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Motivational Techniques and Materials for Teaching High School Science in the City of New Haven

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Introduction

In City Schools, like New Haven, the percentage of Drop-outs in High Schools and Middle Schools are high. One of the many factors that can be attributed to this cause is that the city youths are not “turned on” by traditional academic approach to education by normal, conventional methods of teaching. Most adolescents have their own values and standards with little or negative guidance from parents or guardians, particularly those coming from one parent families. In spite of growing prosperity within a complex society, the postindustrial society demands to prolong the years of formal and generally high standard education. The psychological transformations of adolescents are also affected by the ever-expanding complexity of adult responsibilities (in the home, at work and in the community). Hence, psychologists view that an expanding period is needed to develop the appropriate skills, attitudes and perspectives necessary to become an adult.

Maths and Sciences are dreaded by most students. In order to make these subjects interesting, I have created situations for *Inquiry* and *Enquiry* . Based on Bloom’s Taxonomy, of motivational techniques, my “HO HUM CRASHER” can better be described by the following analogy.

You cannot learn to swim without getting wet. This undisputed fact holds true for scientific, creative, critical and investigative thinking, the process of inquiry. In order to insure that the student gets wet in the liquid of intellectual inquiry, the teacher must lure and lead the students into the swimming pool. The teacher must make sure that the students must do more than just dangle their feet or wiggle their toes in the waters. The teacher may playfully, sneak behind the students, push them in or dive in first and call them to join him/her, pointing out that it is really isn’t so bad. Unfortunately, it is not that easy to get students involve themselves in an intellectual process that is new to them, and once the student gets over the cold, chilling shock of initial plunge, he starts to like it. Thus the student *can* be made to *think.*

The lesson plans are devised by using two domains: COGNITIVE and AFFECTIVE, using the taxonomy of Krathowl and Bloom, (1964). In the Cognitive domain, there is analysis synthesis and evaluation. In the affective domain, there is conceptualization, organization and characterization. Thus in my HO HUM Crasher, (motivational) technique, dogmatic statements are avoided. The teacher must show and tell by way of experiments and demonstrations so that students can see, touch, do a project so that they can remember facts associated with it, for a long time.

Lesson Plans & Classroom Activities:

These plans are developed with “show and tell” activities, experiments, demonstrations or projects. The fields covered to teach are physical sciences, life sciences and earth sciences and chemistry. The topic outline will include: 1) Objective or Problem, 2) Invitation-Capsule Lesson or Technique to get started in class, 3). Stimulation, simulation, experiment, demonstration capsule lesson, 4). Evaluation vocabulary, questions, crossword puzzles, 5). appendices, diagrams & illustrations and 6)bibliography & references.

Teachers’ Philosophy:

When a teacher’s aspirations for himself and his pupils remain dynamic and open-minded, new aims and hopes emerge, and older ones deepen and mature. The really alive teacher continually confronts the challenge of reformulating and enriching his educational objectives. This may be one of the reasons why many of us find teaching so exciting and rewarding. As a concerned teacher, I would have at least achieved my annual goal if I have shaped the student to be his own teacher to survive in this problem filled world. I would also expect and hope that my pupils will know, do and value many things in June that they didn’t (and perhaps couldn’t) know, do or value in September. I hope my other fellow teachers would agree with me in this hopeful expectation.

QUO VADIS!

Capsule Lesson No. 1

Air Pollution and its Effects on Human Lungs

Problem Questions

1). How do you breathe?
2). What parts of your body are involved?
3). What particles go into your lungs?
4). How does pollution affect you?
5). How can you make your lungs healthy and safe?

