Rocks and Minerals

Let us take a journey into five-dimensional thinking to uncover the signs hidden within the fascinating formation of Earth's precious minerals and derive character lessons from them.

"No chemist who studied only the properties of chlorine, a poison, and sodium, an element that reacts explosively when it meets water, could have possibly guessed the properties that would be exhibited when the two combine as sodium chloride—table salt. Here suddenly we have a compound that is not only not a poison but is indispensable to life." (Lanza and Berman (2010), Biocentrism, p.139)

It's another Monday morning. You turn off your phone's alarm, pull yourself out of bed and switch on the light to prepare for school. You pull up the bathroom faucet and wash your face, brush your teeth, and wear your uniform. You then eat a bowl of cereal and drink a glass of orange juice before stepping outside and making your way to the school bus.

Everything you have done so far and will do for the rest of the day would be impossible if there were no minerals. Indeed, without minerals, you would not have access to running water from a faucet, electricity, light, a cereal bowl, a spoon, a drinking glass or even clothing. Indeed, minerals touch our lives in hundreds of ways each day. Life as we know it would not exist without them.

But what do you really know about minerals? Do you know how many minerals there are on Planet Earth? Do you know their importance for plants, animals, and human beings? In this chapter, we will engage in five-dimensional thinking to uncover the signs hidden within the fascinating formation of Earth's precious minerals and derive character lessons from them.

First Dimension : Analytical Thinking

SCIENTIFIC UNDERSTANDING OF MINERALS

What are minerals? Minerals are made of a single element or compound. They have a distinctive geometric shape called a crystalline structure. They are formed through the melting and cooling of magma as water containing dissolved minerals evaporates and leaves behind mineral crystals. There are 5000 known minerals on our planet. Examples of minerals are gold and diamond. Each type of mineral has a specific, uniform crystal structure. Different types of minerals come together to form rocks. Rocks are typically made of two or more minerals.

The individual atoms in a mineral are combined in a specific pattern to form crystals. Crystals have different shapes. Not all minerals have the same crystal configuration. Take a look at the photographs below. You can see that pyrite has different shaped crystals than diamond for example.

To identify a substance as a mineral, it must meet five criteria. These criteria are as follows:

1. The substance must exist a **solid** under regular conditions on our planet.
2. It must be **formed in nature**. It cannot be man-made.
3. It must be **inorganic**. This means that it cannot be made of living things such as wood or leaves for example.
4. It must have a **specific composition**. This means the substance must have a fixed chemical formula or "recipe" of elements.
5. It must have a **definite crystal structure**. Remember- the atoms in a mineral are combined in a specific pattern to form crystals.

How can we tell minerals apart? We can do this through **color**, how light reflects off the surface of the mineral, and by how **hard** it is.

Color

A mineral such as gold, for example, is easy to identify by its color. However, the same mineral can sometimes have different colors. The color of a mineral depends on how the mineral was formed.

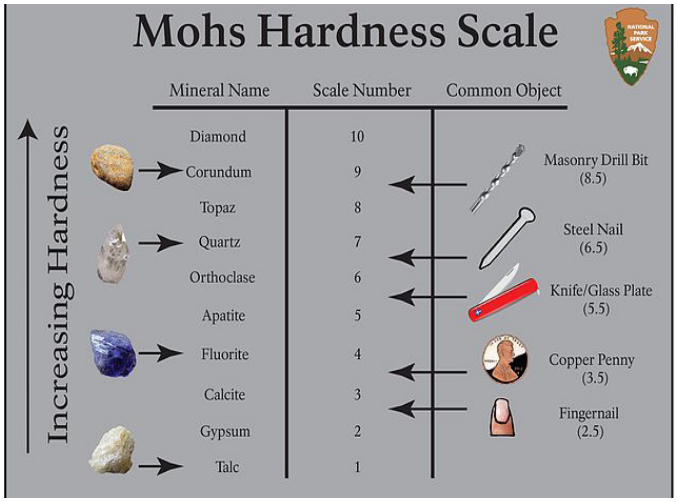
Reflective Properties

Some minerals reflect light easily such as diamond, silver or gold. Others that are not so shiny are talc, gypsum and feldspar.

Hardness

In the previous chapter, we learned that diamond is the hardest substance on Earth. How can the hardness of a mineral be determined? Usually, minerals are compared to a substance of a known hardness using a 'scratch test'. If one mineral, such as a copper nail, for example, can scratch another mineral of a known hardness such as a fluorite crystal, then we can determine that copper is harder than fluorite. A mineralogist named Friedrich Mohs developed a relative hardness scale using the 'scratch test'. Each mineral was assigned an integer number from 1 to 10, where 10 is the hardest (diamond) and 1 is the softest (talc).

