**LJHSCE General Science Review**

**Grade 9**

**Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

 The Science Study Guide has been designed to give learners at the Junior High School level most of the fundamental concepts, facts, principles and theories in the field as underscored by the National Curriculum Guidelines. The best way to prepare for the LJHSCE in science is to study this primer, and the past exams of the WAEC, and more. Now that you have this great study guide as a tool, we encourage you to begin reviewing such fundamentals as: scientific method, living and nonliving matter, health and hygiene, force, heat and sound, magnetism and electricity, environmental science, and more today.

**The scientific method**

At the core of all sciences lies a problem-solving approach called the scientific method. The scientific method has five basic steps, plus one feedback step:

1. Make an observation.
2. Ask a question.
3. Form a **hypothesis**, or testable explanation.
4. Make a prediction based on the hypothesis.
5. Test the prediction.
6. Iterate: use the results to make new hypotheses or predictions.

The scientific method is used in all sciences—including chemistry, physics, geology, and psychology. The scientists in these fields ask different questions and perform different tests. However, they use the same core approach to find answers that are logical and supported by evidence.

**Living or Non-living?**

What makes something a living thing? To be called a living thing, an item must have once eaten, breathed and reproduced. A dead animal or plant is considered a living thing even though it is not alive.

Our coastal temperate rainforest is full of living and non-living things which interact to create a complete and stable ecosystem. When one tree dies and falls over, it becomes a home and provides nutrients for other living things. We call a fallen log with new plants growing on it a nurse log.

Living components of a forest include:

* plants (e.g. trees, ferns, mosses)
* animals (e.g. mammals, birds, insects, reptiles, amphibians)
* fungi
* bacteria

Nonliving things in a forest include:

* rocks
* water and rain
* sunlight
* air

**Living and Nonliving**

Scientists use scientific classification to sort the world, but there are many other ways of sorting. One way we can sort things is by classifying them as living or nonliving. Living things use energy. They move or change shape. They take in food and get rid of waste, and they have babies, or reproduce. Humans, insects, trees, and grass are living things.

Nonliving things do not move by themselves, grow, or reproduce. They exist in nature or are made by living things. There are three groups of nonliving things. They are solids, liquids, and gases. Water is an example of a liquid. A rock is a solid. Oxygen is an example of a gas. Cars, pencils, and air are examples of nonliving things.

**Plants and Animals**

Now let′s sort the members of the group of living things into smaller groups. One way to sort living things is to separate them into plants and animals. A plant grows in a fixed place. It also has no eyes, ears, or nose, and it makes its own food. There are more than 300,000 types of plants on our planet.

The other major group of living things in the world is the animal group. This group has about two million species. Animals get their food by eating living things. Most animals move around to get their food. Most animals also use their noses, eyes, and ears to sense the world around them.

One way to classify living things is to sort them by parts. Animals can be sorted by whether they have a backbone, or spine. Vertebrates is the term scientists use for animals with backbones. Humans, birds, fish, and reptiles are all vertebrates. Animals without backbones are called invertebrates. Worms, spiders, and grasshoppers are invertebrates. Animals can also be sorted by other features. For example, a peacock and a sparrow both have feathers and breathe air. They belong to a group called birds. Plants can also be sorted by their parts. Plants with leaves go in one group. Plants with needles, such as pine trees, go in another group.

**Sorting by Homes**

Animals and plants can be sorted by where they live, or their habitat. Some animals, such as moles and earthworms, live underground. Swamp deer, alligators, and herons all live in swamps. Swamp deer have flat, wide feet. These keep the deer from sinking in the soft ground around swamps. Herons have long toes for the same reason. Animals with fins, such as dolphins and sharks, always live-in water. Do you know where an animal with little or no fur and large ears might live? If you guessed a desert habitat, you are right. Large ears help an animal lose body heat and stay cool in hot weather.

**Scientific Sorting**

Many scientists sort living things into five kingdoms. Others use a system made up of six kingdoms. Each kingdom is sorted into smaller groups until a group contains only one type, or species, of organism. Two of these kingdoms are the plant and animal kingdoms. Scientists also sort some living things into a kingdom called fungi. Fungi seem like plants because they grow in a fixed place. However, they cannot make their own food. Mushrooms are an example of fungi. In the five-kingdom system, the monera and protist kingdoms are made up almost entirely of single-celled organisms. Protists are tiny organisms, or creatures, that are usually made of just one cell. Monerans are microscopic organisms, such as bacteria. In the six-kingdom system, scientists divide the monera kingdoms into the eubacteria and archeobacteria kingdoms.

**Sorting the Kingdoms**

Once scientists classify living things into kingdoms, they can sort the groups even more. For example, there are more than two million types of animals in the animal kingdom. There are more than 70,000 types of fungi in the fungi kingdom. Scientists sort each kingdom into seven groups. They are called kingdom, phylum, class, order, family, genus, and species. The species group is the most exact group that scientists use. Animals in the same species look the most alike. They can reproduce with one another. Animals of different species do not usually reproduce with one another. For example, camels and giraffes are both mammals in the animal kingdom, but they belong to different species.

**Health and Hygiene**

**What is Health?**

Health as scientists describe is a state of complete well-being both physically and mentally. A healthy person is one whose mind and body are completely fit. Hygiene refers to habits or practices that ensure good health and a clean environment.

We consume a variety of foods every day. Food is necessary for all living things. Plants and animals both need food to grow. Plants make their own food whereas animals depend on others for their supply of food. We all begin our day with a good breakfast and have at least two more big meals in the day – lunch and dinner.

