The sets of instructional materials presented in this volume were designed to call into the learning situation the most highly developed cognitive aptitudes of individual students. The assumption behind their design was that learning difficulties in various subject-matter areas could be minimized by altering the content of textual material to fit the individual's aptitude pattern. Four sets of data are included—(1) materials for redundancy studies (redundancy in textual materials), (2) learning materials and tests for studies of elementary set concepts, (3) materials and tests for vocabulary learning studies, and (4) learning materials for mathematical operations studies. Related information may be found in ED 010 627. (JH)
IDENTIFICATION AND DEFINITION OF SUBJECT-MATTER CONTENT VARIABLES RELATED TO HUMAN APTITUDES

Volume II

January 1967

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

Office of Education

Bureau of Research
THE FINAL MOLECULES

In the previous sections we previewed two types of action by which energy released: 1, the taking of the molecule's carbon, and 2, the removal passing of hydrogens. Where the process end? What the final molecules?

The products of energy release mainly on the enzymes in the cells. And, you will recall, depend on heredity. Organisms tend to in habitats where their have the right, kinds substrate molecules to work. Streptococcus lactis, for example, a bacterium with enzymes convert the sugar lactose lactic acid. Lactose is sugar of milk. When microbe grows in milk, lactic acid causes the of curds, and the becomes sour. Man cultivates bacterium and others whose products are responsible for flavors of various cheeses. closely related microbe works the glucose molecule, degrading to lactic acid. It this glucose, along with essentials for living, in rumen of the cow. we call it Streptococcus. When the enzymes of cells attack glucose, the depends on whether or oxygen is available. Without , the end products are dioxide and ethyl alcohol. yield of energy from fermentation process is extremely . It takes less than percent of the sugar's of energy. Also, because damages plasma membranes, dehydrates , and has other disorganizing , yeast cells are sometimes
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INSTRUCTIONS

This is a reading comprehension test of a new kind. It may be unfamiliar to you, so be sure that you understand this explanation.

In general, you are to read the attached materials as well as you can; try to make sense out of what you see despite the missing words. Every time you come to a blank, try to put back the word you think has been left out. It may be helpful to scan the passage quickly before attempting to fill in the blanks.

If you received:
" Bond's number is 007." You might guess "James." You should then write that word in the blank.

Here is a more difficult example.
"________ corebrum is the large ________ portion of the brain ________ makes up about ________ of the brain's total ________."

The sentence makes sense if you insert: "The," "upper," "and," "four-fifths," and "weight."

Notice that only one word goes in each blank, and that all blanks are of the same length. The length of a blank then, is no indication at all of the size of the missing word.

Every fifth word has been deleted from the attached materials. The deleted words may have been abbreviations, hyphenated words, numbers, or any other kind of word.

Some blanks will be easy to fill in. Others will be difficult, and still others may seem impossible. But don't be afraid to guess. You are urged to guess, and it will be to your advantage to do so. Leaving a blank unfilled counts off just as much as guessing the wrong word for it.

Try to finish each test in about ten minutes. If you make any changes, be sure to erase or scratch out your first guess.

Before you begin, fill in the blanks at the top of this sheet.
THE FINAL MOLECULES

In the previous sections we previewed two types of energy released: 1, the taking of the molecule's carbon, and 2, the removal passing of hydrogens. Where does this process end? What are the final molecules?

The main products of energy release depend mainly on the enzymes in the cells. And, you will recall, depend in habitats where their have the right, kinds substrate molecules to work. Streptococcus lactis, for example, a bacterium with enzymes convert the sugar lactose lactic acid. Lactose is sugar of milk. When microbe grows in milk, lactic acid causes the of curds, and the becomes sour. Man cultivates bacterium and others whose products are responsible for flavors of various cheeses. closely related microbe works the glucose molecule, degrading to lactic acid. It this glucose, along with essentials for living, in rumen of the cow. we call it Streptococcus. When the enzymes of attack glucose, the depends on whether or oxygen is available. Without the end products are dioxide and ethyl alcohol. yield of energy from fermentation process is extremely . It takes less than percent of the sugar's of energy. Also, because damages plasma membranes, dehydrates , and has other disorganizing , yeast cells are sometimes.
WATER IS AN ESSENTIAL FOR LIFE

You weigh 120 pounds could be thoroughly "dried" or dehydrated, your weight shrink to about 40. About 2/3 of the water of the human body due to its water. Oranges, tomatoes, melons and like may contain 90 or more water by dehydration. Milk contains around 88 water and meat about percent. These and other are sometimes prepared for and shipment by dehydrating. When 100 lb. of are shredded and dried the dehydrated product is compressed in a hydraulic about one-eighth the original and occupy less than the original volume. Milk, course, must be dried such a manner as to scald the liquid scorch the solid content. calls for evaporating away water in a partial manner. This scheme works because liquids evaporate faster or at a lower temperature the opposing atmospheric pressure reduced. For example, the point of water can reduced from 212°F. 122°F. by decreasing opposing pressure from 760 to 92 mm.

The that dehydrated foods can preserved for long periods time without spoiling shows bacteria and molds also water. These organisms can drying for indefinite lengths time, but they need in order to thrive multiply. The preservation of and meats by drying been practiced throughout the
WHEN WILL YOUR CASE BE TRIED?

We assume that on ______ afternoon you are driving _______ car on a "through" _______ with your mother as ________ passenger. You are driving _______ a safe speed and _______ pavement is dry. At ________ intersection a car driven _______ fast fails to stop ________ as you reach there. _______ efforts to avoid a _______ are useless; the recklessly _______ car smashes into you. _______ addition to other injuries, _______ mother's hip is broken _______ your car is wrecked. _______ weeks later your father _______ that the accident will _______ him about $6,000 in _______ surgical and hospital treatment _______ your mother, buying a _______ car, and hiring help _______ home while your mother _______ convalescing. He has to _______ money to meet the _______. The reckless driver and _______ insurance company either refuse _______ pay anything to your _______ or offer a settlement _______ small that he does _______ want to take it. _______, he secures a lawyer _______ files suit for the _______.

When will the case _______ tried? When will your _______ be able to repay _______ money he has borrowed? _______ it be one month? _______ months?

or when?

In _______ parts of the country _______ will be two to _______ years before the case _______ be tried!

This delay _______ a glaring defect in _______ administration of justice. Delay _______ justice often leads to _______. Yet large backlogs of _______ jam the dockets in _______ all courts.

In 1959 _______ parents of some children
THE ROLE OF THE LEAGUE OF NATIONS

Because of the insistence of President __________, the Covenant, or constitution, __________ the League of Nations __________ made part of the __________ peace settlement. The new __________ was entrusted with carrying __________ various provisions of the __________ treaties and could even __________ changes in the __________ treaties __________. It was also supposed __________ lead the way in __________ armaments and in ending __________ diplomacy. However, the most __________ task assigned to the __________ was the peaceful __________ settlement __________ international disputes.

Any war, __________ or war, or other __________ disturbing to international peace __________ be brought before the __________ of Nations. The League __________ then hold hearings and __________ some peaceful method for __________ the dispute. If one __________ the parties to the __________ resorted to war __________ of the League's decision, __________ might be voted. The __________ could be formally condemned __________ an aggressor, in the __________ that unfavorable world __________ compelled it to behave __________. If __________ necessary, the League __________ ask its members to __________ off all trade with __________ offending __________. As a __________ resort, it could request __________ members to use armed __________ to stop the __________.

Machinery of the League __________ carry out its __________, __________ League of Nations had __________ main organs—the Assembly, __________ Council, and the __________ Secretariat. __________ Assembly was composed of __________ from all of the __________ nations. (At the __________ League's __________, these totaled fifty-eight.) Each __________, large or small, was __________ as equal and __________ single vote. The Assembly

A-6
ProtoPlasm

Plant cell or animal is almost entirely composed of a substance called protoplasm. You can perhaps learn little about protoplasm by the protozoans on your . You may observe that protoplasm is almost transparent. You may also observe that is slightly gray or . Scientists have found that is somewhat like watery or the white of egg. You are not , however, to be able discover this fact from observations.

Protoplasm is living . In fact, so far we know, it is only living material that . When a plant or an animal dies, that was protoplasm before its is no longer so. has changed in some not yet understood. The that fills the cells looks for a time as it did before organism died. Also, as as scientists have yet able to discover, it the same chemical composition the same weight before immediately after death. Yet is different, because it longer has whatever it that made it alive.

Protoplasm of one living looks like the protoplasm every other living thing. samples of protoplasm from organisms, or even from parts of the same , are never exactly alike. of a dog is from that of a . That in your hand not quite like that your foot. Moreover, the
THE PHYSICAL PROPERTIES OF WATER

In ordinary temperatures, water is colorless, transparent liquid. In pure state it is tasteless. Any taste noticed is due to minerals and other impurities. Since these vary from location to another, the taste of water varies also. Water freezes at 0°C and, at sea level, boils at 100°C. The boiling point, however, will change with the pressure changes. In higher altitudes, the boiling point of water is somewhat lower than 100°C.

Water is an excellent solvent. Water dissolve more substances than any other liquid on Earth. This property is an important factor in the erosion of the earth's surface. Some substances in the crust dissolve in rain, streams, or in marsh water. The resulting solutions are washed into lakes or oceans. Finely ground fragments of sandstone rock are carried by the water and sand.

The minerals dissolved in water are taken in plants and are used to take new tissue. Food dissolved in water is carried throughout all parts of the plant. In the body the blood stream, largely water, transports to every cell in the human body.

Water is an important solvent used in laboratories and industrial plants. It is used in larger quantities than any other chemical.

Water expands when it freezes. Water is one of the few substances that expand when they freeze; most substances or shrink. When water
THE EARLY JAPANESE PEOPLE

Factors have played a role in Japan's long . The basic factor influencing history and development in times was her isolation the mainland of Asia, as you know, she a country of islands. Factor helped to keep from being annexed to empire, but the two were so close geographically Chinese culture was able span the East China and the Japan Sea influence the civilization of .

The Japanese are a race. The available evidence the belief that in times immigrants came from mainland and from Borneo, and the Philippines. During Chou Dynasty (c.1123-256 B.C.) many groups of migrated to Japan. During Han Dynasty (202 B. -220 A.D.), Korea under Chinese Rule. After , Chinese and Korean weavers, , and Farmers brought their and culture to the . Thus began the raising silkworms. Chinese medicine and Chinese calendar were introduced.

Scribes brought to Japan language, the writing, and literature of China. The adapted the Chinese language their own way of images and ideas and much of the Chinese. Much later they developed system of phonetic writing simplified the Chinese characters made it easier to them in writing Japanese. step stimulated the growth a native Japanese literature.

Classify the Japanese people Mongoloid, but some scholars
we think about elections usually picture exciting national fighting speeches watched by of televiwers, political caravans the nation in a of publicity. But not campaigns for national office like this. A candidate Congress often finds that campaign means a lot dull legwork and exhausting of speeches to small arena, "When you get away the national arena," Pearson Allen have written, "political gets right back to old horse-and-buggy days... What counts is the all-important of personal contract." How member of Congress wins is important; watching him a campaigner helps us him as a congressman. us look at the--but rather typical--case John Smith, aspirant to

Why does Mr. Smith to run for Congress the first place? Obviously wants to be a--but so do many people. In Mr. Smith's, his decision is not not sure that this be a good year his party. A campaign mean practically deserting his practice for three or months. It will cost . On the other hand, thinks he can win. has served as district and state senator, and feels ready for bigger . And, he reflects, a campaigning might help advertise law practice even if shouldn't win. So Mr.
WHAT WAS THE PLACE
OF THE CHURCH IN THE MIDDLE AGES?

Bernard trudged along the forest road, his long _ of coarse brown cloth
in the brisk autumn __ . Sandal-
shod, he unconsciously avoided __ deep puddles
as his __ body, toughened by years __
tramping in all sorts __ weather, pressed onward. Father __________ was a friar, a ______
priest whose life was ______ to the service of
_________ and man.

