KENYA NATIONAL SPELLING BEE

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SCIENCE

STUDY MANUAL

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SECTION 1

THE HUMAN BODY

RESPIRATORY SYSTEM

Take a deep breath, feel your chest bulge, and exhale. That's your body's respiratory system in action!

These activities will help learners understand the parts of the respiratory system and their functions.

Objectives

The activities in this section will develop learner's ability to:

- Comprehend concepts related to health promotion and disease prevention to enhance health.
- Use interpersonal communication skills to enhance health and avoid or reduce health risks.
- Identify and describe the parts of the respiratory system
- Demonstrate knowledge of the paths that oxygen and carbon dioxide take during inhalation and exhalation

Materials required

- Balls (other items to toss and catch).
- Computer with internet access
- "Respiratory Relay" handout.

Discussion questions

a. What is breathing? Why is it important for your body?

b. What are the body parts that help you breathe?

c. Describe the role each part plays in helping your respiratory system to do its job.

d. What can affect how well the respiratory system works? What can you do to keep your respiratory system healthy?

Note to the instructor: Organize learners into groups of 6, sitting in a circle on the floor or at tables. Shuffle the Respiratory Relay cards, and give one to each student.

ACTIVITY

First, you are going to check out *www. kidsHealth.org* to find out information on how the respiratory system and lungs work. You can make notes on the back of your card, especially about the part of the respiratory system on the front of the card. Then, going around the circle, each person will read the card and describe where that body part fits into the respiratory system. Then, toss the ball from person to person to match the order that oxygen would travel inside the body as we inhale, starting with the trachea, or windpipe. As each person gets the ball, he or she needs to say the body part on his or her card and the body part that comes next. Do this a few times then collect the cards, and reshuffle and redistribute for each group, and repeat the process. What happens to the order of the toss if we are exhaling? After some practice, turn on room lights for inhaling, turn off lights for exhaling. Can your group keep your ball in the air, in the right order, for 1 minute? How many "breaths," inhaling and exhaling, can your group take in 1 minute?

Extension:

Create riddles for group members to answer for each part of the respiratory system. For example: "I protect the lungs. I'm made up of sets of 12. I'm connected to the spine. What am I?" Answer: "The rib cage."

Take a Breath! Board Game

Objective

Learners will explain and describe the respiratory system, including all the body parts associated with inhaling and exhaling