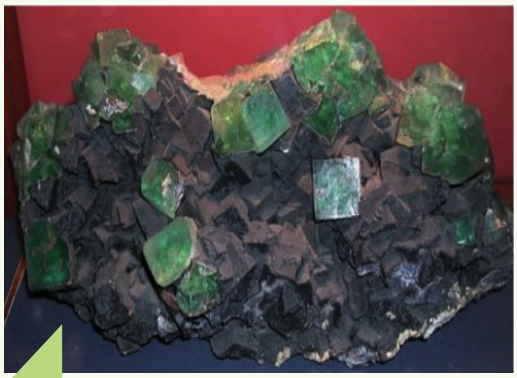
There are many types of minerals. We will explore the properties of some minerals below.



1. Fluorite

This amazing mineral grows in a series of little crystal cubes. It is soft and can easily be scratched with a copper nail. It is also fluorescent- it glows when exposed to ultraviolet light!

Uses of Fluorite:
1. Fluoride, the element extracted from fluorite, is used to make toothpaste. Fluoride is designed to prevent tooth decay.
2. Fluoride is also added to drinking water for the prevention of tooth decay.



Fluorite. University of Waterloo Earth Sciences Museum Collection

2. Copper

Do you know why the Statue of Liberty is green? This is because its surface is made of copper sheets. When copper- which is normally reddish-brown in color- reacts with oxygen in the air, it turns green.

Copper is a good conductor of heat and electricity. It is also an edible nutrient, found in chocolate, nuts and sesame seeds. However, too much ingested copper can lead to copper toxicity causing liver and kidney damage and even heart and brain failure.

Uses of Copper:

1. It is used to make electrical wires because of its good ability to conduct electricity.
2. It is also used to make pots and pans, as it is a good conductor of heat.
3. It is used to make pennies and water pipes as well.
4. It is an important component of high-speed trains.

Copper. University of Waterloo Earth Sciences Museum Collection

Copper Ingot. University of Waterloo Earth Sciences Museum Collection

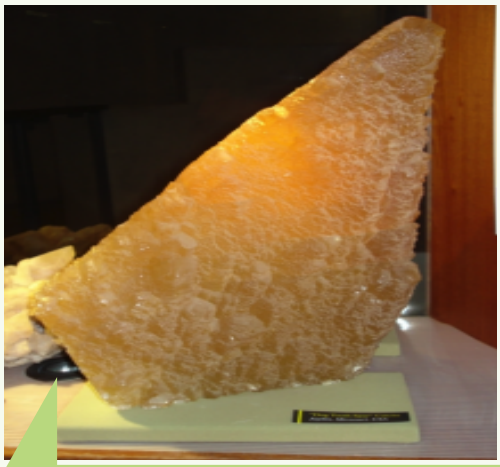
3. Pyrite

Fluorite. University of Waterloo Earth Sciences Museum Collection

This beautiful mineral was once used by the Ancient Greeks to start fires. It comes from the Greek term pyrites lithos that means "stone which strikes fire". Due to its shiny metallic color, pyrite is commonly known as "Fool's Gold".

Uses of Pyrite:

1. Due to its ability to spark when struck with iron, pyrite was once used in the manufacture of rifles.
2. It is used to make jewelry.
3. It is used to make paper and ink.



Calcite. Variety Dog Tooth Spar. University of Waterloo Earth Sciences Museum Collection

4. Calcite

This mineral, consisting mainly of calcium carbonate, is found in abundance on our planet. It comes in 300 different crystalline shapes. In pure form, calcite is white. However, when combined with impurities it can be yellow, green, black, brown or blue. One way of determining whether a piece of rock contains calcite crystals is by testing it with a weak acid such as vinegar or lemon juice. Calcite reacts with acid to form bubbles.

Uses of Calcite:

1. Calcite is used to make asphalt and concrete.
2. Calcite is fed to chickens! It is a good source of Calcium- important for the formation of eggshells.
3. It is also used to make anti-acid tablets.

A Brief Introduction to Minerals

https://youtu.be/8a7p1NFn64s

How can we tell minerals apart? We can do this through color, how light reflects off the surface of the mineral, and by how hard it is.

Amazing Scientific Facts
-Rocks and Minerals-

1.

Did you know that there is a star, fifty light years away from Earth that is a 10 billion-trillion-trillion carat diamond?

2.

Did you know that diamonds are 58 times harder than anything else found on the planet?

3.

Did you know that minerals are necessary for maintaining a healthy and strong body?

4.

Did you know that annually, in the United States alone, it takes 10 tons of minerals for every man, woman, and child to maintain life?

5.

Did you know that almost every area of human activity from agriculture and construction to art and science depends in some way on minerals?

6.