**Where does food come from?**

The food we eat comes from plants and animals. Different parts of the plant are eaten by us as food. We eat the leaves of some plants like spinach, seeds of some plants like corn, flowers of some plants like broccoli, stems of some plants like potato and roots of some plants like carrots. Food from animals are eggs, milk and milk products like butter, ghee etc, We also eat the flesh of some animals like chicken, fish, goat etc. The food that we eat can be thus divided into five types based on their usefulness to our body These types of food provide energy, build our body, protect it from diseases and keep us healthy and strong.

**Components of Food:**

The five types or components of food are:

1. Carbohydrates
2. Fats
3. Proteins
4. Vitamins
5. Minerals

**What are Carbohydrates?**

* Carbohydrates are also known as energy giving foods.
* We need energy to do our daily activities like running, walking, cycling etc.
* Carbohydrate rich foods are potatoes, bananas, corn, sugar, cereal, etc.

**What are Fats?**

* Like carbohydrates, fats are also considered as energy giving foods. Excess or extra carbohydrates are changed and stored as fat in our bodies.
* Foods rich in fats are meat, ghee, vegetable oil, milk, butter, cheese, dry fruits.
* Although fatty foods are necessary for the body but an excessive intake of these foods leads to weight problems like obesity leading to heart problems.

**What are Proteins?**

* Protein rich foods are those foods that help in the growth and repair of muscles and tissues in our body. This is one of the most important food groups. It builds muscles and repairs worn out tissues in our body.
* Foods rich in proteins are milk, chicken, eggs, fish, soya bean etc.
* Now, can you tell me if a coolie or a porter should eat the same diet as an office going person who does a desk job?
* No, a coolie has to do a lot of physical work every day. He carries heavy luggage for which he needs a lot of energy and so his diet should be rich in carbohydrates, which are energy giving foods. An office person sits at his desk all day and hardly does any physical activity hence he needs foods rich in proteins which are body building and tissue repairing foods.

**Water and Roughage**

* Our body is mostly made up of water and this is the reason why water is very important for us.
* We need to replenish the water we lose from our body through our sweat and urine by increasing our intake of water.
* We must drink at least 8 to 10 glasses of water a day. Certain fruits and vegetables contain water in them.
* Water helps in flushing out the toxins in our body and keeping our body clean and healthy.
* Roughage is the fibre present in food, it is that part of the food which is not digested by our system and helps in eliminating waste materials from our body.
* Roughage is necessary to stimulate digestive juices in our body and thus help in digesting food.

**What is Hygiene?**

Hygiene is nothing but maintaining cleanliness through good habits and practices. Good hygiene prevents various diseases from spreading. Hygiene is also a series of practices performed to preserve health. According to the World Health Organization (WHO), “hygiene refers to conditions and practices that help to maintain health and present the spread of diseases.” Would you like to train as a health care professional in the future? Some crucial professionals in this field are listed below:

**Anesthesiologists** are medical doctors who specialize in anesthesiology, which is the medical science of relieving pain and managing the body's vital functions, such as breathing, heartbeat, circulation, temperature, and consciousness.

**Cardiologists** are medical doctors who specialize in the diagnosis and treatment of diseases or conditions of the heart and blood vessels, such as irregular heart rhythms, high blood pressure, heart failure, or heart attacks.

**Dentists** are health professionals who specialize in mouth and dental health problems. Dentists can diagnose and treat dental problems, such as cavities and tooth loss, and perform cosmetic procedures, such as whitening teeth.

**Gynecologists** perform surgeries, such as removal of the uterus (hysterectomy) and ovaries (oophorectomy) and also can provide routine care, such as Pap smears or breast exams. Gynecologists may also practice obstetrics (the management of pregnancy).

**Internists** are medical doctors who specialize in the care of adults. People might choose an internist as their primary doctor for regular checkups and for treating illness.

**Pediatricians** are medical doctors who specialize in the care of children.

**Pharmacists** are licensed health professionals who prepare, dispense, and provide advice about both prescription and nonprescription medicines. They are specialists in medicine action, use, dosage, side effects, and interaction with other substances. They help ensure the safe use of medicines in people of all ages.

**Radiologists** are doctors who do imaging tests, like x-rays, ultrasounds, and MRIs. They may also supervise people who perform tests barium enemas or CT scans.

**Registered nurses (RNs)** provide treatment, counseling, and health education. They provide assessment, plan and implement care, and evaluate outcomes. Nurses work as part of a health care team in a variety of environments, often under the supervision of a doctor.

**Steps to maintain a good Hygiene**

* Have a bath daily. Dust particles stick to our body when we play or sweat. These dust particles attract disease causing germs. Bathing daily keeps these germs away.
* Wash your hands before and after every meal. When we play, the germs present in soil and mud get transferred to our hands and can enter our body causing illnesses.
* Take care of our teeth, brush twice a day and floss regularly to remove food particles that are trapped or stuck between our teeth and are hard to remove.
* Trim your nails regularly.
* Keep hair clean and lice free.
* Take good care of your eyes and ears. Avoid reading in bad light and wash your eyes with cold water regularly.
* Keep our surroundings clean always. Throw garbage in dustbins, do not collect water in drums and buckets as water is the breeding ground for mosquitoes which can cause diseases.
* A recipe for a fruit salad can be inserted.