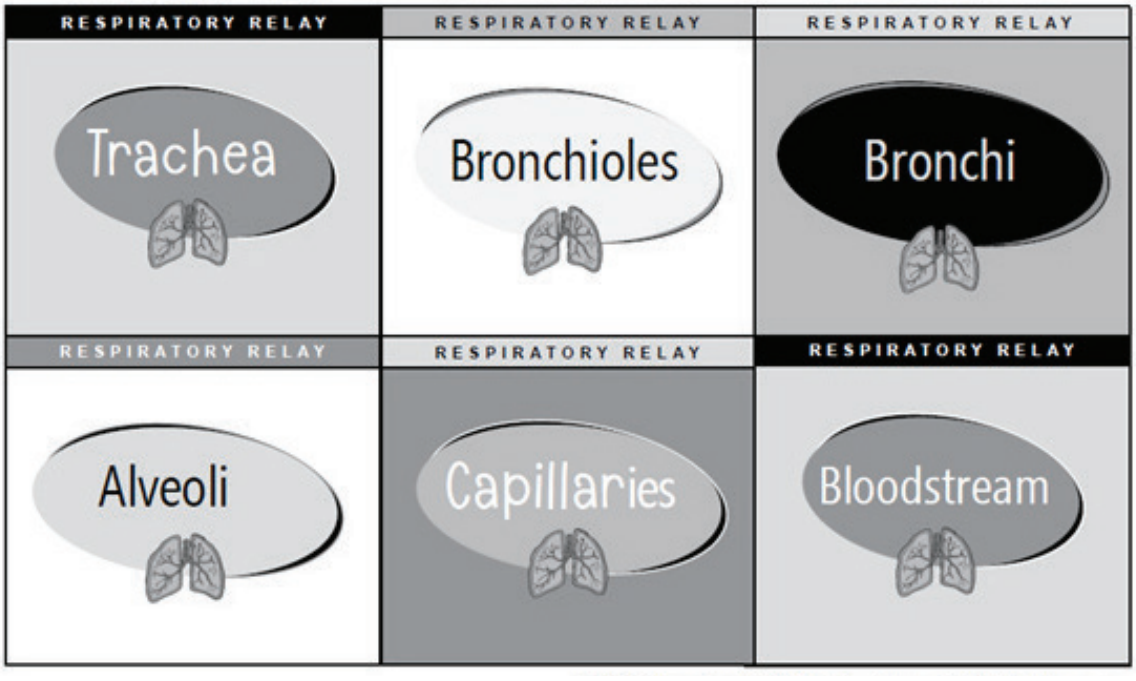
Materials required

- Internet access
- Pencils or pens
- Dice

Note to instructor: Organize learners into small groups; 2 to 4 works best.

It's time to play Take a Breath! Board Game. To begin with, your group has to get ready by creating a set of 20 Breath Cards. Check out the KidsHealth.org articles to learn about the parts of the respiratory system that help you inhale and exhale, including your lungs, trachea, bronchi, bronchioles, alveoli, capillaries, diaphragm, and rib cage. Create a set of Breath Cards with a question about the respiratory system on the front of each card. There should be 20 questions per game. Be sure to include the answers on the back. For example, "what keeps mucus and dirt out of your lungs?" Answer: "Cilia." When all the Breath Cards are ready, place them, answer side facing down, next to the game board and play take a Breath.

Note to instructor: Print enough copies of this page so you'll have a page of cards for each group of 6 students. Then, cut out the cards and give 1 to each student.



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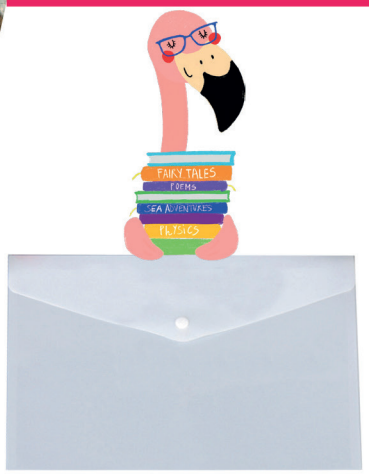

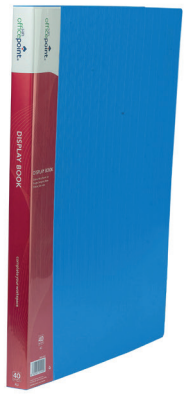

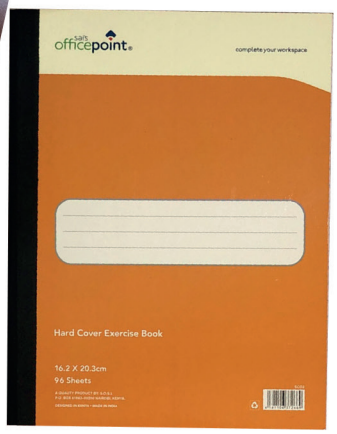

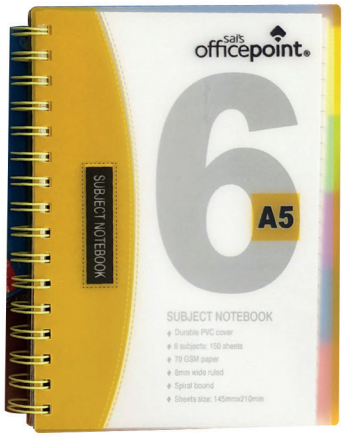

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SECTION 2

THE HUMAN BODY

NERVOUS SYSTEM

Your brain is the boss of your body, but it can't do the job alone. Your nervous system connects the messages from your brain to your body so you can do things like walk, talk, think, feel, and breathe. Your nervous system is the information highway that controls everything you do.

These activities will help the learners understand how the nervous system works.

Discussion Questions

- What is the main control station of your body?
- How does your brain send and receive messages to and from your body?
- What are the three main parts of the nervous system? How do they work together to get the message across?
- What parts of your body protect your nervous system? Where are nerve cells located? About how many nerve cells does your body have?
- What happens if a nerve connection is broken? How would this affect the body?