Objective After the demonstration and instruction of the previous Capsule Lesson, the students should be able to make a model of human lungs out of a one liter plastic bottle, with two balloons and two drinking straws. A sealed rubber sheet at the bottom would act as a diaphragm.
The students should be able to demonstrate and explain:

1). The role of diaphragm, lungs, ribs and air pressure.
2). The bodys ability to breathe depends upon producing different air pressures between the air inside the lung and outside.
3). The diaphragm is a sheet of muscle that stretches across the body and separates the chest cavity from the abdomen.
4). The diaphragm controls the air pressure within the chest cavity.
5). Lowering of the diaphragm causes expansion of the chest which then expands the lungs, thereby decreasing the air pressure in the lungs.
6). The reverse happens when the diaphragm is pushed up making the chest cavity smaller, thereby increasing the air pressure. This will compress the lungs and the air is pushed out.
7) Air Pollution affects the lungs.
8). Smoke, dust, pollen, coal dust, and other harmful particles floating in the air can enter the body when you inhale and thus can cause problems.
9). Understanding of how the lungs work when you breathe (different levels of air pressure) will help students consider and think why on certain days of *inversion* people with respiratory diseases are warned not to venture outdoors.

Evaluation:
Vocabulary

1) Diaphragm
2) Lungs
3) Ribs
4) Air Pressure
5) Air Pollution
6) Anthracosis
7) Black Lung (coal dust)
8) Pollen (allergy)
9) Inversion
10) Respiratory Diseases.

Questions:
How & Why?

1). Describe what happens when you breathe in (inhale) and breathe out (exhale).
2). What kind of materials or particulates are present in polluted air?
3). What is anthracite?
4). Anthracosis is an occupational disease and several people die due to this black lung disease. Where do you think this disease is found and what kind of occupation do you find this disease?
5). What happens when you have an accident and your diaphragm ruptures?

6). What are the poisonous chemicals found in the polluted air and from where did they originate?
7). Name some diseases that affect the lungs?
8) How large or how big are your lungs?

Capsule Lesson No.2

Measuring Tidal Volume-Lung Capacity (Human Lungs)

How to set up an experiment to measure lung capacity

You will need a one-gallon jug or bottle, a large graduated cylinder or a large measuring cup, a two hole rubber stopper to fit the jug, glass tubing (to fit through the holes of the stopper), rubber tubing to fit around the glass tubing, pencil and notebook for record keeping and a graph paper.

Set up the apparatus as shown in Appendix B.

Use bent glass tubes and insert the tubing into the stopper after lubricating the tubes with water or soap solution. It is best to lubricate the holes in the stopper as well. Insert the glass tubes with a very gentle turning motion. Prior to inserting the stopper, fill the jug to about 3/4 of water and slightly color it with safe food color.

Ask one of the students to exhale normally into the rubber tube. The pressure of the exhaled air will force water from the jug into the graduated cylinder. Record how much water passes into the cylinder. This is a measure of the student's *TIDAL VOLUME.* Repeat the experiment for every student in class. You may also want to collect data of measurements by subject group athletes, nonathletes, students of various heights, or ages, smokers or non-smokers, etc. Ask the students to draw a graph and try to plot and pick out the various subject groups mentioned above.

In this activity, the students will focus on one breathing process that they can measure and that may play a role in habitat adaptations like mountain living or high altitudes, several hundreds of feet above sea level. This procedure has to do with how much air is inhaled (or exhaled) with each breath. This measurement is what scientists call as tidal volume.

Unlike total lung capacity, the total space that can be filled in the lungs-tidal volume is a measurement of only that amount of air that ebbs and flows with breathing. This can be compared to measuring the tides of an ocean. The only difference here is that you are not measuring all the water in the ocean but only the water that runs up the beach at high tide and down the beach at low tide.

Scientific Facts That Students May Be Interested

1). It has been found that the lungs of Peruvian Indians who live in the high altitudes of the Andes Mountains hold more air than do the lungs of people who live at sea level.
2). Small animals including rats and mice have more red blood cells than rats and mice that live in the valley or lowlands.
3). When athletes run long distances at high altitudes track coaches have found that the athletes trained at high altitudes run faster than do athletes trained at low altitudes.

Evaluation:
Questions:

1). What do the above three facts have in common?
2). What does adaptation to habitat mean?
3). How can you measure your lung capacity?
4). What is the average tidal volume of all the class?
5). What is the average tidal volume of each of the groups?
6). What is the apparent relationship between tidal volume and "life style" of:
    a) athletes
    b) smokers
    c) students having cold
    d) different ages of students.