Father Bernard's _______ were as accustomed
to ______ for a sick person _______ holding a
plow in _______ furrow as they were ______
turning the pages of _______ prayer book and to
_________ the sign of the _________. For this man
was _______ only a priest; he _______ a doctor,
teacher, bringer _______ news, and good friend
to shut-away people in _______ villages
and to poor _______ in the towns. In _______ for his services, Father _______ asked nothing but
plain _______ and a place in _______ to sleep.

St. Francis __________ St. Dominic founded
organizations _______ friars. Father Bernard's
brown ______ marked him as a ______ (fran-sis'k'n) friar, a follower ______ St. Francis
of Assisi (_________). St. Francis is one ______
the noblest and most ______ characters, not only
of _______ Middle Ages but of _______ time. Born
into a ______ family, as a young _______ he
turned from a ______ of aimless pleasure to
of poverty, self-denial, and ______. Soon Francis gathered about ______ a small band
of _______ followers who adopted his ______
and way of life. _______ went about preaching and
THE JUDICIARY AND THE LAW

speaking, the judiciary branch
out its functions of in two
different ways. it determines the guilt
innocence of persons accused
government of violating ordinances
breaking laws; that is, courts make
decisions regarding and crimes. Petty
violations, as illegal parking, are
as offenses and carry light
penalties--small fines, of license, some
hours days in jail for violations. There are two of criminal
lawbreaking: Misdemeanors felonies.
Misdemeanors are petty (larceny),
disorderly conduct, or . They are
punished by fines or brief jail .
Felonies are more serious such as robbery
(grand ), arson, and homicide in
first, second, and third . The punishments
for these heavier--long prison sentences
even death.

The second function is to judge
between citizens, groups of ,
or citizens and their . These cases are
called . Civil actions in court
claims for wrongful injury person or
property, or restitution of money or
lost by reason of , or for harm
caused failure to perform a
If a person claims has been damaged (he
or she the plaintiff), the court
either agree, and require (the person
accused of the damage) to pay
certain sum, or decide defendant's favor,
requiring plaintiff pay court costs. In
where a person anticipates to his property, for by somebody else's
intended
THE MASS OF AN ATOM AND ITS PARTS

are in the nucleus electrons surround it. Most the mass of the is in the nucleus. two statements imply that electron weighs far less a proton; this is case. Experiments have been in which individual electrons protons have been weighed. experiments show that the of the electron is than that of a by a factor of.

This means that most the mass of the must be furnished by nucleus. However, the mass the nucleus is not by the number of alone. For example, a nucleus has two protons a hydrogen nucleus has proton. Yet a helium is measured to be times heavier than a atom. What can be composition of the helium? A partial answer to problem was obtained when third particle, the neutron, discovered. The neutron carries charge; it is a particle. Its mass is identical to the mass the proton. Thus the of the helium atom consist of two neutrons two protons. Then its will be 2+ but mass will be four the mass of the atom.

Now our nuclear suffices. We can build the atoms for all. Each atom has a consisting of protons and all of the nuclear and part of the
AGRICULTURE AND THE RISE OF CIVILIZATION

Communities, with houses, public communities, with houses, public

governments, laws, and written communities, with houses, public
could not arise until ________ had solved the problem governments, laws, and written
could not arise until ________ had solved the problem
staying in one place. ________ stayed in one place. ________ stayed in one place.

Agriculture was, and is, ________ for civilization. Agriculture was, and is, ________ for civilization.

A second ________ for civilization is organization ________ division of labor. According ________
all of our records, ________ first organizations all of our records, ________ first organizations
of this ________ began under the direction of ________ of this ________ began under the direction of ________
a powerful leader. One ________ of gaining power over ________ men was by owning ________.

Hence, when land became ________ source of food through ________, the head of a ________ family could
marry his ________ and daughters into other ________ families, so that his ________ or most
aggressive son ________ control more property, and ________ on. Fathers or leaders ________ large
families thus became ________ "kings." About these ________ gained power, "kings." About these
rulers ________ grouped soldiers, priests, tradesmen, ________ and others. By conquering ________
people, they acquired large ________ of slaves who ________ of slaves who
built ________ palaces, temples, and pyramids. ________ of slaves who
this way were born ________ first great ________ this way were born ________ first great
civilizations, in ________ Mesopotamia, and the ________ Mesopotamia, and the
Indus ________ of western India. ________ of western India.

You ________ see from this brief ________ of man's rise that ________ change from the savage, ________
______ of time needed for ________ to evolve ________ of time needed for ________ to evolve
modern ________ ancestors. Furthermore, if we ________ in order the various ________ that gave
man ________ control over nature, we ________ they have been made
TAKING RESPONSIBILITY FOR GOVERNING

The party in office _________ held responsible by the _________ for running the government for the achievement of _________ party's program. If a _________ President and Congress have _________ elected, they are considered _________ for laws passed and _________ taken, even though many _________ these laws and actions _________ have been supported by _________ Republicans. Thus, the Democrats _________ the praise and blame (______ on the point of _________) for the New and _________ Deal programs. The Republican _________ Congress and President Eisenhower _________ held responsible for legislation, _________ though much of President _________ program was supported by _________ Democrats.

Not infrequently, however, _________ legislative and executive branches _________ government are controlled by _________ parties. This was the _________ during two years of _________ Truman administration and during _________ of Eisenhower's _________ years _________ the White House. Divided _________ is found even more _________ the state level.

For _________ person who prefers things _________ remain pretty much as _________ are, believing that governmental _________ is generally better than _________ new programs, the matter _________ divided responsibility may be _________ virtue. At least one's _________ party can veto the _________ action which the opposing _________ might take. Many political _________, however, decry divided responsibility. _________ contend that voters elect _________ to carry out programs _________ will meet society's needs. _________ required action is costly _________ Frustrating. Part of the _________ to the problem of _________ responsibility lies in educating _________ to the folly of _________ an executive of one _________

A-15
BUILDING PROTEIN MOLECULES

The DNA and RNA _______ a cell are closely _______. We have already seen _______ the structure of RNA _______ similar to that of _______. What else do biologists _______ about RNA? All cells _______ have been examined contain _______, but some cells contain _______ more than others. Those _______ with much RNA carry _______ much protein synthesis. The _______ in higher animals that _______ digestive enzymes, for instance, _______ large quantities of prote’n. _______ amounts of RNA are _______ in the cells of _______ organs. Certain glands of silkworm also contain striking _______ of RNA, and these _______ the glands that produce protein, silk. For these _______ it is thought that _______ plays an important role _______ protein synthesis.

The preceding _______ of this chapter described _______ biochemists were able to _______ the biological code contained _______ RNA. How are the _______ abilities of RNA related _______ the DNA of the _______?

Biologists believe that the _______ instructions to the cell _______ coded in the DNA _______ the nucleus. Although DNA _______ the library of instructions, _______ cannot act directly in _______ many chemical reactions of _______ cell. There is a _______ simple reason for thinking _______ this is so. In _______ cells the DNA is _______ in the nucleus, whereas _______ cell activities occur in _______ cytoplasm. DNA must therefore _______ indirectly in most cells.

The instructions coded in _______ must be carried into _______ cytoplasm where the work _______ the cell actually goes _______. 
THE STRUCTURE OF THE ATOM

For almost three quarters of a century, scientists have accumulating evidence about the structure of atoms. Some of the evidence has come from study of radioactive elements, radium and uranium. The X-ray tube, and modern electric devices for the structure of atoms given additional information. At present time, scientists recognize atoms are not simple particles. Instead, they are to be composed of different kinds of still particles arranged in a complex way.

An atom of two main parts. positively charged central part called the nucleus. It is very small and very. Its diameter is about cm, or 102 A. is about one one-hundred-thousandth the diameter of the itself, since atoms range 1A to 5 in diameter.

Negatively charged, called electrons, move about nucleus in more or definite regions called shells energy levels. About 1913 Danish scientist Niels Bohr pictured the movement of about the nucleus of atom as similar to rotation of the planets the sun. However, the of the electrons are known to be much definite than the orbits the planets. Electrons move the nucleus of an much as bees move in the area near hive. Sometimes the electrons are farther away. By seemingly haphazard motion the
PETER'S REFORMS

The reforms that Peter Great believed in and to introduce changed the of Russian history. To for himself what Europe like he journeyed there person, and hired shipbuilders, weavers, and other skilled to come to Russia. he was away some his regiments at Moscow, and on his return punished the rebels mercilessly, and killing hundreds of. Throughout his reign he to fight resistance and . The clergy of the Orthodox Church opposed the he made and denounced for employing "heretics" from Protestant countries. Reports among the Russian people he was the great "Antichrist, foretold in Book of Revelation. When learned that his own had plotted against he had Alexius flogged death. Nothing could turn from his relentless purpose.

plans to expand the frontiers to the Baltic the Black Sea involved in wars with the and the Turks. The were famous soldiers with weapons, and at first, their daring young king, XII, they defeated the easily. Peter was not . "I know well that Swedes will beat us a long time," he, "but, at last, they teach us how to." He was right. His with Sweden, the Great War, dragged on for years. In 1708 Charles Russia with his Swedish
THE UNITED STATES MOVES TOWARD WAR

The outbreak of the war in Europe most Americans went with Great Britain and . They believed that Germany be defeated and that United States should stay of the struggle. Isolationist was still strong. As won victory after victory, changed their attitude. In 1939, Congress amended the Act to permit belligerent to buy munitions on cash-and-carry basis. The change Britain and France, since needed our munitions. The of France made Americans the importance of Great to the defense of Western Hemisphere. Hence the States decided to give all aid "short of ." In September, 1940, our transferred fifty over-age destroyers Great Britain in return the use of naval air base sites in , British Guiana, and the Indies. When England no had money to pay imports, Congress passed the Act (March, 1941), which for "lending" war supplies Britain and other countries were fighting the Axis. American Navy began to British ships part way the Atlantic. The United took control of Greenland Iceland with the approval the Danish government-in-exile. By summer, the United States was convoysing British merchant as far as Iceland. November, 1941, Congress said the lend-lease supplies could delivered in American ships.

acting as the "arsenal democracy," the United States to its own defenses.
THE ENERGY OF THE CELL

As we have said, its work by chemical... We have also said... the power to carry... this work comes from... energy. The most important... which supplies this chemical... to cells is glucose. Is broken down in... process of respiration.

If... is simply burned up, will give off heat, this heat could not... used to do the work. Instead, the cell... apart the glucose molecule... step at a time... glucose molecule has six atoms in it. During... it is changed to... kind of molecule after... until it ends up... molecules with only one atom in them. These... carbon dioxide molecules (CO₂).

Time one of these... is changed into another, is released. This energy... now allowed to escape heat. Instead the energy... used to build up... special phosphorus compound called... its initials ATP. Later... energy stored in the... can be used whenever... is needed to do... work of the cell. Of ATP as the... carrier of the cell. Carbon and hydrogen in... glucose are gotten rid... by combining them with... This means that the... products of glucose respiration... carbon dioxide and water. Is needed in the... but carbon dioxide is... waste and must be... Some cells do not... oxygen at all. They...
Second World War began September, 1939, with the invasion of Poland. At the time Germany was ruled a dictator, Adolf Hitler, a man who had risen to power in 1933. The German government established after the First World War had not succeeded well in giving Germany prosperity the people had hoped for. The depression which had begun in 1929 had brought confusion, and hardship. Hitler, the head of his party, promised to bring prosperity. He had also promised to overcome the evils which had been perpetrated upon Germany by the Treaty of Versailles. Hitler had remilitarized the Rhineland, overrun Austria, and occupied Czechoslovakia. Poland was next on his timetable.

In Italy was a dictator, Benito Mussolini. He had risen to power in 1922. Just as Hitler had his own political party, so had his, the Fascist party. The two dictators in 1936 made an alliance which was called the Rome-Berlin Axis. The same methods of the two dictators were much the same. Both built up their military forces and threatened their neighbors. Both took away the autonomy of their people. They restrained the organization of labor and of rival political parties. They built up propaganda to control the ideas of their people. And they both looked to conquest and to building.