Objectives

Learners will:

- Explore how the nervous system works
- Learn the roles of each part of the nervous system
- Explore and demonstrate how neural pathways can be strengthened.

Brain Games

It's easy for young people to make brain connections strong and learn new things. When you practice something over and over, the messages travel from one nerve cell (or neuron) to another until connections are made, so you can do things better and better. That's what's happening when babies learn how to walk, kids learn the ABCs, or adults learn how to be brain surgeons.

Discuss behaviours that affect how well the brain works, such as diet, sleep, exercise, substance abuse, reading, playing video games, etc.

Nervous System Factfinder

Activity

Your nervous system controls everything you do. It's made up of your brain, spinal cord, and all the nerves in your body. The brain is the control centre and the spinal cord is the major highway carrying messages to and from the brain.

Today, you are to read the KidsHealth. org article titled, "Your Brain & Nervous System" to find out more about this amazing system. When everyone is done reading, you'll watch a KidsHealth.org movie on the nervous system. Finally, you'll take the KidsHealth.org quiz on the nervous system to see what you learned.

Extensions

Using different colours of modelling dough, create a model of the brain. Be sure to include the five parts of the brain – cerebrum, cerebellum, brain stem, hypothalamus, and pituitary gland – and lots of wrinkles (also called convolutions).

Draw and label an outline of the brain. Include a brief description of the role of each part.

Quiz

1) Your _____ is the boss of your body and controls everything you do.

2) A nerve cell is also called a:

- Meuron
- Neuron
- Norway
- Heron

3) The nervous system is made up of the brain, the_____, and neurons.

4) The spinal cord helps carry _____ back and forth between your body and your brain.

True or false:

5) Your body has billions of neurons.

6) What kinds of things are your brain and nervous system in charge of?

7) Fill in the letters to name the main parts of the brain:

- _erebrum,
- _erebellum,
- _rain_tem,
- _ypothalamus

SECTION 3

THE HUMAN BODY

ENDOCRINE SYSTEM

How does your body know when to grow? How does it know when it's time to change from a kid into an adult? How does it keep your cells fuelled with energy? The endocrine system handles all these things and much more!

The activities in this section will introduce the learners to the glands and hormones of the endocrine system.

Discussion Questions

- What are some jobs of the endocrine system?
- One of the jobs of the endocrine system is to give directions to your body about when to grow and develop. Can you think of some times during a person's life when the body changes?
- Glands and hormones make a great team. Describe how they work in the body.
- The endocrine system is also involved in preparing your body for emergencies. Know that feeling you get when you're scared or stressed? That's called the "fight or flight" response and your hormones *(especially adrenaline)* are what make it happen. Can you think of a time when adrenaline caused you to spring into action? How did your body feel?
- What kinds of problems can occur with the endocrine system?

Objectives

Learners will learn the names and functions of the various glands of the endocrine system.

Objective

Learners will research and demonstrate why the endocrine system is important for good health.

Activity

Being the endocrine system is a thankless job. When it works well, nobody even notices all the amazing things it does – from helping our bones to grow, to coordinating the changes of puberty, to regulating our blood sugar, energy, and other cell functions. Frankly, the endocrine system is tired of feeling overworked and underappreciated. It could use a little love.

Today you are going to show a little glandular gratitude by writing a thank-you note to your hardworking glands. Be sure to mention at least three glands specifically (as well as the hormones they produce) and the role they play in keeping you healthy.

Extension

Imagine that your endocrine system felt so overworked and underappreciated that it decided to go on strike. Do you know what a strike is? It's when workers refuse to do their jobs. Describe at least three health problems that might occur if your glands and hormones went on strike.

Name That Gland

Instructions:

Use the word bank to answer each question

Word Bank

Adrenal glands, Pancreas, Parathyroid, Pituitary gland, Reproductive glands, Thyroid

1) I live deep within the brain. I'm only about the size of a pea, but I'm very powerful. I make the hormones that help you grow, and I control the activity of other glands too. Who am I?
2) I'm shaped like a bow tie or a butterfly. I'm found in your neck. I make the hormones that help you stay alert and full of energy. Who am I?
3) I'm the largest gland in the body. I produce the hormone called insulin that helps glucose, the sugar in your blood, enter the cells of your body. I work closely with the digestive system. Who am I?
4) We come in pairs, one on top of each kidney. We produce hormones that help you to act fast when you're in trouble or under stress. We're triangular in shape. Who are we?
5) We are a set of four tiny glands that work with the thyroid to control the amount of calcium in the blood. Who are we?
6) In girls, we're the ovaries. In boys, we're the testes. We're involved in all the changes of puberty (*when children begin to become adults*). Who are we?