Did you know that around 99% of the minerals in the Earth's crust are made up of eight elements including oxygen, silicon, aluminum, iron, calcium, sodium, potassium, and magnesium?

7.

Did you know that the green oxidized copper layer coating the Statue of Liberty has acted as a barrier against corrosion since the late 1800s?

8.

Did you know that minerals are made of crystals that have a regular, repetitive internal structure? There are seven types of crystal systems. They are symmetrical. Therefore, if one face of a crystal form is defined, the specified set of point symmetry operations will determine all of the other faces.

Second Dimension : Analogical Thinking

AUTHENTIC VS ARTIFICIAL DIAMOND

As we have learned, minerals are found in abundance on our planet and are designed to be used for different purposes. Without the copper used to make electrical wires, we would not have electrical systems. Without calcite, it would be impossible to make asphalt and concrete. In addition, the presence of certain minerals such as copper in our diets is essential for the formation of healthy bones, nerves and blood vessels.

Every mineral has been designed with a purpose- or multiple purposes- for serving the living beings on our planet. Minerals come in many shapes, colors and sizes. Have you ever wondered why they are so diverse? What is their purpose? Minerals are designed in a variety of beautiful crystal shapes and colors to adorn our world with both beauty and functionality. The abundance of minerals has made it possible to build and beautify our homes and fulfil our nutritional needs.

Can we make a mineral from scratch? Let us consider one of the most prized minerals- the diamond.

To understand the value of a diamond, we need to consider how it was formed. Scientists estimate that diamonds were formed billions of years ago in the upper mantle under conditions of extreme heat and pressure. They estimate that diamonds can only form at temperatures between 900 and 1300 degrees Celsius and pressures between 45 to 60 kilo bars. To put that kind of pressure in perspective, think about the pressure of balancing a jet plane on the tip of your finger.

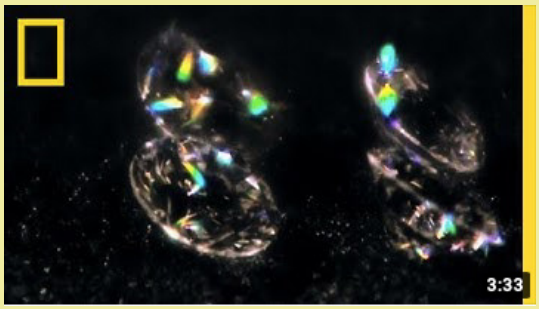
"Diamonds and graphite are both made purely of carbon but have different properties."

Volcanic eruptions appear to have brought the diamonds very quickly to the Earth's surface. After the eruptions, the mounds of volcanic material brought to the Earth's surface cooled, preserving the diamonds within them. The rocks containing the diamonds are known as Kimberlites- named after the South African town in which an 83.5 carat diamond was discovered.

It is interesting that diamonds and graphite are both made purely of carbon but have vastly different properties. Diamonds are shiny and hard (with a rating of 10 on the Mohs Scale) while graphite is dull and soft (with a rating less than 1 on the Mohs Scale). When it comes to the ability of light to travel through them, diamonds are transparent while graphite is opaque. When it comes to electrical conductivity, diamond is an excellent electrical insulator, while graphite is a good electrical conductor.

Diamonds make excellent abrasives, while graphite is an ideal lubricant. Diamonds are used in drilling devices and to make jewelry. In contrast, the softness of graphite makes it an ideal component for pencil-making. It is remarkable that these two substances are made of the same raw material but possess different qualities.