Italy joined Germany in the war at the same time France was retreating before
PROTEINS IN VEGETABLES

Proteins in vegetables are important to some people, especially vegetarians, and so we must know of any changes that occur in the proteins of vegetables when they are cooked. You have already learned that protein compounds differ widely in properties. Because of this, they are affected differently by heating. Some of the proteins are soluble in water and therefore dissolve in the liquid in which the vegetables are cooked. Some proteins are heat, either in the cells of the vegetable or in the water in which they are dissolved. This coagulation of the proteins by heat is important to remember, for most kinds of proteins are affected in different manner. The cooking of vegetable foods is complicated because they are generally mixed with other nutrients that require different methods to make them ready for digestion. For example, the foods which contain protein, such as wheat flour, corn, and peas, also contain a large proportion of starch. We have learned that proteins are made soluble by certain methods, and thus are more easily digested. Then how are vegetable foods to be cooked? The guiding principle should be that vegetables containing both nutrients should not be cooked too long.

Also, it is important to cook them in water that is relatively soft. Hard water contains calcium and magnesium salts which unite the protein called legumin in the form insoluble compounds that are very difficult to digest.

These principles are adhered to in practice.
STOCK EXCHANGES

It was easy to ________ purchasers for the shares ________ joint-stock companies after they ________ paid handsome profits, but ________ was always a risk ________ be taken with new ________. Many joint-
stock companies did ________ make the great profits ________ of them. Many companies ________ in 
bankruptcy. The value ________ shares in joint-
stock companies, ________, varied a good deal.

______ people with money made ________ business of trying to ________ shares when they were ________ and sell them when ________ went up in 
price. ________ of shares was done ________ certain places called stock ________. The man who 
wished ________ sell could almost always ________ someone at the exchange ________ was willing to buy. 
______ were split into small ________, so that 
even landlords ________, small shopkeepers who knew ________ of foreign trade were ________ to invest 
their savings ________ shares of stock. The 
______ with which shares in ________ joint-
stock companies could be ________ or sold on the 
______ exchange helped merchants obtain ________ capital needed for oceanic ________.

Indeed, it became too ________ to sell stock. 
Because ________ the large profits paid ________ a few concerns such ________ the British East India 
______ , the price of their ________ rose rapidly 
in London ________ before 1720. People began ________ buy all kinds of ________ in hope of 
selling ________ at a higher price. 
company was started to ________ people against 
death from ________ drinking, and one "for ________ 
undertaking which shall in ________ course be 
revealed," the ________
DRUGS AGAINST DISEASE

For thousands of years, _____ has used drugs in ____ attempt to cure infectious _____. Most of these drugs _______ mixtures of wild plants _______ few were of any _______. It is difficult to _______ a drug that will _______ microbes in the living _______. If it can kill _______, the drug is usually _______ strong that it will _______ kill the cells of _______ body.

Scientists struggled with _______ difficult problem of finding _______ drugs for many years, _______ at first they had _______ little success. One chemist, _______ 505 attempts, discovered a _______ that would act against _______ germs of syphilis in _______ body. A number of _______ drugs were developed to _______ the one-celled animals that _______ human diseases. These drugs _______ very valuable, although sometimes _______ had harmful effects on _______ body cells.

It was _______ until 1932 that a _______ useful drug for destroying _______ inside the body was _______. A German chemist developed _______ red dye that would _______ germs in the bodies _______ animals without harming the _______ themselves. He had not _______ his experiments when he _______ told that his own _______ was seriously ill. Bacteria _______ entered her blood stream _______ the doctors could do _______ to save her. The _______ gave her a large _______ of the red dye _______ in a short time _______ was on the road _______ recovery.

Chemists working with _______ red dye found that _______ active substance in it _______ a white powder called
PRICE CONTROL: CONSTITUTIONAL HISTORY

When, during World War __________, American agriculture was called __________ to provide for the __________ of allied countries whose __________ were overrun by armies, __________ boomed. So did income. __________ overextended themselves buying new __________, new stock, new equipment __________ blown-up prices.

The collapse __________ the foreign market when __________ war ended knocked the __________ out of prices and __________ debt-ridden farmers could not __________ their obligations. There was __________ hardship. An accepted definition __________ a farm came to __________ "a portion of land __________ covered by a mortgage." __________ depressed condition continued throughout __________ 1920's even while the __________ of the economy was __________ so-called prosperity.

After the __________ Depression set in the __________ had more company in __________ economic misery, but was __________ better off. The New __________ introduced a series of __________ to lift farm prices __________, although mended, remain __________ effective __________ today.

First, an Agricultural __________ Act (AAA) was passed __________ 1933. The plan was __________ raise a fund by use of a "processing __________ on farm products, the __________ to go to those __________ who cooperated in reducing __________. By raising less food, __________ would go up. No __________ ever invited such hostility __________ ridicule. To many people __________ seemed wrong to kill __________ third of the young __________ and plow under every __________ row of cotton while __________ were still people in __________. But the Supreme Court __________ short the experiment. In __________ it pronounced it unconstitutional - __________ because it levied a
PROPERTIES OF SULFUR

Lumps of sulfur are _______ and brittle. They can _______ melted and cast into _______, or roll, form. Another _______ form of sulfur is _______ flowers of sulfur. This _______ soft yellow powder.

is about twice as _______ as water, insoluble in _______, soluble in carbon disulfide (_______2), a non-conductor of electricity, _______ has no marked odor.

some sulfur into a _______ tube and heat it _______. When the sulfur reaches C, it forms a _______, straw-colored liquid. When the _______ is raised, the liquid _______ darkens to amber color _______ thickens. At about 160° _______, the test tube can _______ inverted, and the sulfur _______ not run out. The _______ is now like thick, _______ tar. At a higher _______ it is liquid again. _______ it boils at 444.6° _______.

When the sulfur is _______, some of the vapor _______ in the form of _______ yellow powder (flowers of _______) on the cooler walls _______ the test tube. Hot _______ burns with a blue _______ when it reaches the _______. Sulfur dioxide (SO2), a _______ gas that has a _______ choking odor, is formed.

melted sulfur is quickly _______ by pouring it into _______ water, a dark, sticky _______ of plastic sulfur forms _______ resembles smoked rubber. Plastic _______ can be molded into _______ desired shape while it _______ warm. It hardens into _______ dark mass, which _______ becomes yellow again long _______ it has cooled.

These _______ changes in physical proper _______s

A-26
CAUSES OF INEQUITABLE REPRESENTATION

representation has grown through failures of government. First, those legislatures where one _______ both houses are elected _______ a basis roughly of member per county, such _______ in California, a distortion _______ representation is bound to _______. More people live in _______ counties than rural, and _______ a result the city _______ counts for less.

__________ many states have failed _______ redistrict as their population _______ shifted, leaving rotten boroughs _______ through the state. For _______ Mississippi has not changed _______ districts since 1890, Delaware _______ 1897, Tennessee since 1900, _______ Illinois since 1901.

Third, _______ many states the redistricting _______ has been corrupted by _______.

In most states, the _______ to redistrict or the _______ to gerrymandering has been responsibility of the state _______ themselves. In these states, _______ legislators, who years ago _______ did represent the majority _______ the population, have been _______ reluctant to change the _______ of the legislature in _______ of growing urban population, _______ only because they did _______ relish the prospect of _______ themselves out of their _______. Not only the individual _______ the political party is _______; rural legislators (in two-party _______) are frequently Republican, urban _______ are frequently Democratic; and _______ has been too much _______ expect one party to _______ itself into a minority.

__________ some areas, rural Republicans _______ been supported by conservative _______ interests in the cities, _______ prefer a Republican legislature, _______ of origin, over a _______ legislature more responsive to
THE PARTS OF THE BRAIN

The large upper portion of the brain is called the cerebrum (sêr'ë-brûm). It is divided into two hemispheres, which are separated by a mass of fibers. The other surface of the cerebrum, which is called the cortex (kôr'tëks), is composed of gray matter, up of the cell bodies of neurons. The interior of the brain is formed of nerve fibers and white because of the sheaths of these fibers. Activity, such as voluntary memory, and reasoning, is controlled by the cortex. Thus, "gray matter" is commonly referred to as the equivalent of intelligence. Since activity seems to take largely in the cortex, the area of the cortex is more important than the rest of the brain as a whole. Its area is increased by many deep folds, convolutions, in the surface of the brain. The more deeper the convolutions, the more the cortex. In general, the intelligence of an animal is closely related to the convolutions in its brain. has a more complex convolutions than any animal.

The cerebellum (sêr'ë-bëll'ûm), the "hind brain," lies under the cerebrum. It is divided into two hemispheres and is covered with gray under which are white. This part of the is the center of coordination. Damage to the results in muscle movements are jerky and ineffective. The cerebellum also controls muscular
Faraday and Solutions

people have attempted understand matter. By the 18th century had a good idea gases and how they, but liquids troubled them much. One of the problems facing early chemists the strange behavior of when in solution. Why, example, does a sodium solution conduct electricity, while sugar solution does not? does hydrochloric acid permit flow of electricity better does acetic acid? Why distilled water not conduct while tap water does? do the boiling and points of a solution when its concentration changes?

the beginning of the century Michael Faraday of became interested in these. Through numerous experiments he a systematic knowledge solutions, part of which now called Faraday's Law Electrolysis. He found that he passed the same of electrical charge through of different compounds, the of the different elements at the terminals were to their atomic weights.

1833 Faraday published a on his researches into conductivity of solutions. This included the law just, and it also introduced terminology of electrolysis which today. Thus it was who gave us the electrode to represent the terminal entering a solution. first used the word to describe a solution permits a current of to pass through it.
GOVERNMENT OF INDIA ACT OF 1935

conferences to find a solution to the problem held in London in early 1930's. Gandhi himself present at one of ________. These meetings revealed one of the chief difficulties of the Indian question to be the fear of the Moslem ________ that it would not equal rights with the ________.

In 1935 Parliament enacted new constitution for India. ________ was put into operation 1937. This Government of ________ Act declared India to be a federation of Indian ________ (ruled by their princes) ________ governors' provinces. At the ________ of the federal government ________ the governor, or viceroy, ________ by the crown. The ________ was to be assisted ________ a council of ministers, ________ of the various departments ________ the government.

The federal ________ was composed of two ________, a Council of State ________, a Federal Assembly. Each ________ representatives of the provinces ________ the princely states. ________ local affairs of the states ________ rulers. The governors' ________ provinces ________ legislatures, part of whose ________ were elected by the ________.

The extreme nationalists still absolute independence, although the ________ were willing to accept ________ status. The Indians insisted they had a right ________ govern their own country. ________ British held that by ________ of the differences in ________, religion, language and cast, ________ the general illiteracy of ________ people, India was not ________ able to manage its affairs. India, if left ________ herself, they said, would

A-30
THE ANCIENTS BELIEVED THE WORLD MADE OF "FOUR ELEMENTS"

But to return to the original question: What is the world made of? Guesses and speculations would be useless attempting to answer this question. Because the ancients depended upon these procedures and observation, they made progress in answering the question.

After Thales had suggested, another man proposed that fire might be another of the basic substances from which matter was made. Fire, was suggested and later Pythagoras (pi-thä'gō-räs), an ancient thinker and mathematician who about 600 B.C., thought to have been the first European to express the idea that all matter was composed of these "four elements."

These conclusions seemed to be proved by the observations of the early investigators. When a stick of green wood burned, they saw that was produced, water was out and boiled off the ends, a smoky vapor (air) given off, and an (earth) was left behind. concluded, therefore, that all was made up of amounts of two or of these four basic, elementary, substances.

The Greek, however, made a serious. They failed to make observations of different substances. did not make enough. Consequently, their conclusions were. Strangely enough, the idea all matter is composed "four elements" (earth, air,), and water) persisted until the eighteenth century and was correct by many otherwise
FOREIGN AGGRESSION FURTHERED JAPANESE AMBITIONS

In becoming a modern nation, Japan also became a modern nation. A rapid rise in had resulted from improved services. The Meiji Era alone, expanded from less than to over 50 million. The nation could not produce food for its people. also lacked raw materials needed markets for its. Japan looked to the mainland as a solution its difficulties. As early the Japanese obtained privileges in Korea. It such transactions that irritated Chinese and precipitated the War of 1894-1895. By China, Japan made its significant acquisition of territory its own borders.