Quiz

Instructions:

Answer each question using a word from the word bank.

Word Bank

Adrenaline glands, Parathyroid, Puberty, Diabetes, Hormones, Pineal, Thyroid, Endocrinologist, Insulin

1) The endocrine system has eight _____.
2) _____ are chemical messengers produced by the glands.
3) The hormone _____ is responsible for the fight or flight response.
4) _____ gland is shaped like a butterfly.
5) _____ is the hormone that helps control your blood sugar levels.
6) The four glands that help control the calcium levels in your blood are called the _____glands.
7) When the pancreas doesn't produce insulin, the result is a disease called _____
8) When it's time for boys and girls to begin _____ the pituitary gland gets the ball rolling.
9) A doctor who specializes in treating people with hormone problems is called an _____

SECTION 4

THE HUMAN BODY

IMMUNE SYSTEM

Let's hear it for leukocytes! These germ- fighting white blood cells are an important part of the immune system, along with the other cells, tissues, and organs in the human body that work together to help you fight illnesses.

The activities in this section will help learners learn how the body protects itself from diseases.

Discussion Questions

- What does the immune system do? Why is this job so important?
- What parts of the body make up the immune system?
- What are germs? How can germs spread from person to person? What can you do to avoid getting sick from germs?
- What can you do to help your immune system keep you healthy?

Objectives

Learners will learn about the parts of the immune system and how they function

Activity

Shhh. OK, the coast is clear. Attack! You and some of your closest germ friends have just invaded a person's body. You are on your way to causing an infection, but you run into a roadblock: The person's immune system is fighting back! Your mission may fail! You need to call Germ Headquarters and inform them of the situation. After reading about germs and the immune system at www.KidsHealth.org, write a dialogue back and forth between you and Germ Headquarters describing the battle. In the dialogue, start with how you get into the person's body, and how the body fights back. Describe a mission in which you and your germ friends succeed and cause an illness, and explain what happens to the person's body.

Extension

Sometimes learners can have problems with their immune systems that aren't related to germs. Select an immune system problem like allergies, lupus, celiac disease, or juvenile rheumatoid arthritis. Do research at www.KidsHealth.org to learn more about the problem, and write down some facts explaining symptoms and treatment.

Help Wanted: Leukocytes

Objective

Learners will learn about the role of white blood cells in the immune system

Activity

"Sniffle, Cough." Sounds like you're coming down with something. Well, your leukocytes – germ-fighting white blood cells – can help make you get better. But there's a problem: You seem to be short on white blood cells! You'd better post a help wanted ad to get some more leukocytes fast! Then go to KidsHealth. org to learn about white blood cells. Now you're ready to write a help wanted ad of your own. Include the following information:

- Job description *(what white blood cells have to do on the job)*
- Qualifications *(skills that the white blood cells need to have)*
- Benefits *(what white blood cells will get for doing a good job)*

Good luck hiring some qualified white blood cells!

Quiz

1. What is the job of the immune system?
2. What are leukocytes?
   a. red blood cells
   b. white blood cells
   c. platelets
   d. plasma
3. What do phagocytes do?
   a. Chew up invading germs
   b. Allow the body to remember previous invaders
   c. Carry oxygen throughout the body
   d. Help you stop bleeding if you get a cut
4. List two places where leukocytes can be found?
5. What is another name for the glands in your neck?
6. What do lymph nodes do?
7. Name three places where you have lymph nodes
8. What do we call doctors who specialize in immune system problems?
9. Name two ways you can help your immune system protect you
10. True or false: When your lymph nodes are swollen, your immune system is at work.

SECTION 5

THE HUMAN BODY

CARDIOVASCULAR SYSTEM

This section will help the learners learn about the heart and cardiovascular system.