**Home hygiene in developing countries**

According to Wikipedia, in, developing countries universal access to water and sanitation has been seen as the essential step in reducing the preventable infectious diseases burden, but it is now clear that this is best achieved by programs that integrate hygiene promotion with improvements in water quality and availability, and sanitation. This approach has been integrated into the Sustainable Development Goal Number 6 whose second target states: "By 2030, achieve access to adequate and equitable sanitation and hygiene for all and end, open defecation paying special attention to the needs of women and girls and those in vulnerable situations". Due to their close linkages, water, sanitation, hygiene are together abbreviated and funded under the term WASH in development cooperation.

About 2 million people die every year due to diarrheal diseases, most of them are children less than 5 years of age. The most affected are the populations in developing countries, living in extreme conditions of poverty, normally peri-urban dwellers or rural inhabitants. Providing access to sufficient quantities of safe water, the provision of facilities for a sanitary disposal of excreta, and introducing sound hygiene behaviors are of capital importance to reduce the burden of disease caused by these risk factors.

Research shows that, if widely practiced, hand washing with soap could reduce diarrhea by almost fifty percent and respiratory infections by nearly twenty-five percent. Hand washing with soap also reduces the incidence of skin diseases, eye infections like trachoma and intestinal worms.

Other hygiene practices, such as safe disposal of waste, surface hygiene, and care of domestic animals, are important in low-income communities to break the chain of infection transmission.

Cleaning of toilets and hand wash facilities is important to prevent odors and make them socially acceptable. Social acceptance is an important part of encouraging people to use toilets and wash their hands, in situations where open defecation is still seen as a possible alternative, e.g. in rural areas of some developing countries.

**Force, Heat and Sound**

**Force**

In science, force is the push or pull on an object with mass that causes it to change velocity (to accelerate). Force represents as a vector, which means it has both magnitude and direction.

In equations and diagrams, a force is usually denoted by the symbol F. An example is an equation from Newton’s second law.

F = m·a

where F = force, m = mass, and a = acceleration.

**Units of Force**

The SI unit of force is the Newton (N). Other units of force include

* dyne
* kilogram-force (kilopond)
* poundal
* pound-force

Galileo Galilei and Sir Isaac Newton described how force works mathematically. Galileo's two-part presentation of the inclined-plane experiment (1638) established two mathematical relationships of naturally-accelerated motion under his definition, strongly influencing how we measure force to this day.

Newton's Laws of Motion (1687) predict the action of forces under normal conditions as well as in response to change, thus laying the foundation for classical mechanics.

**Examples of Forces**

In nature, the fundamental forces are

* gravity
* weak nuclear force
* strong nuclear force
* electromagnetic force
* residual force

The strong nuclear force holds protons and neutrons together in the atomic nucleus. The electromagnetic force is responsible for the attraction of opposite electric charge, repulsion of like electric charges, and the pull of magnets.

Non-fundamental forces are also encountered in everyday life. The normal force acts in a direction normal to the surface interaction between objects. Friction is a force that opposes motion on surfaces. Other examples of non-fundamental forces include the elastic force, tension, and frame-dependent forces, such as centrifugal force and the Coriolis force.

**Heat**

Heat is the form of energy that is transferred between systems or objects with different temperatures (flowing from the high-temperature system to the low-temperature system). Also referred to as heat energy or thermal energy. Heat is typically measured in Btu, calories or joules. Heat flow, or the rate at which heat is transferred between systems, has the same units as power: energy per unit time (J/s).

Heat energy, also referred to as thermal energy, is really the effect of moving molecules. Matter is made up of molecules, which are in continual motion and in a solid, vibrate about a mean position. The motion of any molecule increases when the energy of the substance is increased. This may cause an increase in the temperature of the substance or lead to a change of state. The higher the temperature, the greater the internal energy of the substance.

Heat energy is the most easily lost or dissipated form of energy. It is also the form of energy into which other forms of energy can easily change. However, heat can be changed into other forms of energy with a lot of waste also called Solar Energy.

Most people use the word heat to describe something that feels warm, however in science, thermodynamic equations, in particular, heat is defined as the flow of energy between two systems by means of Kinetic energy. This can take the form of transferring energy from a warm object to a cooler object. More simply put, heat energy, also called thermal energy or simply heat, is transferred from one location to another by particles bouncing into each other. All matter contains heat energy, and the more heat energy that is present, the hotter an item or area will be.

**Heat vs. Temperature**

The distinction between heat and temperature is subtle but very important. Heat refers to the transfer of energy between systems (or bodies), whereas temperature is determined by the energy contained within a singular system (or body). In other words, heat is energy, while temperature is a measure of energy. Adding heat will increase a body's temperature while removing heat will lower the temperature, thus changes in temperature are the result of the presence of heat, or conversely, the lack of heat.

You can measure the temperature of a room by placing a thermometer in the room and measuring the ambient air temperature. You can add heat to a room by turning on a space heater. As the heat is added to the room, the temperature rises.

Particles have more energy at higher temperatures, and as this energy is transferred from one system to another, the fast-moving particles will collide with slower moving particles. As they collide, the faster particle will transfer some of its energy to the slower particle, and the process will continue until all the particles are operating at the same rate. This is called thermal equilibrium.

**Units of Heat**

The SI unit for heat is a form of energy called the joule (J). Heat is frequently also measured in the calorie (cal), which is defined as "the amount of heat required to raise the temperature of one gram of water from 14.5 degrees Celsius to 15.5 degrees Celsius." Heat is also sometimes measured in "British thermal units" or Btu.