Diamonds I Didn't Know That

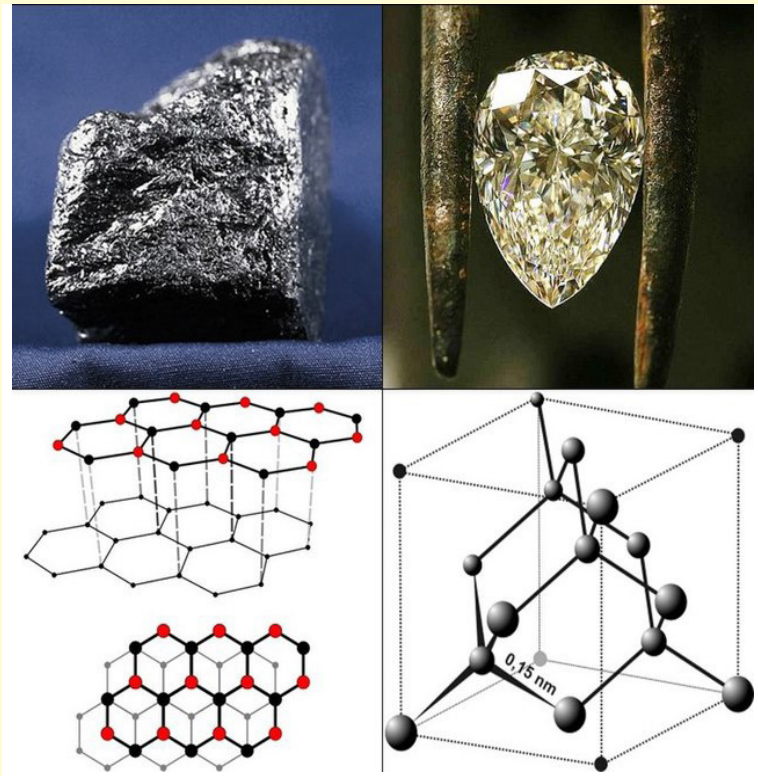


https://youtu.be/w8cvUd9vTtM

DIAMOND

GRAPHITE

Did you know that "blood diamonds" got their ame from the child labor, destruction, and death during the excavation process?



Graphite **Diamond**

Scientists attribute the different properties of graphite and diamonds to the lattice structure of the carbon atoms within them. While the carbon atoms in diamond are closely packed in a 3-dimensional lattice structure, the carbon atoms in graphite are formed in layers, with weak bonds between each layer.

Scientists have attempted to make artificial versions of diamonds by placing carbon seeds in microwave devices together with methane gas. The mixture is then subjected to very high temperature after which a plasma ball forms. Inside the plasma ball, the gas breaks down and the carbon atoms crystallize, forming a diamond.

The process is long- it takes about 10 weeks to form a single diamond and requires raw materials such as carbon seeds and methane gas. The process of growing diamonds in the lab also requires a catalyst. Diamonds found in the upper mantle have no trace of any type of catalyst.

This method could be an alternative to extracting diamonds from mines or riverbeds, which in recent history has led to a lot of political conflict. Most diamonds on the market are known as 'blood diamonds'; that is, diamonds part of an industry filled with armed conflict, child labor, death and destruction. Lab-grown diamonds are a clean alternative to the blood diamond industry.

The noble process of producing artificial diamonds from their raw materials involved the collaboration of many knowledgeable experts based on years of research and hard work. Though the synthetic diamonds are quite similar to ones we find in nature, people prefer to pay a higher price for the latter.

Third Dimension :
Critical Thinking

- ***Can we attribute the formation of a diamond to the individual elements that comprise it?***
- ***Who controls the way the carbon atoms move into position?***
- ***Who controls the electrons contained within them?***
- ***Why is diamond a terrible conductor but graphite- that contains the same carbon components- an excellent one?***
- ***Have you ever thought about the Force that controls the movement of the electrons in the carbon atom's outer shell?***
- ***Who commands the carbon atoms to re-arrange themselves according to the conditions present?***

EXPLORING THE MAKER OF MINERALS

As we scientifically study minerals we also need to question why and how they came to exist on earth. This is required as critical thinking which is very important in scientific inquiries. Let us now consider about the technology used to 'grow' a diamond. Would it be possible to recreate this technology without having the necessary raw materials, information and expertise? Why not? The invention of lab-grown diamonds was built upon decades of accumulated information by a long chain of experts.

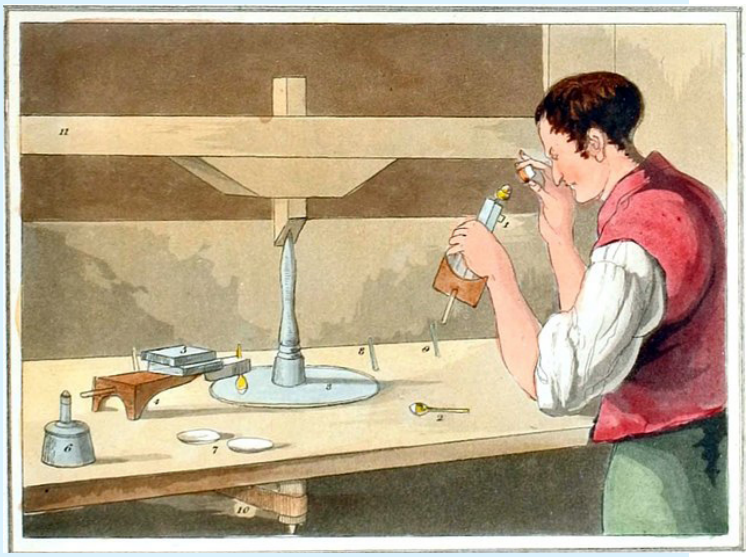
In order to appreciate the magnitude of knowledge and effort exerted in producing a lab-grown diamond, let us go back in time to when the idea of manufacturing diamonds artificially came to be.