Discussion Questions

The heart is an important part of the cardiovascular system. What can you do to keep your heart healthy? What should you avoid doing?

What can happen if the cardiovascular system becomes unhealthy?

Your heart is a muscle about the size of your fist. Compare it to other muscles. Can you control it like you do the muscles in your arms or legs? Can you exercise it like you do other muscles?

Vascular Verse

Objective

Learners will compose original haikus about the cardiovascular system

Activity

A haiku is a type of Japanese poem. It contains 17 syllables in all: five in the first line, seven in the middle line, and five in the last line. Write a haiku about the cardiovascular system that describes something about how this system works.

Before you begin, you'll have to do some research at ***www.KidsHealth.org*** to find out about how the cardiovascular system works, the different parts that comprise this system, and what each does. After you have completed your haiku, you can illustrate it.

The Heart Data Table

Example of Haiku poem with illustration

Instructions:

Perform each activity for 30 seconds, 1 minute, and 3 minutes. Rest for a minute or two between each activity and time periods. After each time period, take your pulse and record that number in the chart below. Then, answer the questions.

Heart Rate Data Table

ACTIVITY	30 SECONDS	1 MINUTE	3 MINUTES
Using the computer			
Climbing Stairs			
Jumping Rope			
Running			
Walking			

Tip: To take your pulse, count your heartbeats for 30 seconds and multiply that number by 2.

Quiz

1) Which activity made your heart beat the fastest?
2) Which activity made your heart beat the slowest?
3) What's the difference in your pulse between 3 minutes if running and 3 minutes of using the computer?
4) Which activities do you think provided the greatest health benefits? Do you think you could do these activities for 30 minutes? Why?
5) Which activity did you enjoy the most? The least?
6) Estimate how much time per day you spend doing things while sitting.
7) Estimate how much time per day you spend doing things that involve moving around.

SECTION 6

HEALTH EDUCATION

1. HIV and AIDS

Reports from World Health Organization (WHO) and Ministry of Health reveal that HIV scourge is higher in developing countries than in developed countries. When someone learns that he/she is HIV positive, it is a devastating experience (very difficult) but with proper counselling, Pre-test and Post-test counselling, one is able to cope with the disease.

HIV is the virus that causes AIDS, whose transmission includes; blood, saliva, breast milk, seminal fluids and vaginal fluids. The four stages of HIV infection are: Window or acute primary stage; incubation stage called Asymptomatic; third Symptomatic and lastly, Full blown. The most commonly used HIV test is known as the Elisa Test.

There are millions of people living with HIV and Aids, mainly in developing countries found in Africa. This is because the rate of new infections is high, as a result of multiple partners, wife inheritance and infidelity (unfaithfulness) among adults. For young people, the HIV menace is spreading faster due to peer pressure, lack of self-control, watching pornography and poor role models.

Myths like HIV and AIDS is caused by witchcraft are stories believed to be true but are not true while misconception is an idea that many people believe due to lack of information and facts.

2. Communicable diseases

Diseases that are easily transmitted or spread from one person to another are known as communicable diseases. Most of these diseases can be controlled through vaccination. These diseases include:

i. Tuberculosis

ii. Malaria

iii. Typhoid

iv. Common cold

v. Measles

vi. Whooping cough

3. Immunization

Immunization is the process of giving special drugs to healthy people to protect them from being infected by certain diseases. A pregnant mother requires vaccines during and after pregnancy to protect herself and safeguard the health of the unborn child, these special drugs are known as vaccines. Some of the immunizable diseases include:

i. Tuberculosis ii. Measles

iii. Poliomyelitis iv. Tetanus

v. Pertussis (whooping cough) vi. Yellow fever

vii. Hepatitis B

viii. Cholera

ix. Typhoid

Exercise

1. What causes HIV?
2. How is HIV transmitted?
3. What causes an increase in the number of new HIV infections among youths in developing nations?
4. What is the meaning of developed nations?
5. What does a communicable disease mean?
6. Give three examples of communicable diseases?