Capsule Lesson No. 3

Classroom Activity

How to Test Relative Humidity:

Activities for monitoring Weather and Climate Tests like these can encourage students on the awareness of pollution.

Objective After performing this experiment, the students can demonstrate and explain a simple test of relative humidity on the school grounds, different sections of the school building or different classrooms.
The material needed is Blue Cobalt Chloride Paper (available in most drug stores or chemical supply stores.). This paper can be utilized in making a simple test of relative humidity on the school grounds. Fasten the strips of paper with spring clamp type of clothes pin to various or minutes it takes for the paper to change color from blue to whitish grey or pink.

This technique can be tried by students in a variety of locations such as under a tree, in a hole in the ground, down a sewer opening, under rocks, in the bathroom etc. The students should monitor relative humidity at different times of the day and on different days.

Questions:

1). What is the importance of Relative Humidity?
2). How would you feel when the humidity is high?
3). What should be the ideal or comfortable humidity?

Capsule Lesson No. 4

Class Activity* : *How to measure Wind Speed and Direction:

Objective As the class begins its exploration of Air Pollution, these factors will be better understood and measured by the students.
Measurement of Wind speed can be determined by several classroom-made devices. One of these is a simple pinwheel made from either paper or plastic.

Project The teacher can have the students make four cuts in a sheet of paper or plastic that is 5" square. Each cut should be made so that it moves from one of the four corners and stops just short of the center point of the paper or plastic. The four corners are bent toward the center, and

a pin is pushed through the five holes (one in each corner and one in the center) to form a pin wheel. The pin should be pushed into the eraser end of a pencil or through the side of a drinking straw. One of the pin-wheel blades should be marked so that it will be easy to count the revolutions of the pinwheel. The pinwheel can be calibrated by having the class ride on a school bus.
The driver of the bus can be instructed to drive the bus at five, ten, fifteen and twenty miles per hour.

The number of revolutions of the pinwheel at each successive speed can be measured by the students. They will then be able to estimate the speed of wind by counting the number of turns the pinwheel makes.

Evaluation:
Questions:

1). Why do you think Wind Speed is important in your understanding of Weather?
2). If you look at the Newspaper under the Weather column, what data do you usually see?
3). Other important data from National Weather Service Office in Stratford include temperature, humidity, precipitation, barometer and rainfall. Describe the importance of each one of the data?

Capsule Lesson No 5

Activity: Greenhouse Effect

In order to set up this experiment, you will need a 150 watt, reflector faced, flood light lamp or Infra Red Heater lamp, a lampstand and a glass or thick plastic sheet.

Objective After this activity the students will be able to explain and describe:

1) What a greenhouse effect is;
2) What are the causes of greenhouse effect;
3) What the dangers and concerns are;
4) What should be done to remedy or control this greenhouse effect.

Experiment Attach a 150 watt, reflector faced incandescent lamp or an Infra Red Heater Bulb to a lampstand.
Place the palm of your hand about 10” to 12” above the lamp and switch on the lamp.

Then place a thick sheet of glass or plastic between the lamp and the palm of your hand. Then flash it in and out after every few seconds. You will feel the heat when there is no glass barrier but there is less or no heat when the glass or plastic barrier is held. In other words, the barrier does not emit the thermal infra red rays, acting like or simulates the carbon dioxide shield. This, exactly what happens in the Greenhouse Effect. Imagine the glass or plastic is made of carbon dioxide and water vapor.

Greenhouse Effect or Atmospheric Effect

Discussion This term is given to the trapping of heat energy radiated from the sun. The name derives from the solar warming observed in greenhouses although, in actual tact it is the direct result of trapping warmed air under plastic ceiling or thermal glass window. In solar greenhouses or solar houses where glass is used, the sunlight readily transmits through the glass but impedes thermal radiation, thereby trapping heat in the building. This phenomenon of greenhouse effect can be experienced by you when you left your car in the sun on a cool day and returned to find the car overheated. This is the reason why most architects plan passive solar heating structures and buildings with windows on the Southern side or (in the Southern hemisphere on the northern side), so that a large portion of heating needs are supplied by the sun. Windows on the East, West and North are minimized.