**Sign Conventions for Heat Energy Transfer**

In physical equations, the amount of heat transferred is usually denoted by the symbol Q. Heat transfer may be indicated by either a positive or negative number. Heat that is released into the surroundings is written as a negative quantity (Q < 0). When heat is absorbed from the surroundings, it is written as a positive value (Q > 0).

**Ways of Transferring Heat**

There are three basic ways to transfer heat: convection, conduction, and radiation. Many homes are heated through the convection process, which transfers heat energy through gases or liquids. In the home, as the air is heated, the particles gain heat energy allowing them to move faster, warming the cooler particles. Since hot air is less dense than cold air, it will rise. As the cooler air falls, it can be drawn into our heating systems which will again allow the faster particles to heat up the air. This is considered a circular flow of air and is called a convection current. These currents circle and heat our homes.

The conduction process is the transfer of heat energy from one solid to another, basically, two things that are touching. We can see an example of this can be seen when we cook on the stove. When we place the cool pan down on the hot burner, heat energy is transferred from the burner to the pan, which in turn heats up.

Radiation is a process in which heat moves through places where there are no molecules, and is actually a form of electromagnetic energy. Any item whose heat can be felt without direct connection is radiating energy. You can see this in the heat of the sun, the feeling of heat coming off a bonfire that's several feet away, and even in the fact that rooms full of people will naturally being warmer than empty rooms because each person's body is radiating heat.

**Sound**

Sound energy is also a type of wave motion. We are heard by others when we talk because of the sound energy we produce. It is due to the effect of the air molecules vibrating when we talk. The vibrating molecules hit our eardrums, which enable us to hear others talk. Sound energy may be converted into electrical energy for transmission, and later the electrical energy can be converted back into sound energy at the receiving end. An example of such transformations could be seen in the microphone and the loudspeaker.

Sound, like heat energy is easily lost. The transformation of one form of energy into another may be accompanied by losses in the form of sound and/or heat that are often not desirable.

**Definition**

A sound wave is the pattern of disturbance caused by the movement of energy traveling through a medium (such as air, water, or any other liquid or solid matter) as it propagates away from the source of the sound. The source is some object that causes a vibration, such as a ringing telephone, or a person's vocal chords. The vibration disturbs the particles in the surrounding medium; those particles disturb those next to them, and so on. The pattern of the disturbance creates outward movement in a wave pattern, like waves of seawater on the ocean. The wave carries the sound energy through the medium, usually in all directions and less intensely as it moves farther from the source.

**Magnetism and Electricity**

**Electricity - What is it?**

Electricity is a form of energy that is transmitted through copper conductor wire to give power to the operation of electrical machines and devices such as industrial, commercial, institutional and residential lighting, electric motors, electrical transformers, communications networks, home appliances, electronics, etc.

When charged particles flow through the conductor, we call it "current electricity". This is because when the charged particles flow through wires, electricity also flows. We know that current means the flow of anything in a particular direction. For example, the flow of water. In the similar way, the flow of electricity in a certain direction is called current electricity or electric current.

**What is magnetism?**

Magnetism is a type of attractive or repulsive force that acts up to certain distance at the speed of light. The distance up to which this attractive or repulsive force acts is called a "magnetic field". Magnetism is caused by the moving electric charges (especially electrons). When two magnetic materials are placed close to each other, they experience an attractive or repulsive force.

**What is the relationship between electricity and magnetism?**

In the early days scientists believed that, there were two uniquely, separate forces. However, James Clerk Maxwell proved these two separate were actually interrelated forces.

In 1820, Hans Christian Orsted observed a surprising thing, when he switched on the battery from which the electric current is flowing, the compass needle moved away from the point north. After this experiment, he concluded that, the electric current flowing through the wire produces a magnetic field.

Electricity and magnetism are related closely to each other. The electric current flowing through the wire produces a circular magnetic field outside the wire. The direction (clockwise or counter-clock wise) of this magnetic field is depends on the direction of the electric current.

In the similar way, a changing magnetic field produces an electric current in a wire or conductor. The relationship between them is called electromagnetism.

Electricity and magnetism are an interesting aspect of electricity sciences. We are familiar with in our everyday lives with the phenomenon of static cling - when two objects, such as a piece of Saran wrap and a wool sweater, are rubbed together, they cling.

One feature of this that we don't encounter too often is static "repulsion" - if each piece of Saran wrap is rubbed on the wool sweater, then the pieces of Saran wrap will repel when brought near each other. These phenomena are interpreted in terms of the objects acquiring an **electric charge**, which has the following features:

* There are two types of charge, which by convention are labelled **positive** and **negative**.
* Like charges repel, and unlike charges attract.
* All objects may have a charge equal to an integral number of a basic unit of charge.
* Charge is never created or destroyed.

 **Electric Fields**
A convenient concept for describing these electric current and magnetic current forces is that of **electric fields** currents. Imagine that we have a fixed distribution of charges, such as on the plate below, and bring in the vicinity of this distribution a *test charge* *Q*.

**Power and Magnetic Fields**
A phenomenon apparently unrelated to power are electrical magnetic fields. We are familiar with these forces through the interaction of compasses with the earth's magnetic field, or through fridge magnets or magnets on children's toys. Magnetic forces are explained in terms very similar to those used for electric forces:

* There are two types of **magnetic poles**, conventionally called North and South
* Like poles repel, and opposite poles attract

However, this attraction differs from electric power in one important aspect:

* Unlike electric charges, magnetic poles always occur in North-South pairs; there are no **magnetic monopoles**.