4. Drug and drug abuse

A drug is any substance taken into our body other than food that alters the normal functioning of our body. Drug abuse or misuse of drugs is an epidemic in our society because many people apply self-medication or take drugs for leisure hence become dependent on them therefore leading to addiction. Some examples of commonly abused drugs include:

i. Tobacco

ii. Miraa (khat)

iii. Alcohol

iv. Cocaine

v. Bhang

vi. Mandrax

vii. Heroine

viii. Inhalants such as cobblers glue and petrol.

Effects of drug and substance abuse

There are numerous effects of drug and substance abuse that affect our physical and mental health, economic and social life for young people and adults. These include;

i. Poor performance and class attendance

ii. Failing to complete assignments

iii. Loss of consciousness

iv. Coma and death

v. Poor health of unborn babies

vi. Impaired judgements

vii. Withdrawal symptoms

viii. Lack of concentration

ix. Addiction

x. Truancy/hallucinations

xi. Rape(factual)

xii. Marital conflict

xiii. Drug induced accidents among others.

Remedies to Drug and substance Abuse

1. Early intervention through guidance and counselling
2. Treatment provided at rehabilitation centre
3. Continuous education and awareness on the dangers of drug and substance abuse

Now answer the questions below using information learnt above

1. Name commonly abused substances?
2. List negative consequences of drug and substance abuse on school going children?
3. Who is an addict?
4. Who is an alcoholic?

SECTION 7

WATER

1. Waterborne Diseases

Waterborne diseases are caused by taking contaminated water, inadequate sanitation and poor hygiene. Waterborne diseases include; dysentery, typhoid, cholera and bilharzia. People can contract these diseases when they drink water that contains dangerous microorganisms, including viruses, bacteria, single-celled organisms called protozoa and larger parasites such as worms.
Ways of controlling waterborne diseases through: effective sanitation, drinking treated water and proper personal hygiene.

2. Water Pollution

Water pollution is the presence of harmful substances in water sources. Sources of water are polluted in various ways such as:

i. Release of human/animal waste into water

ii. Use of farm chemicals near water sources

iii. Industrial waste release into water sources

iv. Oil spillage from leaking tankers

v. Acid rain

vi. Floods

3. Water can be conserved in the following ways:

- Harvesting rain water
- Recycling water
- Re-using water
- Using water sparingly
- Mulching and shading
- Constructing dams

4. Types of Soft and Hard Water

Water is mainly classified as hard water or soft water according to its sources. Hard water contains mineral salts that make it difficult to lather easily with soap. Examples of hard water sources are ocean, well, river, sea, dam and borehole. Soft water contains no or little minerals. Examples of soft water are rain water, distilled or boiled water.

Use the information above to do the exercise

1. How can one contract waterborne diseases?
2. How can waterborne diseases be prevented?
3. Name micro-organisms responsible for waterborne diseases?

SECTION 8

FOOD AND NUTRITION

1. Nutritional Deficiency Diseases

These are diseases caused by lack of specific nutrients in the diet. They include:

- Marasmus
- Kwashiorkor
- Rickets
- Anaemia

2. Food Preservation

Food preservation refers to the proper storage of food for future use.

3. Methods/Techniques of Preserving Food

There are two methods of preserving food:

a) Traditional/Ancient /old Method -These include; salting, smoking, use of honey, use of low temperature and drying

b) Modern /Contemporary methods- They include; drying, canning, dehydrating, chilling and Freezing by use of deep freezer and refrigerator.

4. Nutritional Requirement for Special groups

People with special nutritional requirements include infants, expectant mothers, lactating mothers, convalescents, HIV and AIDS Patients, manual workers and the elderly.

5. Food Poisoning

Food poisoning is an illness of the stomach caused by eating contaminated food. There are two main causes of food poisoning. They are chemicals and micro-organisms.

Assessment Questions

1. A person suffering from Marasmus, lacks which nutrients?
2. What diet should an anaemic person feed on?
3. List five contemporary methods of food preservation?
4. A person who recommends special food for people who need special diet is called_____

SECTION 9

ENERGY

1. Energy

Energy is the ability to do work. It is measured in joule units (J). There are two kinds of energy: Potential energy and Kinetic energy.