Most if not all substances absorb energy in the form of radiation, convert it into heat and then reradiate the energy. The amount of absorption and reradiation depends on the nature of the substance and the wavelength of radiation. In the atmosphere where we live, the short, visible wavelengths of the electromagnetic spectrum (EMS), are not very much affected but the carbon dioxide and water vapor in the air are absorbed by infra red radiation, (IR). About half of the solar radiation is absorbed by water(oceans and lakes), and land surfaces. These surfaces warm up and emit infra red radiation. The atmosphere in turn warms up and remits IR radiation. That part of the atmosphere's remitted radiation that is directed downward towards the earth is called "counterradiation", which is responsible for the greenhouse effect.

Since there is a continuous exchange of IR between the earth and the atmosphere, the air temperature is higher than normal. This high temperature is further increased by air pollution like burning coal, oil, gas, CO_2, etc. The increase in CO_2 in the air and reradiation over long periods of time upsets the "heat balance".

Scientists and meteorologists note that on a worldwide scale the CO_2 in the air has increased by about 25% in the past 100 years. There is a concern all over, that this increase in temperature due to CO_2 may melt the ice caps, glaciers and ice mountains in the north (Alaska, Greenland etc.), raise the sea level and may drown Long Island, New YOrk, New Jersey and New Haven.

Evaluation:

Vocabulary: Define or use each of the following words in a sentence so as to bring out the meaning of each word:

1). Greenhouse Effect.
2). Infra Red Rays.
3). Thermal Radiation.
4). Passive Solar Heating.
5). Electromagnetic Spectrum.
6). Reradiation
7). Counterradiation.
8). "Heat Balance"
9). CO_2Balance.
10). Wavelength.

Questions

1). What do you understand by the term Greenhouse Effect?
2). How do you think CO_2 is added to the atmosphere constantly?
3). What are the causes of this addition to the atmosphere?
4). What do you think are the dangers involved by this process?
5). It is known that increases in CO_2 increases temperature in atmosphere, causes less rainfall thereby affecting agriculture. Has this anything to do with heat waves, drought and loss of crops and harvest (agriculture) in North Carolina, South Carolina and Georgia during this July/ August of 1986?
6). How can you remedy this problem?
7). Can you suggest solutions so that this kind of problem is not repeated in the future?

Capsule Lesson No. 6

Acid Rain

Objective After this activity, the students will be able to explain and describe:

1). What Acid Rain is and how it is formed;
2). What the sources of this pollution are;
3). What harm is done to animals, plants and the atmosphere including biosphere;
4). What steps should be taken to remedy or control the situation.

Experiment In order to conduct this experiment, you would need a pH meter and two receptacles or glasses to collect the rain water.
The rain falling the first few minutes is most acidic. As the rain falls, it washes the atmospheric air, thereby dissolving most if not all the sulfur compounds, nitrogen compounds, fly ash and other particulates, to form the acid rain. Sulfur oxides mix with water to form sulfuric acid. Nitrogen oxides mix with water to form nitric acid. Carbon dioxides mix with water to form carbonic acid.

First collect the rain water that has been falling for the first five minutes. Next collect the rain water after

thirty minutes, or less, if the rain stops earlier.

Measure the samples of water collected for acidity using a pH meter. The first sample may be between 5.00 to 5.5pH. The second sample of rain water may be 6.5 to 7.00pH, indicating that the first sample is more acidic than the second. You can repeat the experiments three or four times to ensure accuracy by repeating results.

Discussion Sulfur dioxide pollutant causes significant loss in crop yield each year. It originates from burning coal, or oil of high sulfur content. This pollutant is notorious for reducing atmospheric visibility, killing plants and rusting metals, and damage to buildings and paint. You might remember that one of the main cause of damage to the Statue of Liberty during the last 100 years was due to acid rain. Sulfur dioxide is also known to cause irritation of eyes, nose, throat and lungs. Of all the studies that have been conducted, more work has been done on the response of plant life to sulfur dioxide than any other air pollutant.
Nitrogen oxides are formed when burning fuels convert nitrogen and oxygen to nitrogen dioxide. This is an unpleasant smelling brown haze which along with being injurious to vegetation, irritates the eyes and noses of air breathing creatures. Trees and plants injured by air pollution develop symptoms peculiar to the specific symptoms. These symptoms provide a possible basis for diagnosing the types of pollutants that have been present.