The of Shimonoseki granted Japan only Formosa and the but also the Liaotung of Manchuria, which jutted into the Yellow Sea. Russians, pursuing their own policy of imperialist expansion Manchuria, had long desired because at its southern lay Port Arthur, one the finest year-round harbors the Far East. Backed France and Germany, Russia Japan to return Liaotung China, and shortly afterward the peninsula and harbor itself through a treaty China. This move angered Japanese, as did Russian in Korea.

Negotiations between and Russia over Korea Manchuria broke down in. Fighting began when Japan, a formal declaration of attacked the Russian fleet Fort Arthur. Much to surprise of the West,
WATER AND MINERALS FROM ROOT TO LEAF

In the daytime, in sunny weather, a wet suit dries quickly. The suit evaporates. Water from plant leaves, too, such weather. Evaporation from is called transpiration. In living plant the water are filled with water all times, from the of the roots to veins in the leaves. water out of leaf cells, lowering the of water in the . Water then diffuses into cells from xylem in veins. The veins are full by diffusion of from the soil into roots. While transpiration takes in the leaves there a continuous stream of upward through the roots stem with its branches. goodsized birch tree may as much as 350 of water on a dry day. A single plant may lose three four quarts of water live, all that is must come in through roots.

You can now why plants must be carefully when they are . Parts of the roots, the root hairs, are in digging the plant. all the leaves are, transpiration continues at the rate as before, but can't get into an root system at that . Do you see why usually "cut back" the of a plant when transplant it? This slows transpiration.

Biologists have long
SALES TAXES

Thirty-two out of forty-eight in this country collect general sales tax. This is the major source revenue for most of states. Some cities also a sales tax. At times it has been that the federal government also enact a sales as a means of more money. However, up now, Congress has never such a tax law the federal government.

A tax is easy to. At the time of a purchase in a store, the consumer pays regular price charged by merchant. Then, he also a small percentage of regular price as an tax payment. The merchant as a tax collector. keeps a record of amount of taxes he, and he turns this over to the treasury the state or city has enacted the sales law.

Some people object the sales tax as regressive tax. They believe burden of taxation falls heavily on poor families it does on wealthy . This is true because families spend almost all income on food, furniture, clothing. Wealthy families on other hand do not all their income on immediate necessities of life. save part of their and invest it on things not in retail stores. Therefore, pay a smaller total of their incomes as .
PROGRAMS TO EXCHANGE PERSONS

Need to exchange people from other countries. This is more than just exchanging tourists who are sightseeing, having fun, simply loafing in strange places. We need a serious exchange of students, teachers, doctors, authors, musicians, farmers, laborers, athletes, dancers, engineers, and people who study and perform and observe. "Breaking down the barriers that divide people from those of other nations and building instead avenues for cooperation, the free interchange of ideas and skills are the purposes of international educational activities."

Since World War II, Congress has authorized several programs to promote educational exchange. Probably the best known are the ones provided by the Fulbright Act (1946) and the Smith-Mundt Act (1948). The Fulbright Act is primarily for the purpose of aiding American students and scholars to teach and study in certain approved countries. Russia, Poland, and the "curtain" countries are excluded. The Smith-Mundt Act created the States Information Agency (USIA), which maintains offices in foreign countries to dispense information about our country.

The International Educational Program, also created by the Smith-Mundt Act, in a year brought 4,146 people more than seventy-five foreign students to visit, teach, and study in our country. More than 1,700 of these visitors were students. The Program provided 1,700 for young people of countries to study in our schools abroad. We sent Americans abroad under this program. Among them were some 1,700 students, who studied in

A-35
COTTON

_________ is the soft, white ________ obtained from the cotton _________. The fibers are long, ________ cells attached to the ________ seeds. The seeds and ________ are formed in a ________ called a boll, which ________ open when the cotton ________

The cotton and ________ are picked from the ________ by hand or by ________ and taken to a ________ gin, where seeds and ________ are separated. The cotton ________ go to a mill ________ cleaning, carding, and spinning ________ thread. The seeds are ________ to produce cottonseed oil, ________ is used to make ________ fats and margarine. The ________ meal which remains is ________ as food for cattle.

_________ is produced in large ________ in the United States, ________, Egypt, and Brazil. In ________ and other countries, cotton ________ spun into thread and ________ into cloth. Some varieties ________ cloth made from cotton ________ lawn, muslin, denim, broadcloth, ________ calico, and cambric.

Under ________ microscope, cotton fibers appear be a flattened, twisted ________. Chemically, cotton is almost ________ cellulose, (C\_6\_H\_10\_O\_5). The subscript " ________ " tells us that the ________ unit is repeated an ________ number of times. When ________ comes from the plant, ________ is creamy-white. It is ________ with chlorine or hydrogen ________ to make it pure ________.

If cotton is soaked ________ strong, cold sodium hydroxide ________ a few minutes and ________ washed and dried, it ________ mercerized cotton. Mercerized cotton ________ a better luster than ________. It is also stronger ________ dyes better than untreated
AN EVALUATION OF BRITISH AND AMERICAN STRENGTH

as its words were, Declaration of Independence along not guarantee independence. If United States (the thirteen colonies) were to be, the Revolutionary War would to be won. The of patriots would be to give life to new country.

Fortunately for Americans, there were men to make sacrifices. Men Tom Paine, whose pamphlets to fan the sparks with distinction as American to France; the Frenchman de Lafayette, the German von Steuben, the Pole Pulaski, who came from Europe to fight liberty; and George Washington, led the ragged and American troops through what Paine called "times that men's souls."

The odds victory seemed to favor British. They had the advantages:
(1) Their army better trained than the troops. (2) Their navy far more powerful than ships available to the. (3) They had the necessary to hire mercenary (paid professional soldiers, such the Hessians) to fight them. (4) They retained loyalty of many colonists.

the other hand, the had these advantages: (1) war was being fought their home grounds, while British were many miles England. (2) They had effective leadership of Washington other men whose tactics proved superior to those British generals. (3) They the eventual support of
CONVERGENT EVOLUTION

have noted that species (e.g., bird and bat, and fish, woodchuck and ) are sometimes found which each other superficially but to reveal the homologies would indicate close kinship. As a result of two species of different closely is termed convergent. It can be explained the basis of the forces of natural selection in a similar way two originally different phenotypes. are certain structural and requirements that must be before any organism, no what its ancestry, can or swim.

Convergent evolution in no sense the of speciation. While two species may come to one another closely as selective forces work on, each species is, at the same time, diverging from own ancestral stock. The Australian marsupials which resemble mammals in both appearance habits illustrate convergent evolution respect to the placental . With respect to the marsupials, however, they represent most dramatic example of radiation, in other words, multiplication of species.

The of evolution is the important generalization about living that has been made. the last chapter we some of the kinds evidence that can best explained by a theory evolution. In this chapter have examined the mechanism which evolutionary change is to occur. Now let round out the story
PARTY AND CONSTITUENCY IN THE UNITED STATES

Writing in Parliamentary Affairs a decade ago, Professor Charles Merriam said that the States had 49 party systems. Since that time, only the number has changed. Now, there are 51 party systems—federal and 50 state, to mention the countless in cities and counties. There is no national party with authority to issue them, to discipline the formulation of their, or to the direct members who public office. A major the in the United can best be defined a quadrennial federation of state parties. This is of course, to the system, which not only governmental power between the and the Nation but makes the 50 states 50 separate constituencies. Governors Senators are elected in state. Each member of national House of Representatives elected in a constituency, the boundaries have been determined the legislature of his state. Even the President Vice-President are chosen by electors who are elected each state. Consequently, in to win elections, a party organization must be to its own state to the various social that dominate or hold balance of power in particular state.

Both federalism the party systems are products of the American. The United States is by geography, by memories the Civil War, by
BRONZE TOOLS

The Bronze Age dawned about four thousand years. People did not throw their old stone tools and begin to use ones. Moreover, the Bronze did not spread rapidly all parts of the world. Many people were still the Stone Age when discovered America, and in parts of the world tribes were still in Stone Age at the twentieth century. bronze came to used widely in any section of the world, say that those people living in the Bronze Age.

The use of metal an important step forward a higher level of civilization. The new tools opened many possibilities for man. metal weapons with stone and you will realize much more efficient man be with his bronze. They helped bring him the doorway of civilization. the dawn of civilization, had learned much. Lacking means of protection that animals had, he had his superior wits and become in a real the master of his. He had learned speech, use of fire, the of bronze weapons. He learned to and reap, to cook food, to sew, to, to build houses for, and to dig out log and use it a boat.

Among these
THE CHANCES OF FOSSIL FORMATION

The number of organisms _________ are fossilized after death _________ a very small percentage _________ all the organisms that _________ ever lived. You have _________ noticed that the conditions _________ which fossils are formed _________ very rigid. After death _________ organisms do not encounter _________ conditions.

Most land animals _________ eaten by scavengers or _________ decay too rapidly to _________ fossils. There are probably _________ fossil remains of the _________ of millions of bison _________ ranged the Great Plains _________ hundreds of years. The _________ land plants or animals _________ have formed fossils are _________ that have been in _________ conditions after death, such _________ freezing in glaciers, falling _________ bogs or swamps where _________ proceeded slowly to produce _________ or petrification, or being _________ in tar pits or _________.

Water plants and animals _________ more apt to form _________, since after death they _________ to the bottom of _________ body of water in _________ they live. Here in _________ sediments they encounter slow _________ and sedimentation, conditions favorable _________ fossil formation.

Ocean sediments _________ the shore have provided greatest number of fossils. _________ is abundant in shallow _________ waters, and the sediments _________ the shore are constantly _________ so that the bodies _________ dead organisms are quickly _________.

You can see that _________ chances that any particular _________ will become a fossil death are very slight. _________ chances that we will _________ a fossil after it _________ formed are equally slight.

_______ a very small amount _________

A-41
SYNTHETIC RUBBER, SILICONES

Perhaps you have seen dry their hands with or violinists rub their over the same kind substance.

For generations mankind found many ways for the different substances known resins. These are hard, noncrystalline solids which are in water but soluble many organic solvents. They either softened or melted heat. The resins include materials as resin from turpentine pine trees; amber, fossil resin from cone-bearing; copal and kauri, resins are useful in making and lac, the secretion an insect, from which is made.

As uses natural resins increased, the became inadequate and chemists interested in the production synthetic resins, now commonly plastics. These materials resemble resins in appearance and. The names "resin" and " at one time were interchangeably. Strictly speaking, however, the name implies, may molded or pressed into forms under heat, or or both. A plastic has a larger molecular than a resin; many the plastics soften when, but they do not liquid. Heated resins form with relatively low viscosities.

plastics are continually being. A careful control of makes it possible to a plastic which will perfectly adapted to the use. An almost limitless of plastics can be , and it is now to make an astounding
Textbooks Sampled for Study I
Textbooks Sampled

Biology


A-44
Chemistry


A-45
American Government


World History


Cloze Tests for Redundancy Study III
THE SHINING METAL

Charles Hall had a __________ laboratory in his father's __________. He had made most __________ the laboratory equipment himself. __________ young man had remade ____________ batteries. Now he could ____________ electric current. He was ____________ to do some experimenting.

__________ liked to study metals. ________ had read chemistry books. ________ had learned many facts. ________ wanted to do some experiments. That was why ________ had remade the old _________. It was the reason ________ had made other laboratory _________.

Charles Hall knew that ________ metal could be changed ________ a solid. This change ________ be made by adding ________ certain chemicals to the metal. ________ mixture had to be ________. The heat would melt ________ chemicals. Then the chemicals ________ run together.

Next, this ________ mixture would be cooled. ________ would become solid.

Charles ________ read facts about alumina ________ his chemistry books. The ________ had stated that alumina ________ found in an ore. ore was called bauxite. ________ believed alumina was a _________.