**Sound, Light, Electricity, and Magnetism Fundamentals**

 1. **Electricity:** A form of energy that can be produced from other forms of energy

2. **The Law of Conservation of Energy:** Energy can never be created or destroyed; it can change forms. When energy changes form, it is never 100% efficient because some energy is always given off in the form of heat.

 3. **Static Electricity:** Non-moving electricity caused by the build-up of electric charges on an object. Examples: lightening, hair standing up when rubbed with a balloon, socks sticking together when they come out of a dryer.

 4. **Matter:** Anything that has mass and takes up space. Matter is made up of atoms. There are three phases of matter: solids, liquids, and gases.

 **Solids:** molecules are tightly packed, have lots of bonds, and move by vibrating back and forth.

 **Liquids:** molecules are more loosely packed than solids, have fewer bonds than solids, and move by rotating around each other.

**Gases:** molecules are very loosely packed, have very few bonds, and move all over the place like crazy. Vacuum: an area / a place that has absolutely no matter / atoms in it. Examples of a vacuum are outer space, and the vacuum that can be created in a science lab using a bell jar that has all of the air sucked out of it using a pump.

 5. **Atom:** The smallest piece of an element (like gold, oxygen, or lead) that still has all of the properties of the element.

**Nucleus:** The center of an atom

**Protons:** Found in the nucleus of an atom; they have a positive charge Neutrons: Found in the nucleus of an atom; they have no charge (they are neutral)

 **Electrons:** Orbit around the nucleus; they have a negative charge

6. **Charged particles:** An atom gets a charge when it has an unequal number of protons and electrons. **Positive charge:** an atom gets a positive charge when it loses electrons (it will have more protons than electrons)

**Negative charge:** an atom gets a negative charge when it gains electrons (it will have more electrons than protons)

 **Neutral charge:** an atom has a neutral charge when it has the same number of protons and electrons.

 7**. Like Charges:** Like charges repel each other. Two objects with positive charges will repel each other. Two objects with negative charges will repel each other.

 \* Two neutral objects will not have any reaction; they will neither attract nor repel.

8**. Unlike (opposite) Charges:** Unlike charges attract each other. A positive object will be attracted to a negative object and vice-versa. A positive object also attracts a neutral object, and a negative object will also attract a neutral object.

9. **Repel:** push away from each other.

10. **Attract:** pull towards each other.

11. **Methods of Charging Particles**:

 **a. Friction Method:** 2 objects rubbing against each other

 **b. Conduction:**  involves the direct contact of objects; electrons flow through one object into another object.

**c. Induction:**  No contact is necessary. Involves a rearrangement of electric charges when a neutral object gets close to a charged object.

12**. Electric Discharge**: loss of static electricity as charges move-off of an object

13**. Current Electricity:** moving electricity caused by the flow of electrons along a path called a circuit.

 14. **Circuit:** pathway that allows for the flow of electrons. When a circuit is complete (closed) electrons are able to flow through the circuit. When a circuit is incomplete (open) electrons cannot flow through the circuit.

15. **Battery:** device that produces electricity by converting chemical energy into electrical energy. Batteries have two terminals; a positive terminal and a negative terminal. When a battery is hooked up to a circuit, electrons leave the battery through the negative terminal, flow through the circuit, and then return to the battery through the positive terminal.

16. **Direct Current:** A circuit in which the electrons flow in only one direction (from the negative terminal, around the circuit, and then back into the positive terminal of a battery).

 17. **Series Circuits:** There is only one pathway for the electrons to travel in a series circuit, so the electrons must move through all of the devices in the circuit. If one device is shut off, all of the devices will shut off. The devices must share the electrical pressure, so as more devices are added, each one gets less power.

18. **Parallel Circuits:** Electrons have more than one path to follow. Each appliance has its own path, so you can shut off one appliance at a time. Appliances do not share the electrical pressure, so as more appliances are added, each appliance continues to get the full voltage that it needs to work properly.

19. **Voltmeter:** Measures electrical current.

 20. **Galvanometer:** measures weak electrical current.

21. **Conductors:** materials that allow electrical current to flow through them easily. Metals are good conductors.

22. **Insulators:** materials that do not allow electrical current to flow through them easily. Plastic and rubber are good insulators.

23. **Magnetism:** A force caused by a magnetic substance. Iron, nickel, and cobalt are the only three naturally magnetic elements.

 24. **Magnets:** Magnets are attracted to metal objects, and will attract and repel each other. Permanent magnets are usually made out of steel. Temporary magnets (electromagnets) are made out of a soft iron core, copper wire, and a battery.

 25. **Magnetic Poles:** a magnet is strongest at its poles (north and south). Like Poles: Like poles repel each other . A north pole of a magnet will repel the north pole of another magnet. The south pole of one magnet will repel the south pole of another magnet. Unlike Poles: Unlike poles attract each other. A north pole will be attracted to a south pole.

 26. **Magnetic Field:** The invisible lines of force that surround a magnet. A magnetic field can produce

magnetic field (when a compass is placed near a complete circuit, the compass needle will move).

 27. **Wave:** All waves transfer energy (move energy from one place to another). There are two kinds of waves: mechanical waves and electromagnetic waves.

28. **Mechanical Waves:** must travel through matter. They are created when atoms bump into each other. Examples of mechanical waves are ocean waves and sound waves.

