our population—with competencies understood to cover knowledge, skills, attitudes and values”. In addition, in 2008 UNESCO launched the policy document ICT Competency Standard for Teachers with focus on teacher education and digital literacy without defining the concepts. In Sweden, digital competence is also used as a foundational concept in the currently launched national strategy for the digitalization of education.

The overall aim of this strategy is to provide children and students the opportunity to develop the ability to use and create with digital technology and understand how digitalization affects the individual and society. Three areas in particular are in focus: Digital competence for all in the school system, Equal access and use, and Research and evaluation of the possibilities of digitalization. Thus, personnel working with children and students should develop the competence to choose and use appropriate digital tools in education and the opportunity to develop digital competence during their education and through workplace training.

**Read the passage and Answer the questions that follow:**

1. What are the basic skills in ICT?2. When was the ICT competency Standard for Teachers launched by the UNESCO?

3. What is digital literacy?4. How many competences does the Digital Competence Framework include?

5. Expand the terms: ICT & UNESCO

**5. PHOSGENE - THE DEADLY VILLAIN OF THE BHOPAL GAS TRAGEDY**

Phosgene (COCl2) is a highly toxic compound that was first synthesized in 1812. At room temperature (70∘ F), phosgene is a poisonous gas that may appear either colourless or as a white to pale yellow cloud that can have a pleasant odour similar to that of newly mown hay or green corn. Phosgene is a major industrial chemical used to make plastics, pharmaceutical agents, synthetic foam, dyes, andpesticides with the worldwide chemical industry annually producing more than 2–3 million tons of phosgene. Phosgene first gained its deadly reputation during World War I, when it was used in chemical warfare. Phosgene was used extensively as a choking agent and was responsible for a large majority of chemical warfare deaths. It has been estimated that phosgene accounted for 80,000 of the 100,000 deaths from chemical gas exposure in World War I. Exposure to dangerous concentrations of phosgene may cause the following symptoms to develop quickly: coughing, burning sensation in the throat, watery eyes, difficulty breathing, nausea, and vomiting. Direct skin contact with phosgene can result in lesions similar to those from burns.

Phosgene causes damage to biological molecules in two ways. It can react with water to form hydrochloric acid. When considering the fact that water is present in the lungs and on the skin, it is easy to see how exposure to phosgene can cause significant damage. This first reaction contributes far less to the typical symptoms of phosgene exposure but is more responsible for the irritant effects. The second reaction is called an acylation. Phosgene attaches to reactive groups on biological molecules, such as proteins and phospholipids. These reactions can result in structural changes in membranes and proteins andstop them from functioning properly. Inhaled phosgene attacks the major constituents of surfactants and tissue membranes in the lungs causing irreversible acute lung injury and life-threatening fluid accumulation in the lungs leading to pulmonary edema. On the night of December 2, 1984, a breakdown occurred at Union Carbide India Limited (pesticide plant) in Bhopal, Madhya Pradesh. A runaway reaction in a tank caused the pressure relief system to vent large amounts of poisonous gas into the atmosphere.

An estimated 40 tons of phosgene mixed with methyl isocyanate (also highly toxic) were released into the atmosphere and it spread through towns located near the plant. The Bhopal disaster is considered the worst industrial disaster in history. Over 500,000 people were exposed to the gases and between 3000 and 10,000 people died within the first week.In 1989, Union Carbide paid $470 million in compensation to the Indian government. Moreover, seven Union Carbide employees were convicted of “death by negligence” for their role in the Bhopal tragedy. Warren Anderson, the chairman and CEO of Union Carbide never faced trial over the deadly industrial accident. Shortly after the incident, Anderson visited Bhopal and was arrested but was released after paying a $2000 bail and fled the country. Since 1993, the Indian government tried several times to extradite him but never succeeded. Anderson escaped all attempts to bring him to trial and died in a Florida nursinghome on September 29, 2014, at the age of 92. The Bhopal Gas tragedy is considered to be one of the largest Industrial accidents in the world history and the release of Phosgene was responsible for the large scale destruction that ensued.

**Read the passage and Answer the questions that follow:**

1. Mention some of the industrial uses of Phosgene.

2. List out some of the symptoms of Phosgene exposure.

3.What caused the release of Phosgene in the Union Carbide plant?

4. Define the term ‘Acylation’ briefly in one or two sentences.

5. What was the chemical mixture that caused the Bhopal disaster?