Some scientists discovered a __________ to make powdered alumina __________ a usable metal. The ________ metal was named aluminum.

the new metal took ________ and work. That made ________ more expensive than older ________ had been. Men knew ________ to make aluminum twenty ________ before Charles Hall tried _________. Not twenty-five tons of ________ had been made.

Charles ________ there was a large ________ of alumina in the ________. He decided to find ________ quick way to make _________. If the metal could ________ made quickly, it would ________ be very expensive.

He ________ to find a way ________ dissolve alumina. He experimented ________ several chemicals. He decided ________ use cryolite. When cryolite ________ heated it became a _________. Charles Hall felt certain ________ liquid cryolite and heat ________ dissolve alumina.

Charles measured ________
THE SHINING METAL

Charles Hall had set a chemistry laboratory in father's woodshed. He had most of the laboratory himself. Now the young had completed the remaking, restoration, of old batteries that electric current might used. He felt that last he was prepared do some experimenting.

For time the study of minerals appealed Charles. When quite young, had read books on . From books he had many facts that had his desire to carry some laboratory experiments. It then that he set work on the restoration old batteries and other he needed.

One bit information Charles Hall had from a chemistry book that a powdered metal be changed into a . This change could be by adding certain chemicals the metal, then heating mixture until both the and the chemicals melted ran together. After this mixture had cooled, it be solid in form.

the chemistry book, Charles learned of a substance alumina. The book stated alumina was found in ore called bauxite and scientists believed it was metal.

After that chemistry had been published, scientists a method by which could be made usable metal. The substance was named aluminum. The process used to make required so much time effort that this new was more expensive than older metals had been. the twenty-year period previous Charles Hall's interest in with alumina, not twenty-five of aluminum had been.

Charles knew that there a large amount of in the earth. He determined to find a
"It's a pity you're a little older, Billy," said George Chrisman. "I would give you a job as Express rider. There's good money in it."

George Chrisman was the Western agent for the express company. That company was on the point of starting a plan which many thought was ridiculous. But the other hand, everybody had the Mississippi River and the West Coast thought the plan was fine. The Express Company planned to maintain a system of fast riders for regular carrying of the mail. The distance to be covered was about two thousand miles. The route extended from Missouri River to California.

Chrisman had been joking when he had spoken to Billy. However, young William Cody, a Pony Express rider, was no joke.

"Oh, I say, Mr. Chrisman, give me a chance at it!" was the plea. "I can ride as well as any man—know I can!"

"Sure, I can ride," replied his good-naturedly. "But it takes riding, Billy—it takes sand!"

On the table contained the notice that set the whole West talking. Chrisman handed it to Cody so the boy read it. This is what he read:

"To San Francisco in 8 days by Overland, California and Pike's Express Company. The first of the Pony Express leave the Missouri River April 3rd, at 5 P.M., and it will run regularly thereafter, letter mail only. A of departure on the River will be in contact with the East, will be announced in time."

The boy’s eyes as he said, "Oh, me a chance at . Where is it to?"
THE PONY EXPRESS RIDER

"It's too bad you're older, Billy," said George. "I'd give you a job as a rider. There's pay in it."

Chrisman the Western agent for the express company. The company was ready to carry out plan. People living between Mississippi River and the Coast liked the plan. said it was foolish.

plan was for a group of fast riders to mail. The distance to covered was about two miles. The route reached the Missouri River to .

Chrisman had been joking Billy. But being a Express rider was no job to young William Cody.

"Give me a chance at !" said Billy. "I ride well as any man."

"It takes more than riding," said Chrisman. "It takes sand."

St. Louis newspaper lay the table. A notice had set the buzzing. Chrisman handed it to William Cody. This is the boy read:

"To Francisco in 8 days Central Overland, California, and Peak Express Company. The will leave the Missouri , Tuesday, April 3rd, at o'clock in the afternoon. run weekly. It carry letters only. It start from a town the Missouri River. That will be in touch the East by telegraph. town will be named ."

"Give me a chance," Billy. "Where is it start?"

"From St. Joseph," replied the agent. "Do want to watch them?"

"Sure," replied Billy. "But want to carry the muself!"

"We'll think about ," said Chrisman.
Before 1860, the United States reached only the far west as the _____ River. There were hundreds _____ miles of forests and _____.
ADVENTURES OF THE WHALEPS

"Thar she blows!" That _______ the cry heard on ________ ships. They are exciting _________. They were the words ________ told that a quarry ________ been seen. That cry ________ the signal for the ________ of the whale, the ________ creature of the seas.

________ days of the clipper ________ and pirates and of ________ American whalers are gone. ________ story of whaling is ________ of the roaring seafaring _________. It is an exciting ________ even today.

A whaling ________ carried several boats. These ________ were lowered from the ________ ship after whales were ________.

The whaleboats were very ________. Everything was where the ________ could find it at ________ time of the chase. ________ harpoons were where the ________ could reach them quickly. ________ were in racks at ________ bow. Three hundred fathoms ________ rope were coiled 'n ________ tubs. There was a ________. The boat might not ________ near the mother ship.

________ were four oarsmen and ________ mate in each boat. ________ man knew what his ________ was to be during ________ chase.

The mate was ________ of the crew. He ________ orders to the oarsmen. ________ was at the tiller. ________ steered the boat.

Each ________ had his job, too. ________ bow oarsmen was the ________. He stood up with ________ harpoon in his hands, ________ soon as the boat ________ near the whale. The ________ oarsman pulled the sweeping ________.

The tub oarsman threw ________ on the rope as ________ ran through the chocks. ________ water kept the rope ________ burning. The stroke oarsman ________ the stroke for the ________ men. He ________ also helped ________ keep the line clear, ________ pull in the rope, ________ to coil it.

The ________ important weapon was the ________.

A-54
ADVENTURES OF THE WHALERS

"Thar she blows!" That was the traditional cry on ships. No more exciting than these have echoed the seas. They were words that broke monotony whalers; they told that quarry had been sighted. The cry was the signal the chase of the , the mightiest creatures of seas. Like the age the clipper ships, or days of pirates, the when the American whalers to the far corners globe is gone. Story of whaling is of the roaring seafaring , but it is an story even today.

When whaling vessel started out, carried several boats which lowered from the mother after whales were sighted. whaleboats were the picture neatness. The whalers knew everything must be where could find it in exciting moment of the. The boats were fully. The harpoons, ready to seized by the mate, in gleaming racks at bow. Three hundred fathoms rope were neatly coiled wooden tubs. Other equipment a compass, lanterns, candles, food, for there was certainty that the boat stay within sight of mother ship.

The crew each boat consisted of mate and four oarsmen. man aboard knew exactly his chore was to during the chase.

The was boss of the and gave orders to oarsmen. At the beginning the chase he stood the tiller, which was the stern of the. With both his hands the tiller, the mate the craft.

Each of four oarsmen had special , too. The bow oarsmen as harpooner. When the was approached, he stood
INDEPENDENCE DAY

Residents of a Midwestern where a great celebration to take place were early on the morning July Fourth. Everyone was a hurry to finish minute preparations. Boys and called to their comrades, " going to be a day. We'll have a crowd."

From the appearance this town anyone might that it was about for an Independence Day . Flags were flying from automobiles, trucks, and wagons nearly ready for the parade which would be important event of the . Much work had been on these "floats." On historical scenes were represented as Betsy Ross making first American flag and Jefferson writing the stirring of the Declaration of . Other floats showed the between articles used in days and those used . Candle molds, spinning wheels, other cherished antiques of times were shown on floats.

Preparations had been for several kinds of . Races would be held those who wished to them. In the afternoon would be a baseball .

Picnic tables were ready the big public park. and other visitors to little town had brought lunches to share with they hoped to see the celebration.

A platform had been built for occasion was draped with , white, and blue cloth. this platform a speaker remind the people of reason for having a .

The speaker for this celebration was to be . He probably had more about the Declaration Independence and more about days than anyone else the community. He could depended on for a
INDEPENDENCE DAY

People of a Midwestern ________ were to have a

July ________. They were up early ________ the morning

of July ________. Everyone was in a ________ to

finish last minute ________. Boys and girls called

________ to their friends, "It's ________ to be

a clear _________. We'll have a good _________."

This was Independence Day. ________ flew from

homes and ________ buildings. Cars, trucks, and

________ were nearly ready for ________ big parade.

The "floats" ________ ready. Scenes from history

represented. There was Betsy

making the first American ________. There was Thomas

Jefferson ________ the Declaration of Independence.

Floats showed things used ________ Colonial
days and those ________ now. There were spinning

and many other things. ________ were

floats which showed ________ of today.

There would ________ races, too. In the

________ there would be a ________ game.

Picnic tables were ________ in the public park.

and other visitors had ________ picnic

lunches to share ________ friends.

A platform had ________ built. It was decorated

red, white, and blue ________. A speaker

would remind ________ people why they were ________
a celebration.

The speaker ________ this year's celebration was

be Judge Hood. He ________ a great deal

about ________ Declaration of Independence. He

more about Colonial days ________ anyone

ever in the ________. He would make a ________
speech.

Tom Fleming was ________ represent Thomas

Jefferson in ________ parade. His mother had ________
his costume.

One day ________ the celebration Tom and

________ friends went to visit ________ Hood.

They learned a ________ deal about the Declaration

Independence. They learned about ________

men who had written ________ signed it. They also

________ why it was written.

________ costume was heavy. He ________ of

how warm Jefferson ________ have felt. The long

________
Achievement Test for Redundancy Study IV
THE SHINING METAL

Directions

This is a test of your ability to answer questions about the story you have just read.

1. Your answer must be marked, in pencil, on the separate answer sheet which has been provided.

The following is a sample question to show how your answers are to be marked. Study the sample carefully and if you have any questions, raise your hand.

SAMPLE QUESTION
1. In what year did Columbus discover America?
   (1) 1092  (2) 1492  (3) 1892  (4) 1490

ANSWER TO BE MARKED ON SEPARATE ANSWER SHEET
1. (1) (2) (3) (4)

The correct answer to the sample question is answer Number 2. On the separate answer sheet we have blackened the space beside the Number 2 to show the correct answer.

2. Read each question carefully and then look at the four choices shown underneath the question. Decide which of the four choices is the correct answer. Then turn to the separate answer sheet and blacken the space beside the number that matches the answer you have selected. Blacken the space between the lines completely but make sure you blacken only one space for each question.

3. You should try to answer as many questions as you can. Do not spend a great amount of time on any one question; if you cannot think of the answer quickly, move on to the next question.

4. If you wish to change any answer, erase your first answer completely. Do not make any stray marks on the answer sheet.

PLEASE DO NOT MAKE ANY MARKS ON THE TEST BOOKLET
MARK YOUR ANSWERS WITH PENCIL ONLY

A-59.
22. Which of the following was not a result of Charles's work?

(1) Many new industries were developed.
(2) Thousands of new jobs were created.
(3) Aluminum was made more durable.
(4) Aluminum was processed more inexpensively.

23. Where would an aluminum miner work most of the time?

(1) in the open air
(2) in a mine tunnel
(3) in a laboratory
(4) in a factory

24. What is the main reason that railway tracks are laid to the place where the bauxite is to be mined?

(1) to carry the miners to work
(2) to carry in mining equipment
(3) to carry ore to the crushing mills
(4) to carry away the top crust of earth from the mine area

25. Which of the following is true about the supply of bauxite?

(1) There was once a large supply but it is now almost used up.
(2) There has been a large supply until now, but it could become scarce in the future.
(3) There has never been a large supply.
(4) There is an almost endless supply.

26. What color is bauxite?

(1) It is always white.
(2) It is always red.
(3) It is always the same color as aluminum.
(4) It can be white, yellow, red or almost any color.
8. Why was aluminum so expensive before Charles's new way of refining it?
   (1) It was very rare.
   (2) Mining it was very difficult.
   (3) Refining it took much time and work.
   (4) People thought it was the same as silver.