 29. **Electromagnetic Waves:** do not need to travel through matter; they can pass through a vacuum (like outer space). There are many different types of electromagnetic waves, each type of electromagnetic wave has a different wave length. You can look at the electromagnetic spectrum to see the various types of electromagnetic waves and their different wavelengths. Examples of electromagnetic waves are light waves and radio waves.

30. **Longitudinal waves:** also caused compression waves; these waves make matter move in the same direction as the wave is traveling. As the matter moves there will be areas of compressions (places where the atoms get mushed together) and areas of rarefractions (places where the atoms get spread out). Examples of longitudinal waves are sound waves.

 31. **Transverse Waves:** these waves make matter move at right angles to the direction in which the wave is moving. Examples of transverse waves are light waves and radio waves.

32. **Sound:** A form of energy that travels as longitudinal / compression waves. Sound is caused by vibrations. Sound waves are mechanical waves, so they must travel through matter. Sound travels fastest through solids because in solids the atoms are closer together, so they will bump into each other faster, and make the sound wave travel faster.

33. **Electromagnetic Spectrum:** When the different types of electromagnetic waves are put in order based on their wavelengths, they form the electromagnetic spectrum. Below is a small portion of the electromagnetic spectrum.

34. **Light:** a form of energy that travels as electromagnetic waves. Light travels in straight lines called rays. When a light ray bumps into an object, three different things can happen: Light can be Transmitted: This happens when light passes through an object Light can be Reflected: This happens when light bounces off of an object. Objects can be seen because light bounces off of them. The color of light that is being reflected by an object is the color of light that you see when you look at an object. Ex: a blue shirt reflects blue light and absorbs all of the other colors of light. Light can be Absorbed: This happens when light energy “soaks-into” an object and becomes heat energy.

35. **Emit:** To give off.

 36. **Transparent:** If an object is transparent you can see through it, and it allows light to pass through it clearly. Glass windows are transparent.

37**. Translucent:** If an object is translucent it allows light to pass through it, but not clearly. Lace or gauze curtains are translucent.

 38. **Opaque:** If an object is opaque, light cannot pass through it. A wooden table is opaque.

39. **Refraction:** The bending of light when it changes speed as it passes through different types of mediums.

**Environmental Science**

**Environmental science** is an interdisciplinary academic field  that integrates physical, biological and information Environmental science is an interdisciplinary academic field that integrates physical, biological sciences  (including ecology, biology, physics, chemistry, zoology, mineralogy, oceanography, soil science, and physical geography, and atmospheric science) to the study of the environment, and the solution of environmental problems.  Today it provides an integrated, quantitative, and interdisciplinary  approach to the study of environmental systems.

Environmental scientists study subjects like the understanding of earth processes, evaluating alternative energy  systems, pollution control and mitigation, natural resource management, and the effects of global climate change.  Environmental issues almost always include an interaction of physical, chemical, and biological processes. What are some of the environmental issues in Liberia? Environmental scientists bring a systems approach to the analysis of environmental problems. Key elements of an effective environmental scientist include the ability to relate space, and time relationships as well as quantitative analysis.

 **Helpful Links:**

[**https://www.sciencefun.org/**](https://www.sciencefun.org/) **A well-known site for science fun for everyone. Check it out!**

[**https://www.nature.com/**](https://www.nature.com/) **latest review & analysis on many scientific issues.**

[**https://www.electricityforum.com/**](https://www.electricityforum.com/) **a leader in electrical training courses and webinars.**

[**https://www.thoughtco.com/**](https://www.thoughtco.com/) **An extensive site with science, tech, math and much more.**

[**https://www.britannica.com/search?query=physics**](https://www.britannica.com/search?query=physics) **treats all concepts in this field.**

[**https://www.nationalgeographic.com/**](https://www.nationalgeographic.com/) **A look at science and the environment.**

[**https://www.brainpop.com/health/**](https://www.brainpop.com/health/) **the human body and social emotional learning.**

[**https://www.bbc.co.uk/programmes/scienceandnature/scienceandtechnology**](https://www.bbc.co.uk/programmes/scienceandnature/scienceandtechnology) **science & technology. Contains quizzes.**

 **Glossary**

**acceleration** the change in the velocity (speed and direction) of a moving object.

**acids** chemical substances.

**agriculture** growing crops and raising animals for food.

**alkali** is a basic, ionic salt of an alkali metal or an alkaline earth metal.

**atom** the smallest particle of an element.

**axis** the imaginary line through the North and South poles that the earth rotates around.

**bacteria** tiny microorganisms that live in animals, plants, soils, and water.

**Bernoulli’s principle** this is the inverse relationship between the pressure and speed at a point in a fluid.

**binary** consisting of two parts or two elements.

**Big Bang** a powerful explosion from which our universe was created about 14 billion years ago.

**biology** is the scientific study of life.

**carnivores** animals that eat other animals.

**cell** the basic unit from which all living organisms are made.

**chemical** a substance made from elements or compounds, which are made from atoms and molecules.

**chemistry** is the scientific study of properties and behavior of matter.

**compound** a chemical made by combining the atoms of two or more different elements.

**conduction** the flow of electricity or heat through a material.

**container** a box that holds things.

**data** information, usually measured in the form of numbers, that can be processed by a computer.

**deforestation** clearing of the forest.

**DNA** Deoxyribonucleic acid. The chemical inside chromosomes that lets parents pass genetic information to their offspring.