One of the first references in literature to creating a diamond artificially was put forth by science fiction author H.G. Wells in his short story "The Diamond Maker". The story portrays a fictional scenario where Upper Mantle conditions are recreated on the planet's surface. This story may have inspired attempts to produce artificial dia-

monds, but these were not successful until the 1950s when General Electric was able to produce small, brown rocks. De Beers later came up with their own methods to produce artificial diamonds, but these were only used industrially using cutting devices and high-power electric machines.

In 1970, the first diamond considered to be 'gem-quality' was produced, but this was still quite small and nowhere near the quality of diamonds found in nature. Up until the early 21st century, lab-synthesized diamonds were very small in size. It is only in the past decade or so that the artificial diamond industry picked up speed and improved the quality of its products. Lab-produced diamonds now account for about 2-3 per cent of the diamond market.

We can see in this timeline of events how the invention of artificial diamonds came to be. Artificial diamonds did not miraculously appear on the planet as a precise combination of carbon atoms bound together by



covalent bonds. The development of the technology required to make a diamond using microwave technology, methane gas, and carbon seeds occurred after many industrial attempts. In fact, making an artificial diamond would not have been possible without the accumulated knowledge and efforts of conscious human beings over thousands of years.

When it comes to human discoveries and inventions, it is interesting to remember that many- if not most- human discoveries came about through moments of inspiration preceded by long periods of hard work. For instance, Renz J. Hay, developed a theory of crystal structure, after a friend dropped a highly valued calcite crystal to the ground, making it shatter into many pieces. On closer inspection, Hay was intrigued to discover that the Calcite crystal had in fact, broken into similar rhombic shapes. By continuing to break other pieces of calcite and discovering that they broke in a similar way each time, Hay was able to formulate a theory about crystal structure.

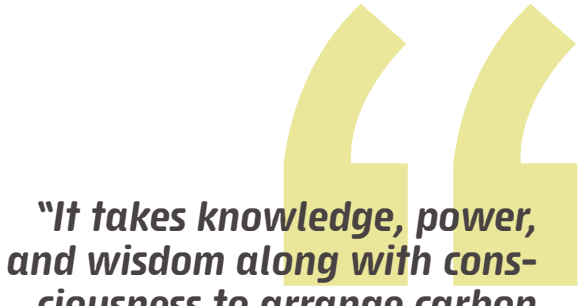
Fancy Blue Diamond made by Syntechno LTD

To understand the magnitude of the research involved and the hard work exerted by scientists to discover the way things work and to achieve incredible inventions, we must remember that all human technology was built upon the work of thousands of other individuals over hundreds of years.

Can we attribute the formation of a diamond to the individual elements that comprise it? To answer this question, we must break a diamond down to its individual components- the carbon atoms. And since the way these carbon atoms bond plays a crucial role in the apparent properties of a diamond, we must consider this as well.

Who controls the way the carbon atoms move into position? Who controls the electrons contained within them? Diamond is a terrible conductor of electricity- this is because its structure does not contain free electrons. Why is that? Why is diamond a terrible conductor but graphite- that contains the same carbon components- an excellent one? In theory, this is because each carbon atom in graphite is bonded to only three carbon atoms- not four- keeping one electron 'free' to conduct an electrical current. Have you ever thought about the Force that controls the movement of the electrons in the carbon atom's outer shell? The Force who commands the carbon atoms to re-arrange themselves according to the conditions present?

Given our experience of lab-grown diamonds, we know that it takes knowledge, power, and wisdom along with consciousness to arrange carbon atoms into diamonds. Just as we do not believe the formation of an elegant palace through the self-arrangement of its bricks is possible, we cannot accept the idea that very useful minerals such as diamonds, with their elegant structures, are the works of the blind natural forces and material causes. As we discover the complex structures and benefits of various minerals, we will realize that they must be the work of the One who has tremendous knowledge and power. We will desire to learn more about the Maker of minerals as we understand how important they are for our survival.



"It takes knowledge, power, and wisdom along with consciousness to arrange carbon atoms into diamonds."