9. Before Charles developed his new method, how much aluminum had been made?
   (1) none
   (2) about 100 pounds
   (3) less than 25 tons
   (4) over 1000 tons

10. Alumina is found in an ore called
    (1) aluminum
    (2) bauxite
    (3) cryolite
    (4) silicate

11. What material did Charles use to help dissolve the alumina?
    (1) cryolite
    (2) chlorate
    (3) bauxite
    (4) potassium

12. In the production of aluminum, which of these processes comes next after mining?
    (1) refining
    (2) crushing
    (3) mixing with water
    (4) molding

13. Compared with most other metals, aluminum weighs
    (1) 1/10 as much
    (2) 1/3 as much
    (3) 2 times as much
    (4) 10 times as much

14. Which of these is an ore?
    (1) aluminum
    (2) silver
    (3) barium
    (4) bauxite
15. Which of these is a metal?
   (1) cryolite
   (2) bauxite
   (3) aluminum
   (4) ore

16. What is used to loosen the ore in the mines?
   (1) picks
   (2) dynamite
   (3) heat
   (4) drills

17. How is ore carried from the mines to the crushing mills?
   (1) by carts
   (2) by trucks
   (3) by railway
   (4) by barges

18. Solid pieces of aluminum are called
   (1) "bricks"
   (2) "blocks"
   (3) "pigs"
   (4) "bars"

19. About how long ago did Charles discover his process?
   (1) 10 years
   (2) 25 years
   (3) 75 years
   (4) 200 years

20. When cryolite is heated, it becomes
   (1) a powder
   (2) a gas
   (3) a solid
   (4) a liquid

21. Which of the following statements is not true of aluminum?
   (1) It will rust.
   (2) It can be shaped into many forms.
   (3) It is used to make more than 3000 different things.
   (4) It can be polished like silver.
22. Which of the following was not a result of Charles's work?

(1) Many new industries were developed.
(2) Thousands of new jobs were created.
(3) Aluminum was made more durable.
(4) Aluminum was processed more inexpensively.

23. Where would an aluminum miner work most of the time?

(1) in the open air
(2) in a mine tunnel
(3) in a laboratory
(4) in a factory

24. What is the main reason that railway tracks are laid to the place where the bauxite is to be mined?

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25. Which of the following is true about the supply of bauxite?

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26. What color is bauxite?

(1) It is always white.
(2) It is always red.
(3) It is always the same color as aluminum.
(4) It can be white, yellow, red or almost any color.
27. How is water used in making aluminum?
(1) to loosen the ore at the mine
(2) to dissolve the cryolite
(3) to dissolve the minerals in the powdered ore
(4) to wash the finished product

28. Why is aluminum a valuable metal today?
(1) It is very expensive
(2) It is often mistaken for silver.
(3) It is not very expensive and has many uses.
(4) It is as hard as diamond.

29. Why is aluminum produced in different forms?
(1) Different forms are needed for different purposes.
(2) Different refineries learned to make it in different ways.
(3) The different methods of refining it cause the different forms.
(4) The different forms depend on the color of the ore.

30. What source of electricity did Charles use in his laboratory?
(1) a wire from his father's house
(2) a portable electric generator
(3) batteries
(4) lightening
APPENDIX B

Table of Contents

LEARNING MATERIALS AND TESTS FOR STUDIES OF ELEMENTARY SET CONCEPTS.............................................B-2

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Sets (VT)

You have known about sets of objects for a long time. You probably have a set of dishes in your home. Maybe your father has a set of garden tools or a set of golf clubs.

The word set is used in the study of mathematics. You can think of a set as a number of objects that are grouped together for some reason. The objects are called elements of the set. The dishes are the elements of a set of dishes. Each golf club is an element of the set of golf clubs.

The reason why objects are elements of a certain set may not be clear. We could have a set with three elements -- a horse, a book, and a dish -- if we chose to list these as the elements of the set.

If there are so many elements in a set that they all cannot be listed, we may just describe the set. Examples of this are:

- the set with the elements all eleventh graders
- the set which includes all horses
- the set with all even numbers as its elements

Disjoint Sets

We are now going to learn about some things about pairs of sets. This first section is about pairs of sets that are called disjoint sets. You will be given examples of disjoint sets. See if you can tell what makes two sets disjoint sets.

The set with the elements 1, 2, 3 and the set with the elements 4, 5, 6 are examples of disjoint sets. However, the set with elements 1, 2, 3 and the set with the elements 3, 4, 5 are not disjoint sets.

The set with all men as its elements and the set with all women as its elements are disjoint sets. But, the set with all men as its elements and the set with all people as its elements are not disjoint sets.
The set with the elements a, b, c and the set with the elements x, y, z are disjoint sets. But, the set with the elements a, b and the set with the elements a, e, i, o, u are not disjoint sets.

Here are some more pairs of sets that are disjoint sets.

1. The set which has all dogs in it and the set which has all cats in it.
2. The set with 1, 3, 5, 9 as its elements and the set with 4, 2, 8 as its elements.
3. The set with elements t, g, r and the set with the elements s, f.
4. The set which has all even numbers in it and the set which has all odd numbers in it.

Here are some more pairs of sets that are not disjoint sets.

1. The set which has all cars in it and the set which has all black Fords in it.
2. The set with 1, 5, 6 as its elements and the set with 5, 8, 2 as its elements.
3. The set with the elements s, t, u and the set with the elements s, a, t.
4. The set which has all odd numbers in it and the set which has all numbers greater than ten in it.

Can you make up other examples of disjoint sets?

**Union of Two Sets**

This section is about the union of two sets. The union of the set with top, ball, cat as its elements and the set with dog, car as its elements is the set with top, ball, cat, dog, car as its elements.

Some more examples of the union of two sets will be given. See if you can tell how to make the union of two sets.
1. The union of the set with the element Tom and the set with the element Joe is the set with the elements Tom, Joe.

2. The union of the set with the element Tom and the same set (that is, the set with the element Tom), is the set with the element Tom.

3. The union of the set with the elements Tom, Joe and the set with the element Bill is the set with the elements Tom, Joe, Bill.

4. The union of the set with the elements Tom, Joe and the set with the element Joe is the set with the elements Tom, Joe.

5. The union of the set with 0,1,2 as its elements and the set with 7,8,9 as its elements is the set with 0,1,2,7,8,9 as its elements.

6. The union of the set with elements a,b,c and the set with the elements b,c,d is the set with elements a,b,c,d.

7. The union of the set which has all men over six feet tall in it and the set which has all women over six feet tall in it is the set which has adults over six feet tall in it.

8. The union of the set which has all numbers greater than ten in it and the set which has all numbers greater than twenty in it is the set which has all numbers greater than ten in it.

Can you tell how to make the union of two sets?

Intersection of Two Sets

This section is about the intersection of two sets. The intersection of the set with a,b,c as its elements and the set with c,d,e as its elements is the set with c as its elements.

Some more examples of the intersection of two sets will be given. See if you can tell how to make the intersection of two sets.
1. The *intersection* of the set with Tom as its element and the same set (that is, the set with Tom as its element) is the set with Tom as its element.

2. The *intersection* of the set with Tom, Joe as its elements and the set with Joe as its element is the set with Joe as its element.

3. The *intersection* of the set with Tom as its element and the set with Joe as its element is the set without any elements.

4. The *intersection* of the set with 8, 6, 4, 2 as its elements and the set with 1, 2, 3, 4, 5 as its elements is the set with 2, 4 as its elements.

5. The *intersection* of the set which has all animals in it and the set with barn, cow, house, dog as its elements is the set with cow, dog as its elements.

6. The *intersection* of the set with a, e, i, o, u as its elements and the set with d, a, e, r, b as its elements is the set with a, e as its elements.

7. The *intersection* of the set with the elements 7, 8, 9, 10 and the set with the elements 4, 9, 6, 7 is the set with the elements 9, 7.

8. The *intersection* of the set which has all whole numbers less than ten in it and the set which has all whole numbers greater than four in it is the set with 5, 6, 7, 8, 9 as its elements.

9. The *intersection* of the set with Joe, Mary, Dick, Bob as its elements and the set with Bill, Jan, Mary as its elements is the set with Mary as its element.

Can you tell how to make the *intersection* of two sets?
Sets (VD)

You have known about sets of objects for a long time. You probably have a set of dishes in your home. Maybe your father has a set of garden tools or a set of golf clubs.

The word set is used in the study of mathematics. You can think of a set as a number of objects that are grouped together for some reason. The objects are called the elements of the set. The dishes are the elements of a set of dishes. Each golf club is an element of the set of golf clubs.

The reason why objects are elements of a certain set may not be clear. We could have a set with three elements -- a horse, a book, and a dish -- if we chose to list these as the elements of the set.

If there are so many elements in a set that they all cannot be listed, we may just describe the set. Examples of this are:

- the set with the elements all eleventh graders
- the set which includes all horses
- the set with all even numbers as its elements

Disjoint Sets

In this section we will learn about disjoint sets. Two sets are said to be disjoint if no element belongs to both sets.

The set which is made up of all boys and the set which is made up of all girls are disjoint sets because no one is a boy and a girl at the same time. Everyone is either a member of the set of all boys or a member of the set of all girls.

The set of all eleventh graders and the set of all football players are not disjoint because some eleventh graders are also football players.

Another example of disjoint sets is the set with a, b, c, d as its elements and the set with e, f, g as its
elements. These sets are **disjoint** because none of the elements of either set are also elements of the other set.

An example of sets that are not disjoint is the set with elements \( a, e, i, o, u \) and the set with elements \( a, b, c, d \). These two sets are not disjoint because the letter \( a \) is an element in both sets.

### Union of Two Sets

This section is about the union of two sets. The union of two sets is a set that contains all of the elements in either the first set or in the second set.

For example, the union of the set which has all eleventh grade boys in it and the set which has all eleventh grade girls in it is the set which has all eleventh graders in it.

The union of the set with \( A, B, C, D \) as its elements and the set with \( D, E, F \) as its elements is the set with \( A, B, C, D, E, F \) as its elements. You will see that each element of the set with \( A, B, C, D \) as its elements is in the union and that each element of the set with \( D, E, F \) as its elements is in the union. You will also see that the letter \( D \) is put in only once in the union although it appears in both sets.

An element is in the union of two sets because it is an element of one set or the other. For example, the letter \( d \) is in the union of the set with \( b, d \) as its elements and the set with \( b, f, g \) as its elements because the letter \( d \) is an element of the set with \( b, d \) as its elements. The letter \( b \) is also in the union because it is an element of the set which has \( b, d \) in it and the set which has \( b, f, g \) in it as well. The whole union of the set with elements \( b, d \) and the set with elements \( b, f, g \) is the set with elements \( b, d, f, g \). Each of the letters in the set with \( b, d, f, g \) as its elements are in either the set with \( b, d \) as its elements or the set with \( b, g, f \) as its elements.
Intersection of Two Sets

This section is about the intersection of two sets. The intersection of two sets is a set that has all the elements that are in the first set and that are in the second set.

For example, the intersection of the set of eleventh graders and the set of football players is the set of eleventh graders who are football players.

The intersection of the set with elements $A,B,C,D$ and the set with the elements $A,C,E,F$ is the set with elements $A,C$. The letters $A$ and $C$ are the only letters that are in both the set with $A,B,C,D$ as elements and the set with $A,C,E,F$ as elements. An element is not in the intersection unless it is in both of the sets.

Here is another example. The intersection of the set with house, barn, shed as its elements and the set with house, barn, school as its elements is the set with house, barn as its elements. The intersection is the set with house, barn as its elements because "house" and "barn" are elements of both the set with house, barn, shed as its elements and the set with house, barn, school as its elements.
Sets (FI)

There are many ways to talk about "any group of things." We might say: a set of dishes, or a set of garden tools, or a _____ of golf clubs.

Can you see one way we may talk about a group of things? Any group of things may be called a _____.

We can show a set in several ways. Think about what is said below:

A set of dishes may be shown by dishes.

A set of garden tools may be shown by garden tools.

Golf clubs means a ____ of golf clubs.

A ___ may be used to show a ____. Now you can see that one way to show a set is by a _____.

Sometimes we want to refer to things in a set. The elements of a set of golf clubs are each of the golf clubs.