Carbon Oxygen Cycle

By way of recycling in the biosphere, materials are used over and over again. In this case *two basic life life processes are involved in the carbon-oxygen cycle* . *These are respiration and photosynthesis.* Both animals and plants respire. Only green plants photosynthesize. During respiration carbon compounds are oxidized, and carbon dioxide (CO_2) is released in the environment. During photosynthesis, green plants take water and CO_2 from the environment and using sun's energy, break down the water molecules. These hydrogen atoms from the water molecules combine with carbon dioxide which the green plants use to form carbohydrates (starch)-food of plants. When this happens, oxygen from water molecules is given off into the atmosphere. The atmosphere normally contains 21% oxygen and 0.04% carbon dioxide. The second role of Carbon-Oxygen Cycle involves the making of organic compounds. Plants make food (carbohydrates) during photosynthesis. Other organic compounds are made from these carbohydrates. Plant-eating animals use these organic compounds to make their own protoplasm. These animals are in turn eaten by other animals. These animals also use the same compounds. All organic compounds contain carbon. When plants and animals die, the organic compounds in them break down. The carbon leaves their decaying bodies as carbon dioxide.

Rock fuels and mineral fuels play a small part in the carbon-oxygen cycle. Millennia ago, in the geologic past, the carbon of plants and animals were stored as coal and petroleum. When these fuels are burned, carbon dioxide is released into the atmosphere.

A diagram of the carbon-oxygen cycle is found in Appendix D.

Evaluation:
Vocabulary: Define or use each of the following words in a sentence so as to bring out the meaning of each word.:

1). Acid Rain
2). Sulfur Compounds
3). Nitrogen Compounds
6). Photosynthesis.
7). Rock fuel
8). Carbon-Oxygen Cycle.

4). pH
5). Fly ash.
9). Millennia.
10). Carbohydrate.

Questions:

1). Explain how Acid Rain is caused.
2). List the various sources of pollutants that contribute to the formation of Acid Rain.
3). What biological effects are caused by the different types of pollutants?
4). Describe and explain with the aid of a diagram, carbon-oxygen cycle.
5). How can you control the various types of pollution?
6). How can you and your friends stop polluting the environment, your home, your class and your school?

(Think about soda bottles, beer cans, candy wraps, ice cream cups, straws, plastic spoons, papers, aluminum foils, plastics, matches, hamburger wraps, paper bags, sticks, paper cups, etc.)

Capsule Lesson No. 7

Water Pollution

Pre-Test Questions

1).What is the difference between Air Pollution and Water Pollution?
2). Can you think of any other forms of pollution?
3). What types of pollutants cause water pollution?

Objective Ask the students to read the three page pamphlet published by the Department of Environmental Protection, 165 Capitol Ave., Hartford, CT 06106, entitled "1984 Housatonic River Fish Monitoring Study." It is a report on PCB levels in several species of fish from the Housatonic river.

After reading the report, the students will be able to:

1). Locate where Housatonic River is on a map of Connecticut:.
2). Explain what PCB is and the levels that are safe and unsafe:
3). Why the DEP and GE conducted this study:
4). What are the original sources of the PCBs that ended as pollutants in the Housatonic River:
5). The polychlorinated biphenyls are a family of stable and persistent chemical compounds manufactured in the U.S. from 1929 to 1977. Are they manufactured after 1977?
6) locate and identify the places and types of fishes studied:
7). Explain what a Fish-Kill is.

Evaluation:

Vocabulary: Use a good dictionary, encyclopedia or reference book from the library to define or use the following words in a sentence so as to bring out the full meaning of the word:

1) coolant
2) capacitor
3) heat exchanger
4) adhesives
5) ppm
6) acceptable level.