De Beers to Sell Diamonds Made in a Lab

https://youtu.be/LfzL6gc8cos

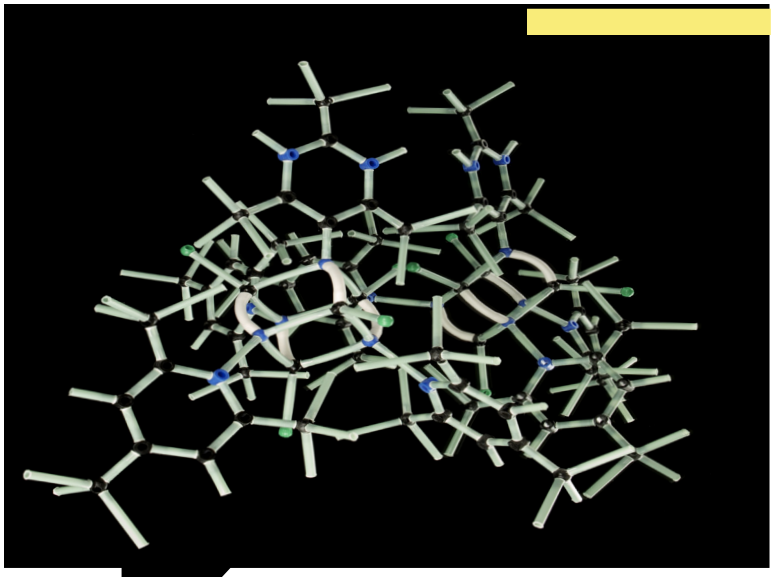
Fourth Dimension : Meditative Thinking

CONNECTING AND COMMUNICATING WITH THE MAKER OF MINERALS

Even if we conclude that there must be a Maker of minerals, how can we know with certainty who the Maker is? Let us visit some of the elements involved in the formation of a diamond crystal once again. Think about the carbon atoms. Consider how they are employed wisely to come together to begin to form crystals. Under conditions of high temperature and pressure, each carbon atom will bond to another four atoms using strong covalent bonds. The resulting lattice structure is designed to make diamond a very hard substance.

The formation of a diamond is linked to the entire universe. Carbon, from which a diamond is made, is an element that was created shortly after the Big Bang- the incredible moment about 14 billion years ago when the universe formed. The formation of a carbon atom at the micro level requires first that electrons, protons, neutrons, and other subatomic particles are arranged in a particular order. The state of a diamond depends on the stability of this subatomic system from moment to moment.

At the macro level, many factors (apparent causes) are needed to form minerals such as diamonds. Indeed, billions of years ago, it appears that the conditions on Earth were 'just right' for diamonds to form. However, what makes carbon atoms move to their correct locations? What allows them to accumulate at a certain speed? Is it by chance that the carbon atoms just so happen to be in the vicinity of one another so that they begin to bond or is there more



at play? What allows the carbon atoms to systematically lock into place, one after another, to produce a diamond crystal? According to Smithsonian diamond expert Jeffrey Post, a one carat diamond represents "billions and billions of carbon atoms that all had to lock into place to form this very orderly crystalline structure."

Minerals are linked to all forms of life. As we have learned, subatomic particles and their respective properties are necessary for the formation of elements. Then, elements come together to establish particle bonds and subsequently gain mineral properties. Minerals then become essential building blocks for plant life so that plants can play vital roles in animal and human bodies. Minerals also act as necessary instruments for the fulfilment of countless human needs and wants. Thus, minerals are necessary for sustaining our physical bodies and for

[1] Read more: https://www.smithsonianmag.com/science-nature/diamonds-unearthed-141629226/#73GtrxoUr3AVLitJ.99

Minerals make our life beautiful and colorful. That is why they were created in a range of colors and shapes. Their various colors and shapes make it easier to identify which of them contain the nutrients needed to support our health- like fluoride and copper- and which can be used for jewelry-making and global trade, such as gold and silver.

As we learn more about minerals, we will understand that the Maker of minerals must be the Maker of the entire universe along with its building blocks such as elements and subatomic particles. He must be the All-Powerful who creates and controls elements along with their particles. He must be the All-Knowing and All-Wise who has carefully considered what building blocks were required to create the infrastructure we need on this Earth. He must be the Most Kind and Most Compassionate who fulfills the needs and desires of living beings through the uses of many minerals. He must be the Most Beautiful who clearly formed our planet and adorned it with the most precious and beautiful gems.

Importance of Minerals

https://youtu.be/kSydxyrZSYY

Fifth Dimension : Moral Thinking

RESPONDING WITH BETTER CHARACTER

The great thinker of ancient Greek civilization, Socrates (d. 399 BC) said that knowledge is virtue. We need to reflect upon this saying in order to appreciate what we learn through the sciences. But how does this scientific knowledge make me virtuous? Virtue is what our character reflects and this is why we would like to respond to the abundance of minerals in various forms on our planet which we seldom stop to appreciate. Have you ever thought about what life would look like if we ran out of essential minerals?

We did not purchase the precious minerals on our planet. They are given as a gift. Thus, we need to reflect on their value for sincere appreciation. So, why should we be grateful for the presence of minerals?

Important minerals you need and the foods that contain them

https://youtu.be/N-Lzx3Qepro

"Why should we be grateful for the presence of minerals?"