The elements of a garden tools are each of the garden tools. You can see that a china dish, a brown dish and a plastic dish are ________ of dishes. One way to show the elements of dishes is like this.
The five letters might be shown by the elements are A, B, C, D and E.

Disjoint Sets

Let's think about two sets that are called disjoint sets. See if you can tell from the examples what makes two sets disjoint sets.

1 2 3 and 4 5 6 are disjoint, 1 2 3 and 3 4 5 are not disjoint.

all men and all women are disjoint, all men and all people are not disjoint.

a b c and x y z are disjoint, a b and e a o i u are not disjoint.

Below you will find pairs of sets that are disjoint sets.

all dogs and all cats, 1 3 5 9 and 4 8
Here are some pairs of sets that are not disjoint sets.

- all cars and black Fords
- st and st
- all odd numbers and all numbers greater than 10

Can you make up other examples of disjoint sets?

**Union of Two Sets**

Now we will look at the union of two sets. The symbol, \( \cup \), is used to mean union. The union of

- top ball cat and dog car is top car ball cat dog.

Here are some more examples of the union of two sets.

- Tom Jack Bob \( \cup \) Joe Pete = Tom Joe Bob Pete Jack
- 0 1 2 \( \cup \) 7 8 9 = 0 7 1 2 8 9
- a b c \( \cup \) b c d = a b c d

B-11
Can you tell how to make the union of two sets?

**Intersection of Two Sets**

The symbol, $\cap$, is used to mean the intersection of two sets. The intersection of $\{8, 6\}$ and $\{4, 2\}$ is $\{2, 4\}$.

Here are some more examples of the intersection of two sets.

- All men over 6 feet tall $\cup$ All women over 6 feet tall = All adults over 6 feet tall
- All numbers greater than 10 $\cup$ All numbers greater than 10 = All numbers greater than 10
- $\{12, 4, 7, 9\} \cup \{11, 3, 9\} = \{12, 4, 7, 11, 3, 9\}$
Can you tell how to make the intersection of two sets?
There are many ways to talk about "any group of things." We might say: a set of dishes, or a set of garden tools, or a ___ of golf clubs.

Can you see one way we may talk about a group of things? Any group of things may be called a ___.

We can show a set in several ways. Think about what is said below:

A set of dishes may be shown by dishes.

A set of garden tools may be shown by garden tools.

Golf clubs means a ____ of golf clubs.

A ___ may be used to show a ___. Now you can see that one way to show a set is by a ___.

Sometimes we want to refer to things in a set. The elements of a set of golf clubs are each of the golf clubs. The elements of a garden tools are each of the garden tools. You can see that a china dish, a brown dish and a plastic dish are ____ of dishes. One way to show the elements of dishes is like this: china dish, brown dish, plastic dish. The first five letters
might be shown by \[ \begin{array}{c}
A \\
B \\
C \\
D \\
E \\
\end{array} \]
where the elements are

\[ \text{A, B, C, D and E.} \]

**Disjoint Sets**

Two sets are said to be disjoint sets if no element belongs to both sets.

**Examples:**
- even numbers and odd numbers
- \[ \text{a b c d e} \] and \[ \text{f g h j i} \]
- all boys and all girls

The sets below are not disjoint.

- \[ \text{a e i o u} \] and \[ \text{a b c d} \]
- \[ \text{1 2 3 4 5} \] and \[ \text{2 10 4 6 8} \]

**Union of Two Sets**

The union (\( \bigcup \)) of two sets is a set that has in it all of the different elements in both sets.

**Examples:**
\[ \begin{array}{c}
A \\
B \\
C \\
D \\
E \\
\end{array} \bigcup \begin{array}{c}
D \\
E \\
F \\
\end{array} = \begin{array}{c}
A \\
B \\
C \\
D \\
E \\
F \\
\end{array} \]
Intersection of Two Sets

The intersection (\(\cap\)) of two sets is a set that has in it all of the elements that are the same in both sets.

Examples:

\[
\begin{align*}
\{a, b, c, d\} & \cap \{a, c, e, f\} = \{a, c\} \\
11\text{th graders} & \cap \text{football players} = \text{11th graders who play football} \\
\{1, 2, 4\} & \cap \{2, 4, 6, 8\} = \{2, 4\} \\
\text{house barn} & \cap \text{school barn} = \text{house barn}
\end{align*}
\]
On this test, $\cup$ means union.
On this test, $\cap$ means intersection.

Answer questions 1-12 either YES or NO.

1. Is 8 an element of the set of all whole numbers between 1 and 10? 

2. Are table chair and barn disjoint sets? 

3. Could horse be an element of all animals? 

4. Think about the set with the elements small, long, short and the set with the elements tall, high, big. Are these sets disjoint sets? 

5. Could table be an element of the set of all members of a family? 

6. Is the intersection of the set with the elements 1, 2, 3, 4 and the set with the elements 2, 3, 4, 5, 6 a new set with the elements 2, 3, 4? 

7. Is 22 an element of even numbers between 1 and 20? 

8. Are pen and pencil disjoint sets? 

B-18
9. Think about \( \frac{15}{16} \) and \( \frac{17}{20} \).

Is 16 an element of the union of these sets?

10. Are the set with the elements \( a, b, c, d, e \) and the set with the elements \( a, e, i, o, u \) disjoint sets?

11. Think about the sets with the elements 8, 9, 10 and the set with the elements 13, 9. Is 13 an element of the union of two sets?

12. Are \( \{2, 4, 6, 8, 10\} \) and \( \{1, 2, 3, 4, 5\} \) disjoint sets?

13. What is one element of the letters in the alphabet?

14. Write down an example of something that is not an element of the set with 2, 4, 6, 8 as its elements.

15. Make two disjoint sets.

16. Think about the set with the elements wood, lead, iron, steel and the set with the elements iron, wood, steel, lead. Write the intersection of these two sets.

17. If \( \{a, c, m\} \) is the union of 2 sets, what could the 2 original sets be? \( \{a, c, m\} \) and \( \{o, q, r\} \).
18. Write down one element of the set of the days of the week.

19. List two sets that are disjoint.

\{_______\} and \{_______\}

20. Think about the set with the elements a, o, u and the set with the elements l, m, n, o. What is the union of these two sets?

21. Write down something that does not belong to

\[\begin{array}{c}
k \\
i \\
l \\
m \\
\end{array}\]

22. \[\begin{array}{c}
a \\
e \\
i \\
o \\
u \\
\end{array}\bigcap
\begin{array}{c}
a \\
o \\
o \\
l \\
M \\
P \\
\end{array}\]

23. If you know that the intersection of two sets is the set with big, fat as its elements what could the two original sets be?

24. Give one element of \[\text{months of the year}\]

25. \[\begin{array}{c}
1 \\
3 \\
5 \\
7 \\
\end{array}\bigcup
\begin{array}{c}
5 \\
6 \\
7 \\
8 \\
\end{array}\]

26. If you know that the union of two sets is the set with house, barn, cat, dog, boy as its elements, what might be the two original sets?

_______ and _______
Write as many words as you can that have meanings which are the same as or similar to the four words below.

<table>
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<tr>
<th>Antipodal</th>
<th>Duress</th>
<th>Altercation</th>
<th>Nascent</th>
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</table>

Name ________________________________
APPENDIX C

Table of Contents

MATERIALS AND TESTS FOR VOCABULARY LEARNING STUDIES III AND IV......................................................C-2

Synonym Production Test Used in Vocabulary Study III.................................................................C-2

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Definition Material Used in Vocabulary Study IV.................................................................C-68
Synonym Production Test Used in Vocabulary Study III
Production Test

Write as many words as you can that have meanings which are the same as or similar to the four words below.

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C-3
Write as many words as you can that have meanings which are the same as or similar to the four words below.

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<th>Duress</th>
<th>Altercation</th>
<th>Nascent</th>
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Write as many words as you can that have meanings which are the same as or similar to the four words below.

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<th>Stripling</th>
<th>Salubrious</th>
<th>Ignominious</th>
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Synonym Matching Test Used in Vocabulary Study III
Matching Test

Name __________________________

This is a test to see how well you have learned the correct meanings of the words you just studied. Lists 1 and 2 represent synonyms for the words in Groups 1 and 2. For each word in List 1, write the number in the blank that corresponds to the word that means the same or most nearly the same from Group 1. After you have finished List 1 then continue on to List 2 using the words in Group 2. Only Group 1 words are to be used with the synonyms in List 1 and Group 2 words used with List 2 synonyms.
Group 1
1. Succinct
2. Paroxysm
3. Lissome
4. Duress
5. Altercation
6. Stripling

Group 2
1. Limpid
2. Nascent
3. Salubrious
4. Ignominious
5. Alacrity
6. Antipodal

List 1
- willowy
- cub
- squabble
- minor
- brief
- control
- quarrel
- argument
- spasm
- youth
- convulsion
- dispute
- flexible
- outburst
- restraint
- confinement
- curt
- captivity
- limber
- lad
- seizure
- condensed
- supple
- short

List 2
- treacherous
- immature
- promptness
- emerging
- converse
- serene
- eagerness
- punctuality
- wholesome
- beginning
- invigorating
- quickness
- dishonorable
- bracing
- transparent
- clear
- contrasting
- crystalline
- fraudulent
- new
- healthful
- opposite
- vile
- reverse

C-8
Definition Material Used in Vocabulary Study III
Definitions

Directions: Read the definition of each word carefully and then write in the space provided below it a definition in your own words.

A person undergoing a visible and violent reaction from either physical or emotional causes can be said to be having a paroxysm. Thus a paroxysm is any unusually explosive excitation.

When all the elements of the environment work together to produce a feeling of general well being, it can be considered a salubrious environment. Thus salubrious describes any condition that is good for one.

When two or more people express different opinions, get excited, and contradict each other, the event is called an altercation. Thus an altercation is a social interaction characterized by heated exchange of opposing arguments.
A person who performs a task as soon as he perceives it and as though he really wants to do it is acting with alacrity. Thus alacrity implies both immediacy and cheerfulness in the carrying out of some activity.
Synonym Material Used in Vocabulary Study III
Synonyms

Directions: On each of the following pages are two lists of words. The first list is made up of the words whose meanings you are to learn. In the second list, there is a synonym for each word in the first plus one word which is not a synonym for any of the words in the first list. Write the word from List 1 in the space beside its synonym in List 2. Write "none" by the word which is not a synonym. When you have finished all five blanks, fold the page back along the dotted line and check your answers as they are given on the other side of the page. Then follow the same procedure for the other pages in this booklet.
List 1: Antipodal Ignominious Stripling Succinct

List 2:

1. _______lad
2. _______dishonorable
3. _______short
4. _______heal
5. _______opposite

C-14
1. stripling
2. ignominious
3. succinct
4. none
5. antipodal
List 1: antipodal ignominious stripling succinct

List 2:

1. _______brief
2. _______reverse
3. _______fraudulent
4. _______invite
5. _______cub
1. succinct
2. antipodal
3. ignominious
4. none
5. stripling
List 1: antipodal ignominious stripling succinct

List 2:

1. _______treacherous

2. _______converse

3. _______curt

4. _______lad

5. _______incur
1. ignominious
2. antipodal
3. succinct
4. stripling
5. none
List 1: antipodal ignominious stripling succinct

List 2:

<p>| | |</p>
<table>
<thead>
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<tbody>
<tr>
<td>1.</td>
<td>______ material</td>
</tr>
<tr>
<td>2.</td>
<td>______ counter</td>
</tr>
<tr>
<td>3.</td>
<td>______ minor</td>
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<tr>
<td>4.</td>
<td>______ vile</td>
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<tr>
<td>5.</td>
<td>______ compressed</td>
</tr>
</tbody>
</table>

C-17
1. none
2. antipodal
3. stripling
4. ignominious
5. succinct
List 1: antipodal ignominious stripling succinct

List 2:

1. ________current
2. ________compact
3. ________sprig
4. ________contemptible
5. ________antagonistic
1. none
2. succinct
3. stripling
4. ignominious
5. antipodal
List 1: antipodal ignominious stripling succinct

List 2:

1. _______ contrasting
   xxxxxxxxxxxxxxxxxxxxxxxxxxx
   xxxxxxxxxxxxxxxxxxxxxxxxxxx

2. _______ foul
   xxxxxxxxxxxxxxxxxxxxxxxxxxx
   xxxxxxxxxxxxxxxxxxxxxxxxxxx

3. _______ hurried
   xxxxxxxxxxxxxxxxxxxxxxxxxxx
   xxxxxxxxxxxxxxxxxxxxxxxxxxx

4. _______ youth
   xxxxxxxxxxxxxxxxxxxxxxxxxxx
   xxxxxxxxxxxxxxxxxxxxxxxxxxx

5. _______ condensed
   xxxxxxxxxxxxxxxxxxxxxxxxxxx
1. antipodal
2. ignominioues
3. none
4. stripling
5. succinct
Sentence Material Used in Vocabulary Study III
Directions: On the next page are given four words whose meanings you are to learn followed by five short sentences. In the blank to the left of each sentence write the word non by the sentence not related to any of the words. When you have classified each sentence fold the page along the dotted line and check your answers. For each word there is only one sentence and there is one sentence which does not have a related word. Then continue the same procedure for the remainder of the pages in the booklet.
List 1: duress limpid lissome nascent

List 2:

1. _______ A tulip bulb shows just a tip of green above the earth.
2. _______ A tall tale told by a fisherman.
3. _______ A hula dancer performs with grace and skill.
4. _______ Direct rays from the sun light up a tiny glade encircled by deep forest.
5. _______ A wild bird tries to escape through the bars of his cage.
1. Nascent
2. none
3. lissome
4. limpid
5. duress
List 1:  duress  limpid  lissome  nascent

List 2:

1. _____ Sounds of a flute coming from a distance through still air.