**ecosystem** a community of living plants and animals, and nonliving things such as air or water, that occupy the same habitat and interact with one another.

**element** a substance whose atoms are all the same. Examples include gold, oxygen, nitrogen, and carbon.

**electricity** a type of energy caused by electrons inside atoms. Static electricity is made by electrons building up in one place, while current electricity happens when electrons move around.

**energy** a property of an object that allows it to do something now or in the future. Different types of energy include kinetic energy (movement energy) and potential energy (stored energy.)

**environmental science** the field of science that studies the interactions of the physical, chemical, and biological components of the environment and also the relations and effects of these components with the organisms in the environment.

**experimental research** is a study that strictly adheres to a scientific research design. It includes a hypothesis, a variable that can be manipulated by the researcher, and variables that can be measured, calculated and compared.

**fetus** a baby growing inside the uterus from its ninth week until its birth.

**force** a pushing and pulling action that change an object’s speed, direction of movement, or shape.

**fungi** plantlike living things that do not have leaves, flowers, or green color, and that do not make their own food.

**genome** the complete collection of the genetic inside a living thing.

**genus** a large group of closely related plants or animals.

**gravity** the pulling force between every mass in the universe and every other mass.

**habitat** the surroundings where an animal or a plant naturally lives.

**herbivores** animals that eat only plants.

**HIV/AIDS** (human immunodeficiency virus/acquired immunodeficiency syndrome) is a virus that attacks the body’s immune system. If HIV is not treated, it can lead to AIDS. You can get HIV from contact with infected blood, semen, or vaginal fluids.

**insectivores** animals that eat insects for food.

**invertebrates** animals without backbones.

**magnetic field** the invisible pattern of force that stretches out around a magnet.

**mass** the amount of matter that an object contains.

**matter** the material which everything around us is made from. Matter includes solids, liquids, and gases, and both living and nonliving things.

**microscopic** very small.

**molecule** a substance made from two or more atoms bonded (joined tightly) together. The atoms in a molecule might be the same or different.

**nanotechnology** a way of building tiny materials by joining together individual atoms or molecules.

**neutron** a particle inside the nucleus of an atom that has a neutral electric charge.

**omnivores** animals that eat plants and animals

**oxygen** a gas in the atmosphere that people and animals need to breathe to stay alive.

**pH** a measurement that tells us whether an acid or base is strong or weak.

**physics** is one of the most fundamental scientific disciplines, and its main goal is to understand how the universe behaves…

**phylum** one of the main parts of the animal kingdom.

**pressure** the force pushing on a surface. The bigger the force or the smaller the area it acts on, the higher the pressure.

**prey** an animal that is hunted by another animals for food.

**proton** a particle inside the nucleus of an atom that has a positive electric charge.

**renewable energy** a type of energy that will not run out, generated from sources such wind, waves, and sunlight.

**reproduce** have babies.

**sanitation** the provision of clean water and sewage disposal.

**scientific method** is the principles and procedures for the systematic pursuit of knowledge involving the recognition and formulation of a problem, the collection of data through observation and experiment, and the formulation and testing of hypotheses.

**species** a single kind of living thing. All people are one species.

**vertebrates** animals that have backbones.

**LJHSCE Science**

**Grade 9**

**Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**50 Questions Test (Check Your Knowledge)**

1.A \_\_\_\_\_\_\_\_\_\_\_\_\_ retains its shape and size.

 A) solid

 B) liquid

 C) gas

 D) plasma

2. What are the three subatomic particles found in an atom?

 A) electron, proton, ion

 B) neutron, photon, electron

 C) electron, proton, neutron

 D) proton, neutron, isotope

3. The process by which a liquid becomes a gas \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 A) evaporation

 B) condensation

 C) sublimation

 D) diffusion

4. The buildup of electrical charges on an object is called \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

 A) static electricity

 B) electric electricity

 C) DC electricity

 D) AC electricity

5. The pitch of a sound depends on its \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

 A) amplitude

 B) frequency

 C) intensity

 D) resonance

6. Which of the following is a source of direct current?

 A) wall outlet

 B) battery

 C) bar magnet

 D) None of the above

7. A \_\_\_\_\_\_\_\_\_\_\_\_ has a definite size, but not a definite shape.

 A) gas

 B) plasma

 C) liquid

 D) solid

8. T/F Friction within machinery increases efficiency.

 A) True

 B) False

9. T/F Metals conduct heat.

 A) True

 B) False

10. Human can live without spleen.

 A) True

 B) False

11. A zygote is a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

 A) two-celled embryo

 B) solid ball of about 50 cells

 C) blastocyst

 D) fertilized egg

12. A collection of cells that come together to perform a specific function is known as a(n)\_\_\_\_

 A) organ

 B) organism

 C) organ system

 D) tissue

13. The \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is a basic functional and physical unit of heredity.

 A) gene

 B) genetics

 C) geneticist

 D) genome

14. The three primary types of muscle fiber present in human body are

 A) smooth, cardiac, and digestive

 B) cardiac, respiratory, and smooth

 C) skeletal, smooth, and cardiac

 D) skeletal, cardiac, and digestive

15. Blood and nutrients are carried from mother to the developing fetus through the \_\_\_\_\_\_\_.

 A) cervix

 B) endometrium

 C) umbilical cord

 D) Fallopian tubes

16. The tubes that carry blood back to the heart are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

 A) veins

 B) aortas

 C) arteries

 D) capillaries

17. The \_\_\_\_\_\_\_\_\_\_\_\_\_system moves blood around the body, providing important nutrients to cells while simultaneously ridding the cells of waste.