2. Forms of Energy

There are different forms of energy. These are;

- Chemical energy
- Heat energy
- Light energy
- Sound energy
- Magnetic energy
- electrical energy
- Mechanical energy

3. Methods of heat transfer

i. Conduction - is the transfer of heat through solids.

ii. Convection - is the transfer of heat through liquids and gases.

iii. Radiation - is the transfer of heat through a vacuum.

4. Properties of light

i. Light travels in a straight line

ii. Light can be reflected

iii. Light can be refracted

iv. Light can be dispersed to form a spectrum

5. Forms of Electricity

There are two forms of electricity;

a) Static electricity e.g. lightening

b) Current electricity e.g. generators, dynamos

6. Energy transformation\par

Energy transformation means energy conversion from one form to another.

i. Energy transformation in burning fuels;

Chemical Energy → **Heat Energy** → **Light Energy**

ii. Energy transformation in an electromagnet;

Chemical Energy → **Electrical Energy** → **Magnetic Energy**

iii. Energy Transformation in a simple circuit;

Chemical Energy → **Electrical Energy** → **Heat Energy** → **Light Energy/ par**

7. Energy Conservation

Energy conservation is protecting energy, using resources and managing them well. There are three main methods of conserving energy

i. Using energy sparingly.

ii. Using energy efficient devices e.g.

thermos

flask.

iii. Using renewable sources of energy e.g.

Solar, Biogas, Charcoal, Wind.

8. Properties of Matter

Matter refers to anything that occupies space and has mass. Matter exists in three forms; Solid, liquid or gas.

9. Effect of Heat on matter

When matter is heated, it can evaporate, expand or melt. When the amount of heat is reduced, it can condense, freeze or contract.

a) On Heating

Solid → *Melting Process* → **Liquid** → *Evaporation Process* → **Gas**

b) On Cooling

Gas → *Condensation Process* → **Liquid** → *Freezing Process* → **Solid**

Note: The process by which gas changes to solid directly or vice versa is known as sublimation\par.

10. Composition of Air

Air is a mixture of gases. The table below shows their percentages out of 100%

	GAS	PERCENTAGE %
1	Nitrogen	78%
2	Oxygen	21%
3	Inert Gases	0.97%
4	Carbon Dioxide	0.03%

Exercise

1. Name five forms of energy?
2. Which form of electricity is commonly used in Kenya?
3. Name gases that form the composition of air?

SECTION 10

MIXTURES

A mixture is a combination of two or more substances together. Solids that dissolve in liquids are called solutes. The liquid in which a solute dissolves in is called the solvent. A mixture of a solute and a solvent is known as a solution. Liquids that mix to form one layer are known as miscible. The solution formed is said to be homogenous. Liquids that do not mix at all are called immiscible liquids, such liquids are said to be heterogeneous.

Methods of separating mixtures

Mixture can be separated in the following ways

i. Winnowing

ii. Evaporation

iii. Handpicking

iv. Decanting

v. Sieving

vi. Use of Magnets

vii. Filtering

viii. Distillation

Making Work Easier

Tools or machines make our work easier; some machines that make our work easier include jembe, panga, bottle opener, weighing balance, spring balance and beam balance.

Force

Force is a pull or a push. Force is measured in Newton's using a spring balance. Some examples of force include; Weight, gravity, friction, magnetic and inertia. Friction force helps us to walk, write, erase, skate, brake, light fires and wash clothes. Ways of reducing friction force include; lubricating, using ball bearings, using rollers, streamlining, smoothening and polishing surfaces.

Levers

A lever is a simple machine that has efforts, fulcrum and load positions\par. Levers that have their turning point at the centre include crowbar, claw hammer, lid opener, scissors, pliers and see-saw. Levers that have load at the centre includes: - Wheelbarrow, nutcracker, foot, door & hinges, garlic crasher and bottle opener. Levers that have effort position at the centre include: fishing rod, spade, tongs, and shovel.

Inclined Planes

Inclined planes are also known as slopes. Examples of inclined planes are ladder, staircase, ramp, door steps, winding road, on a hill, screw, vice and clamps.

Single fixed pulley

A pulley is a wheel over which a rope or chain is stretched. A pulley is used for lifting or lowering heavy loads.

Questions

1. A process of combining two or more substances is known as?
2. Identify six ways of separating mixtures?
3. What are levers used for?
4 Which machine is widely used by shopkeepers?

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