01

1. Minerals help our bodies grow and develop

Minerals, like vitamins, are a vital component of our nutrition. The body is designed to use the various minerals found in food in its daily functions. There are two main types of minerals- macro minerals and trace minerals. Macro minerals are needed by the body in more significant amounts than trace minerals. Here are a few examples of minerals helping our bodies: calcium, iron, potassium, and zinc.

Why should we be grateful for the presence of minerals?

02

2. Minerals are used in agriculture

Minerals play a key role in the processes involved in agriculture. Fertilizers used in farming practices are made of phosphate rock, sulfur and nitrogen to help increase crop yield. The machines used to plant and harvest crops are made of metal. Trucks, cars and planes, also made of metal, are used to transport grains, fruits, vegetables and livestock. In factories, food processors and storage equipment are also made from various metals and minerals.

03

3. Minerals are used in construction and manufacturing

In construction, the building materials we use to build our homes, offices, factories, schools, roads and bridges are all made from minerals such as iron, steel and cement. The devices we use on a daily basis are made from minerals. For example, televisions, washing machines, stoves and refrigerators are all made of various metals such as steel and aluminum. Kitchen utensils are made of stainless steel, and aluminum. Clay is used to make plates, and cups, and even toothpaste and cosmetics. To make glass, we need sand, selenium, silicon and soda ash.

04

4. Minerals are used in transportation

As far as transportation goes, for example, iron, steel, lead, platinum, copper and aluminum are used to make cars. The roads cars run on are made of asphalt, gravel and concrete. Even the petroleum used in cars is extracted in a process that involves minerals.

05

5. Minerals are used to make electronics

The technological advances that we enjoy today would not have been possible without minerals. Copper, that is used to make wires, is a key part of electricity without which we would not be able to use electronic devices.

06

6. Minerals are used in art, photography and music

In art, minerals comprise the physical materials artists use to express their creativity. Sculptors use clay and marble. The world of photography relies on the use of silver- a mineral used to transfer images to film. In the world of music, metals are used to make instruments.

07

7. Minerals are used in science and warfare

In science, microscopes, test tubes and beakers are all made of minerals. Unfortunately, the use of minerals has also been abused by some scientists to develop chemical warfare and instruments of destruction.

In short, minerals are part of every aspect of our lives. It is a clear fact that life would have been possible without minerals. Thus, we owe thanks to the creation of minerals for every second of our life on this planet.

Minerals provide inspiring lessons for moral and meaningful life. For instance, formation of precious minerals such as diamonds are **lessons** for the observant. How many times have we complained about difficult times, or stressful situations in our lives? How many times have we protested, internally or externally, about hardship?

With life comes both hardship and ease. The formation of a beautifully created mineral, such a diamond, under the most difficult of circumstances is an example of one of our Creator's signs. When rocks are exposed to enormous amounts of pressure and heat and yet, are not crushed, this shows that hardship might press down upon us for some time, but

due to our Creator's mercy, it will not crush us completely. We are designed to withstand the adversity that comes with life. Like precious stones, we have been designed to emerge out of difficult situations in more beautiful, precious forms. The law of impermanence, designed by our Creator, is designed to support this phenomenon. Just as rocks are not subjected to temperature and heat forever, our souls and bodies are not designed to suffer permanently on this Earth.

The rare beauty of minerals, produced by rocks that underwent transformation by extreme pressure and heat, should remind us that our Creator allows our trials and afflictions to conform us into beautiful beings through hardship- in just the same way that rare minerals are formed through exposure to extremes of temperature and pressure. Interestingly, minerals are created with certain a malleable crystal structure for better usage. For instance, iron does not have perfect crystal structure. The so-called imperfection of its structure is a perfect opportunity to mix iron with carbon in order to obtain steel structure. Likewise, the mix with other metals give us different materials for various usage. Thus, as the imperfection of metals is a means for perfecting their properties, we can benefit from our shortcoming in terms of learned lessons to perfect our character. Once we gain such a perspective, everything in life will be a means for flourishment. In other words, we will always see a full cup even when it is half full of water. That is because we will perceive oxygen in the other half which is even more important than water for our life.

"Like precious stones, we are designed to emerge out of difficult situations in more beautiful, precious forms."

How shall we offer our appreciation for precious gifts of various minerals?

The True Bestower of Bounties wants in return for those gifts three things: one is remembrance, another is reflection and the third gratitude:

1

Remembrance is realizing that there is a Creator of precious minerals.

2

Reflection is thinking of minerals as gifts of our Creator's mercy.

3

Gratitude is being thankful to the Creator for bestowing upon us the minerals that we exploit for building and beautifying our living spaces, and for maintaining our health.

To help reflect on the gift of precious minerals on our planet, we need to strengthen our appreciation of beauty and senses of perseverance and humility. To enhance our appreciation of beauty, perhaps, we shall make a beauty log, write down examples of beautiful minerals we encounter on a daily basis.