 A) lymphatic

 B) circulatory

 C) respiratory

 D) metabolic

18. The intestines are the organs primarily responsible for\_\_\_\_\_\_\_\_\_\_\_\_

 A) absorption

 B) digestion

 C) elimination

 D) ingestion

19. T/F For most females, ovulation occurs during menstruation

 A) True

 B) False

20. T/F If fertilization occurs, it usually occurs in the uterus.

 A) True

 B) False

21. What are the last four teeth that a person will get?

 A) canines

 B) molars

 C) premolars

 D) wisdom teeth

22. Teeth do not only help us to eat, but they also help us to\_\_\_\_\_\_\_\_\_\_\_

 A) hear

 B) talk

 C) taste

 D) think

23. HIV is transmitted by

 A) blood and sex fluids

 B) kissing and shaking hands

 C) tears, urine and sweat

 D) toilet seats and mosquitos

24. Malnutrition means…

 A) a person is not eating properly

 B) undernutrition or over-nutrition

 C) someone is starved

 D) someone is eating too much

25. Where does digestion begin?

 A) stomach

 B) small intestines

 C) pancreas

 D) mouth

**CALCULATIONS AND EXPLANATIONS**

26. A tourist in London is buying gasoline. The pump meter reads 52 liters (L) when the tank is full. How many gallons is this?

27. Identify at least six substances that normally are (a) solids, (b) liquids, (c) gases.

28. Find the hypotenuse of a right triangle whose sides are 8 ft and 5 ft. Use the theorem of Pythagoras.

29. A nurse announces that your temperature is 38.6$°$ Celsius. If you ask him to express this in Fahrenheit, what reading should he give?

30. Using the formula P = VI, find the power needed to operate an electric iron using a voltage V of 110 V and a current I of 6 A.

**Matching Questions (31 – 35)**

Column A contains a list of phrases. On the line to the left of each phrase, write the letter of the response from Column B that logically completes each phrase. Each item in Column B may be used only once.

 Column A Column B

\_\_\_\_\_ 31. The first artificial satellite A) Alan Shepard

\_\_\_\_\_ 32. The first human to journey into space B) Mae Jemison

\_\_\_\_\_ 33. The first black woman to travel into space C) Neil Armstrong

\_\_\_\_\_ 34. The first person to walk on the moon D) Sputnik

\_\_\_\_\_ 35. The first American to travel into space E) Yuri Gagarin

**Short Answer Questions (36-42)**

From the box below, choose the word that best completes the sentence. Write the word in the blank. You will use each word only once.

**voltages**

**elements**

**conductor**

**current**

**resistance**

**Ohm’s law**

**insulator**

36. Science has discovered more than 100 different kinds of materials called\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. Can you name some of them?

37. The purpose of all \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is to provide a force to move electrons.

38. The flow of electrons is called electric \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

39. The ability of a material to resist the flow of electrons is called its \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

40. An \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is a material that prevents the electrons from traveling through it easily.

41. A \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is a material through which electrons may travel freely.

42. The simple relationship between the electrical units of volts, amperes, and ohms is called\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

43. An ecologist calculated the yearly rainfall in Monrovia. Her data is organized into the table below:

 ***Month***  ***Rainfall (In.)***

 January 2.1

 February 2.8

 March 4.7

 April 6.1

 May 17.4

 June 35.4

 July 31.3

 August 13.6

 September 26.2

 October 23.3

 November 9.9

 December 4.5

 In which month was rainfall the heaviest?

 A) May

 B) June

 C) July

 D) August

44. A scientist wanted to determine the toxicity of venom in five species of snakes in Africa. She collected data on the mortality (or the death rate) from each snake species’ bite.

 ***Snake*** ***Mortality percentage***

 Black Mamba 95%

 Cape Cobra 28%

 West African Carpet Viper 42%

 Gabon Viper 20%

 Black-Necked Spitting Viper 13%

 Which of the following lists the snakes from most deadly to least deadly?

 A) Black Mamba, West Africa Carpet Viper, Cape Cobra, Gabon Viper & Black-Necked Spitting Viper

 B) Black Mamba, Black-Necked Spitting Viper, Gabon Viper, Cape Cobra & West Africa Carpet Viper.

 C) Black-Necked Spitting Viper, Gabon Viper, West African Carpet Viper, Cape Cobra & Black Mamba.

 D) Black-Necked Spitting Viper, Black Mamba, Cape Cobra, Gabon Viper & West Africa Carpet Viper.

45. T/F According to the United Nations, half of the world’s people live in countries where there isn’t enough clean drinking water.

 A) True

 B) False

46. T/F Sanitation is the development and establishment of environmental conditions favorable to the health of the public.

 A) True

 B) False

47. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ refers to a set of practices associated with preservation of the health and healthy living…

 A) epidermis

 B) hygiene

 C) medicine

 D) science

48. According to WaterAid, in Liberia, lack of safe water and sanitation causes over \_\_\_\_\_\_\_\_\_ deaths per year in children under five.

 A) 500

 B) 600

 C) 700

 D) 1,000

49. The variable that is measured in an experiment is called \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 A) Control

 B) Outlier

 C) Independent Variable

 D) Dependent Variable

50. A prediction that can be tested is called \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

 A) Dependent Variable

 B) Independent Variable

 C) hypothesis

 D) procedure