Capsule Lesson No. 8

RADIOACTIVITY:

Objective After this activity, the students will be able to explain and describe:

1) What radiation is;
2) What are the effects of radiation to biological organisms;
3) The sources and effects of radioactive pollution from commercial power plants;
4) The radioactive pollution from nuclear weapons production;
5) Radioactive pollution from nuclear warfare.

Activity One of the simplest methods to detect radiation is the DIGI-CHECK Thermo foil. It is an

extremely sensitive liquid crystal that reacts to minimal temperature fluctuations. It is based on scientific insight acquired during research into thermography, during early detection of breast cancer. The thermographic micro-Encapsulated Cholesteric Liquid Crystals (ECLC), disclose by discoloring indicating the presence of malignant tumor.
The blood circulation at your finger tips is controlled by emotional stress, smoking, radiation and other physiological conditions. You can detect your thermal radiation by pressing your thumb on the foil of the plastic DIGI-CHECK for ten seconds. Your immediate level of blood circulation and your emotional condition will be represented by the color of the foil.

In an activated state, the crystals are dark colored. The color ranges from dark-brown to red, green, and blue the last color signifies that you are relaxed and have good circulation. If you have been smoking or very tired, the color would be dark-brown, showing the stressed and crucial condition.

The DIGI-CHECK is very inexpensive and can be obtained from Progressive Enterprises, 145, Elmdale Road, Canterbury, Connecticut 06331. An illustration of the DIGI-CHECK is

Discussion:

Radioactive Effects on Biological Organisms:

Radioactive substances emit either nuclear particles which consist of alpha or beta particles or pure energy radiation like X-rays and Y-rays (gamma rays). These energetic waves cause damage to human tissue when exposed. While travelling through the tissues, these rays rip electrons from the molecules and atoms. This phenomenon leaves the atom and molecules “ionized” or charged electrically. These ionized particles and the ejected electrons can cause death or damage to cells and cell components.

The severity and type of damage depends on what and where the waves strike, the amount of radiation, the exposure time, and the sensitivity of the struck cell.

In living things, (animals and plants), cells form organs, organs form systems and systems comprise the whole body. Radiation damages or kills cells. If most of the cells die, the organ which is made up of these cells will die. (lung, liver, kidney, brain, mammary gland(breast) etc.) If the important organs die (ex. heart, lungs, brain etc) the system dies and the whole organism dies. So it is evident to note that the ultimate consequence of radiation is *death* .

Radiation is measured in *rems.* The lethal dose of radiation when exposed to the whole body is in excess of 1000 rems over a brief period(minutes or hours as it happened in *Hiroshima* and *Nagasaki* , bombings. Even a dose of 500 rems will cause death, if delivered to the whole body at one time., at least in 50% of the cases. Below 500 rems to 100 rems, radiation sickness occurs and some patients will die eventually. At radiations below lOO the effects and consequences are very difficult to detect or predict. In most lower radiation exposures it is mostly cell damage and not cell death. But the damaged cells may replicate and multiply causing complications. It also depends on the sensitivity of the cell. In an ordinary cell tissue like flesh or bone, the damage caused is called “somatic” damage. The most feared somatic damage is the blood cancer or leukemia. If the reproductive cell (testes, sperm, ovum etc.) is damaged, then *mutation* can be caused and this damage is passed on to future generations. Even doses of one rem can cause mutations depending on the latency period and the time between exposure and effect is long.

Radiation Pollution from Commercial Plants:

Nuclear power plants use uranium 235 fuel in the reactor where it fissions and generates heat which is used to produce electricity. The fission products gradually accumulate and thereby affect the chain reaction. The *spent fuel* is then removed and stored under water in large pools near the reactor site.

Other types of radioactive wastes from nuclear reactors are fission product gases (krypton, xenon), filter media left over from treating contaminated cooling and cleaning water, other solid wastes like cleaning paper and protective clothing.

The most serious, health hazard from nuclear wastes is the *uranium mill tailings.* These mill tailings are residues obtained when uranium ore is crushed, ground and chemically processed to produce a compound U308 known as " *yellow cake* ". This operation releases small amounts of radon gas and uranium dust. During the refining process the finely ground tailings are suspended in water. The water gradually seeps and evaporates leaving a dry pile containing radium which decays into radon and other isotopes. The yellow cake conversion produces sludge and other wastes which includes some gas, but mainly radium, some uranium and thorium.