To strengthen our sense of perseverance, we shall remember how minerals are formed under high temperatures and pressure. Perseverance is seeing things through to the end by overcoming challenges. Be aware of our transformation into a stronger, more resilient individual through hard work, facing and overcoming obstacles and completing the tasks that we are responsible for.

To strengthen our sense of humility, we shall consider the diamond. Does it boast of its beauty? Or does its beauty reveal itself? Humility is being aware of our strengths and talents, but not boasting of them in any shape or form. People with a stronger sense of humility are generally more grateful, forgive others more easily and are healthier, more balanced individuals than those with a less developed sense of humility.

TEST YOUR KNOWLEDGE

I.UNDERSTANDING SCIENCE TERMS

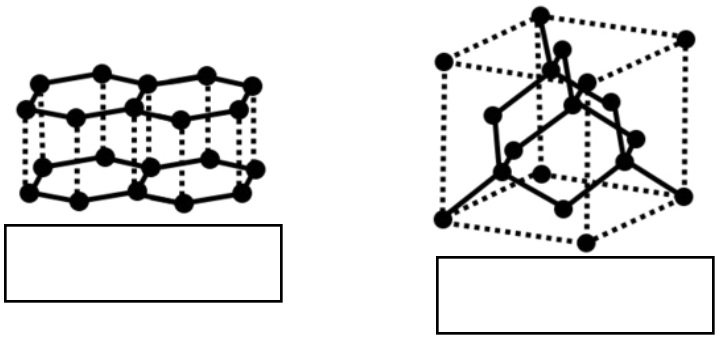
Complete the following sentences with a word or words from the Science Terms that will make the sentence correct.

Hardness Iron Zinc Reflective Properties Macro minerals Trace minerals Color Potassium

1. We can differentiate minerals by their _____, _____ _____ or by their _____.
2. _____ _____ are needed by our bodies in larger amounts than _____ _____.
3. _____ is a mineral designed to support our immune system.
4. The mineral used to produce hemoglobin in red blood cells is called _____.
5. _____ is a mineral designed to keep the nervous system working optimally.

Label the following diagram:

Allotropes of carbon



II.CHECKING FACTS

Determine whether each of the following is true or false.

1. Fluorite glows when exposed to ultraviolet light._____
2. Copper is used to make jewellery. _____
3. Anti-acid tablets contain pyrite. _____
4. Copper is a terrible conductor of heat._____
5. The carbon atoms in graphite are arranged in layers with strong bonds between each layer._____
6. A diamond is the hardest substance on Earth. _____
7. Mercury is a mineral. _____

III. UNDERSTANDING CONCEPTS

Write a short answer for each question or statement.

1. Where are minerals found on our planet?

2. List the criteria required to classify a substance as a mineral.

3. What are minerals made of?

4. How do you know that there is a Hidden Hand behind the design of minerals?

5. List two hidden messages found in minerals from their Maker.

6. Why is it an offense to deny the presence of the Maker of the minerals?

IV. APPLYING CONCEPTS

Write a paragraph to answer each question.

1. How is the process by which a diamond forms in nature different from how artificial diamonds are made?

2. Describe how your daily life would be impacted geological mineral scarcity became more wide-spread?

3. Why do you think the atoms that make up individual crystals could not have created the Earth's minerals?

4. The One who creates the Earth's minerals has to be the Creator of the Earth. Why?

5. Why do you think the existence of minerals is an extremely valuable gift? Describe two things that make you appreciate the value of this gift.

6. How can you show your gratitude to the One who granted you the gift of minerals?

_____
_____
_____
_____
_____

V. THINK-THANK GAME

In this "think-thank" game, we want you to think about the nose and give thanks to their Maker. We also call it the "play to praise" game. The goal of this game is to think of at least five things about the nose that you are thankful for.

Number of players:
At least two.

Directions:

Player 1 repeats an appreciation phrase loudly and quickly. Player 2 responds, without pausing, with something to be thankful for. This is repeated five times.

To win:
Player 2 needs to respond five times (without pausing) with different things about minerals to be thankful for in order to win the game.

Here is an example of two rounds of this game:

1.Player 1 repeats the appreciation phrase loudly and quickly. For example: "Thanks to the Maker of minerals!"

2.Player 2 responds, without pausing, with something about minerals to be thankful for. For example: "making beautiful diamonds from carbons"

3. Player 1 repeats the appreciation phrase again loudly and quickly. For example: "Thanks to the Maker of minerals!"

4.Player 2 responds, without pausing, with another thing about minerals to be thankful for. For example: "For creating various minerals to sustain our life"

This should be continued for another three rounds until Player 2 wins or loses.