Every one must be aware of the "Three Mile Island" accident, on March 28, 1979, that should not have happened. Human errors, leaks, management problems, proper training and safety valves should be taken care of so that such accidents do not happen in the future. The Chernobyl accident in Russia that happened in 1986 is the worst kind that has ever happened in human history.

Radiation Pollution from Nuclear Weapon Production:

Radioactive wastes from military-related operations producing weapon materials such as tritium and plutonium do also concern many environmentalists. These types of plants have been in operation for more than thirty years. Most of the high-level radioactive wastes are produced as nitric acid solutions of fission products and transuranics.

To store these wastes, large stainless steel tanks are needed. To simplify this costly, storage problems, first they have to be neutralized with sodium hydroxide to permit storage in ordinary steel tanks. Secondly, the dissolved radioactive materials are precipitated and the water was evaporated from the liquid mixtures to reduce the storage volume. As a result of these operations high level radioactive wastes which are in storage now are composed of damp crystallized salt, sludge, and other solutions with a total volume of twenty million gallons.

In operations where there is low level radioactive wastes, contaminated equipment, hardware like valves, pipes, reactor fittings, tanks, pumps, contaminated oil, mercury, cloth, papers and plastics, are buried in shallow-earth burial grounds on the plant site 2O' wide and 2O' deep, well above the mean water table depth of 45'. Some of the wastes are packaged in concrete materials. The solid waste area is monitored by a system of wells and boreholes. On the basis of volume, military wastes are much larger than commercial wastes because the military wastes are in aqueous form and the latter is in the form of spent fuel. Other forms of radioactive wastes come from military-related operations like plutonium production, nuclear detonations, naval reactors, submarine production,missiles and other defence weapons.

Radiation Pollution from Nuclear Warfare:

Albert Einstein once said that the unleashed power of the atom has changed everything except our way of thinking. There are many concerned people who fear that one nuclear war will put us back to the stone age

and you have no second chance to correct the mistake. They go all the way out to exhibit and inform people about the effects and dangers of nuclear war, and to arouse the public to assess the value of a growing nuclear arsenal as the basis of our security. We are the most powerful nation in the world, yet we can be destroyed with less than 30 minutes warning; so can the Russians. Either we have to learn to live with the Russians or we will both die at about the same time.

When the atom bombs were dropped at Hiroshima and Nagasaki on August 6, & 9, 1945, the complete destruction of the two cities was caused by light and heat which ignited everything combustible, followed by shattering shock wave. Then numerous fires raged out of control raising air temperature to about 2000 degrees fahrenheit. The thermal effects of nuclear explosions are very drastic and very destructive. A nuclear explosion releases enormous energy within a millionth of a second. The temperature rises to 15-20,000 times that of the temperature of the sun's surface. The fire ball that touches the ground evaporates everything including concrete, steel and rock. There are many burned victims from those bomb blasts who are living today after having plastic surgery.

People may receive doses to the whole body from penetrating radiation, or to specific internal organs from drinking water or eating food which is contaminated from fallout or by breathing contaminated air. During the Bikini bomb test on March 3lst, 1954, a girl had beta-particle burns, twenty nine days after the fallout, even though she was 100 miles away from the bomb blast. When genetic cells from the reproductive system are damaged, mutation or cancer may result and affect many generations to come.

Evaluation:
Vocabulary: Pick out the important vocabulary words, list them down, and write a sentence that brings out the full meaning of the word.

Questions

1). What are the various radioactive effects on biological organisms?
2). What are the units by which radiation is measured?
3) What do you think is the most serious form of radiation?
4) List the different types of radiation pollution from commercial power plants.
5) Write a report of "the three mile island" and "the Chernobyl incident". You can ask the librarian to help you find the proper references. Suggest your own solutions to prevent such accidents in the future.
6) What are the dangers of nuclear war?

APPENDIX A.

Model of HUman Lungs
(figure available in print form)

APPENDIX B

MEASURING TIDAL VOLUME-LUNG CAPACITY
(figure available in print form)

APPENDIX C

Air Pollution Crossword Puzzle:

Circle the following words in this puzzle. The words are located either down, across or diagonally.

1) Alpha	7) Radiation	13) Oil
2) Beta	8) Detector	14) Ozone
3) Gamma	9) Fusion	15) Solar
4) Pollution	10) Rain	16) Carbon
5) Fission	11) Acid	17) 0xygen.
6) BTU	12) Coal	

(figure available in print form)

APPENDIX D.

CARBON-OXYGEN CYCLE:
(figure available in print form)

APPENDIX E

Shown below is an illustration of DIGI-CHECK card

which has a foil of thermographic micro-encapsulated cholesteric liquid crystals.

(figure available in print form)

APPENDIX F

Air Pollution Effects on the Human Body:
(figure available in print form)
Air Pollution can be a contributing factor to chronic bronchitis, emphysema, and lung cancer. It can also increase the discomfort of those suffering from allergies the common cold, pneumonia, and bronchial asthma.

The major pollutants of air pollution are: 1) Sulfur oxide, 2) Nitrogen oxide, 3) Hydrocarbons, 4) Particulates, 5) Photochemical smog, 6) Carbon monoxide, 7) Metals, 8) Fluorides and 9) Radioactivity.

ANNOTATED BIBLIOGRAPHY

1). B1oom, B. S.; Taxonomy of Educational Objectives Handbook-1; Cognitive Domain (1956), David McKay Co., New York. 207 pages along with Kratwohl; Affective Domain, Handbook-II.

Surveys the classification of educational goals and objectives, evaluations etc., by a committee of college and university examiners.

2). Connecticut Department of Environmental Protection, 1984 Housatonic River Fish Monitoring Study, Hartford,CT.

Gives a report on PCB levels in several species of fish from the Housatonic River. This study was conducted under an agreement with General Electric and Dept. of Environmental Protection.

3). Cotton, A., Lynch, L; Chemistry-An Investigative Approach (1970), Houghton Mifflin, New York.

Gives a good handle on how to teach chemistry with interesting experiments that call for investigation with inquisitive mind.

4). Joseph, A., Brandwein, P. F., Morholt, E., Castka, J. A. A Source Book of Physical Sciences; Harcourt,Brace & World Inc., New York.

Contains ample resources, experiments and capsule lessons and different interesting ways to get started in class.

5). Massen, J. B.; Effects and Dangers of Nuclear War (1978), Daly City, CA.

A good educational exhibit outlaying the facts of Hiroshima & Nagasaki bombings and Bikini Island bomb explosions. It also gives the tragic effects of thermo nuclear scars in both lives and properties.

6). Mayer, W. V., Biology Teachers' Handbook (1978), John Wiley & Sons, New York.

Gives useful hints for teaching biology.

7). Miller, J. E., The Green house Effect, Encyclopedia Americana.

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8). Morholt, E., Brandein, P. & Joseph, A.; A Source Book of Biological Sciences (1966), Harcourt, Brace & Jovanovich New York.

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Approach to modern biology by way of pacing guide to meet today's student needs. The individual curriculum needs can be structured by a minimal course, an average course an enriched course or a multilevel course.

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Gives several experiments, discussions and projects that could be done by students so that they can understand present day pollution problems.

11).Ruedisili, L. C., Firebaugh, M. W.; Perspectives on Energy, (1982); Oxford University Press, New York.

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Booklet describes the micro encapsulated cholesteric liquid crystals that disclose color changes by reacting to thermographic radiation at the finger tips. The extremely sensitive liquid crystal is in the form of foil.

13) Scarfo, R. G.; P.O. Box 217, Thorndyke, PA. Air Pollution Charts.

These charts and posters are good for displaying in classroom walls.

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This article gives a very in-depth understanding of the greenhouse effect and the role of CO2 shield that traps the infra red rays, thereby causing changes in the climate, crop failures, drought, drier climates, warm and hot weather and several indirect effects.

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