2. _____ The first fading of darkness each morning.

3. _____ A dog's faith in his master.

4. _____ A dictator refuses to allow the newspapers "Freedom of expression."

5. _____ A weeping willow moving in a breeze.
1. limpid
2. nascent
3. none
4. duress
5. lissome
List 1: duress  limpid  lissome  nascent

List 2:

1. ______ A dangerous criminal is handcuffed to two policemen.
2. ______ Three young greyhounds frolicking on a lawn.
3. ______ A rock crystal free of impurities.
4. ______ A magician casts his spell.
5. ______ A sketch containing the necessary notes for a large ambitious sculpture.
1. duress
2. lissome
3. limpid
4. none
5. nascent
List 1: duress limpid lissome nascent

List 2:

1. ______ A man weakened by fatigue.

2. ______ An engineer realizing which line of attack will eventually produce the solution to a construction problem.

3. ______ A beautiful princess held captive by a wicked knight.

4. ______ The fingers of a concert pianist as they run across a keyboard.

5. ______ An argument presented briefly but well.
1. none
2. nascent
3. duress
4. lissome
5. limpid
List 1: duress limpid lissome nascent

List 2:

1. ______ An acrobat performs a difficult feat with ease. xx
2. ______ An author's style characterized by being very understandable and smooth. xx
3. ______ An amusing story told to an audience. xx
4. ______ A newborn baby lying in a cradle. xx
5. ______ A child is made to "clean up his plate" before he gets dessert. xx
1. lissome
2. limpid
3. none
4. nascent
5. duress
List 1: duress limpid lissome nascent

List 2:

1. _______ A butterfly coming out of its cocoon.
   xxxxxxxxxxxxxxxx

2. _______ An over active mental patient is put in a strait jacket.
   xxxxxxxxxxxxxxxx

3. _______ The large, beautiful eyes of a doe.
   xxxxxxxxxxxxxxxx

4. _______ An ice skater bends and sways gracefully while figure skating.
   xxxxxxxxxxxxxxxx

5. _______ A word whose meaning is unknown.
   xxxxxxxxxxxxxxxx
1. nascent
2. duress
3. limpid
4. lissome
5. none
Sample Synonym Production Test Used in Vocabulary Study IV

C-28
SAMPLE SYNONYM PRODUCTION TEST

Name: ________________________________

Write as many **synonyms** for the following words as possible.

tractive  
gauche

lissome  
surreptitious

C-29
Synonym Materials Used in Vocabulary Study IV
NAME ____________________________

DIRECTIONS: On each of the following pages are two lists of words. The first list is made up of the words whose meanings you are to learn. In the second list, there is a synonym for each word in the first plus one word which is not a synonym for any of the words in the first list. Write the word from List 1 in the space beside its synonym in List 2. Write "none" by the word which is not a synonym. When you have finished all five blanks, fold the page back and check your answers as they are given on the other side of the page. Then follow the same procedure for the other pages in this booklet.*

START TIME ______________

*These same directions appeared on the front of every booklet.
Booklet 1

Booklet 2

C-32
List 1: tractive, gauche, lissome, surreptitious

List 2:
1. ______ drawing
2. ______ clumsy
3. ______ pliable
4. ______ secretive
5. ______ customer

List 1: juxtapose, acumen, inveigh, celerity

List 2:
1. ______ wisdom
2. ______ cypress
3. ______ join
4. ______ censure
5. ______ velocity

C-33
1. tractive
2. gauche
3. lissome
4. surreptitious
5. none

1. acumen
2. none
3. juxtapose
4. inveigh
5. celerity
List 1: tractive, gauche, lissome, surreptitious
List 2:
1. _______ awkward
2. _______ intimate
3. _______ pulling
4. _______ flexible
5. _______ shady

List 1: juxtapose, acumen, inveigh, celerity
List 2:
1. _______ speed
2. _______ inspire
3. _______ prudence
4. _______ blame
5. _______ neighbor

C-34
1. gauche
2. none
3. tractive
4. lissome
5. surreptitious

1. celerity
2. none
3. acumen
4. inveigh
5. juxtapose
List 1: tractive, gauche, lissome, surreptitious

List 2:
1. _______ ungraceful
2. _______ plastic
3. _______ sneaky
4. _______ hauling
5. _______ scholar

List 1: juxtapose, acumen, inveigh, celerity

List 2:
1. _______ sanitary
2. _______ adjoin
3. _______ reproach
4. _______ swiftness
5. _______ keenness
1. gauche
2. lissome
3. surreptitious
4. tractive
5. none

1. none
2. juxtapose
3. inveigh
4. celerity
5. acumen
List 1: tractive, gauche, lissome, surreptitious

List 2:
1. ______ wedlock
2. ______ underhandedness
3. ______ gawky
4. ______ elastic
5. ______ tugging

List 1: juxtapose, acumen, inveigh, celerity

List 2:
1. ______ border
2. ______ rapidity
3. ______ condemn
4. ______ waterfall
5. ______ brightness
1. none
2. surreptitious
3. gauche
4. lissome
5. tractive

1. juxtapose
2. celerity
3. inveigh
4. none
5. acumen
List 1: tractive, gauche, lissome, surreptitious

List 2:
1. ______ towing
2. ______ graceful
3. ______ granulate
4. ______ cumberson
5. ______ shifty

List 1: juxtapose, acumen, inveigh, celerity

List 2:
1. ______ gaseous
2. ______ haste
3. ______ connect
4. ______ shrewdness
5. ______ denounce
1. tractive
2. lissome
3. none
4. gauche
5. surreptitious

1. none
2. celerity
3. juxtapose
4. acumen
5. inveigh
List 1: tractive, gauche, lissome, surreptitious

List 2:
1. _______ bendable
2. _______ stealthy
3. _______ unwieldy
4. _______ merrily
5. _______ dragging

List 1: juxtapose, acumen, inveigh, celerity

List 2:
1. _______ meet
2. _______ cleverness
3. _______ abuse
4. _______ melodious
5. _______ acceleration

C-38
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<td>5</td>
<td>celerity</td>
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</tbody>
</table>
List 1: taxonomy, parturition, alacrity, chivalrous
List 2:
1. _______ eagerness
2. _______ classification
3. _______ unselfish
4. _______ scratchy
5. _______ childbirth

List 1: rancid, antipodal, explication, limpid
List 2:
1. _______ odorous
2. _______ elaboration
3. _______ woody
4. _______ transparent
5. _______ opposite
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</table>
List 1: taxonomy, parturition, alacrity, chivalrous

List 2:

1. _______ birth
2. _______ tacky
3. _______ generous
4. _______ readiness
5. _______ categorization

List 1: rancid, antipodal, explication, impid

List 2:

1. _______ translucent
2. _______ stale
3. _______ contrary
4. _______ development
5. _______ mischief
1. parturition
2. none
3. chivalrous
4. alacrity
5. taxonomy

1. limpid
2. rancid
3. antipodal
4. explication
5. none
List 1: taxonomy, parturition, alacrity, chivalrous

List 2:

1. _______ soapy
2. _______ benevolent
3. _______ grouping
4. _______ nativity
5. _______ zest

List 1: rancid, antipodal, explication, limpid

List 2:

1. _______ lucid
2. _______ running
3. _______ expansion
4. _______ smelly
5. _______ contrasted
1. none
2. chivalrous
3. taxonomy
4. parturition
5. alacrity

1. limpid
2. none
3. explication
4. rancid
5. antipodal
List 1: taxonomy, parturition, alacrity, chivalrous

List 2:
1. _______ subdivision
2. _______ considerate
3. _______ hearty
4. _______ hatching
5. _______ cheerful readiness

List 1: rancid, antipodal, explication, limpid

List 2:
1. _______ opposing
2. _______ clear
3. _______ old
4. _______ warmth
5. _______ amplification

C-43
1. taxonomy
2. chivalrous
3. none
4. parturition
5. alacrity

1. antipodal
2. limpid
3. rancid
4. none
5. explication
List 1: taxonomy, parturition, alacrity, chivalrous

List 2:

1. _______ spirit
2. _______ organization
3. _______ delivery
4. _______ gallant
5. _______ lighted

List 1: rancid, antipodal, explication, limpid

List 2:

1. _______ enlargement
2. _______ crystal
3. _______ musty
4. _______ antithesis
5. _______ beneath

C-44
1. alacrity
2. taxonomy
3. parturition
4. chivalrous
5. none

1. explication
2. limpid
3. rancid
4. antipodal
5. none
List 1: taxonomy, parturition, alacrity, chivalrous

List 2:

1. _______ courteous
2. _______ do-able
3. _______ keenness
4. _______ genesis
5. _______ pigeonholing

List 1: rancid, antipodal, explication, limpid

List 2:

1. _______ repulsive
2. _______ contradictory
3. _______ wishful
4. _______ interpretation
5. _______ crystalline
1. chivalrous
2. none
3. alacrity
4. parturition
5. taxonomy

1. rancid
2. antipodal
3. none
4. explication
5. limpid
List 1: paroxysm, sinuous; reciprocation, aberration

List 2:
1. _______ sailing
2. _______ frenzy
3. _______ exchange
4. _______ unconformity
5. _______ circuitous

List 1: boorish, mediate, delineate, endemic

List 2:
1. _______ vulgar
2. _______ describe
3. _______ intercede
4. _______ nippy
5. _______ native
1. none
2. paroxysm
3. reciprocation
4. aberration
5. sinuous

1. boorish
2. delineate
3. mediate
4. none
5. endemic
List 1: paroxysm, sinuous, reciprocation, aberration

List 2:

1. _______ exception
2. _______ roundabout
3. _______ give and take
4. _______ watery
5. _______ rage

List 1: boorish, mediate, delineate, endemic

List 2:

1. _______ recorder
2. _______ indigenous
3. _______ portray
4. _______ coarse
5. _______ intervene
1. aberration
2. sinuous
3. reciprocation
4. none
5. paroxysm

1. none
2. endemic
3. delineate
4. boorish
5. mediate
List 1: paroxysm, sinuous; reciprocation, aberration

List 2:

1. _______ oddity
2. _______ furor
3. _______ devious
4. _______ swapping
5. _______ chilly

List 1: boorish, mediate, delinquent, endemic

List 2:

1. _______ negotiate
2. _______ original
3. _______ numerous
4. _______ picture
5. _______ unrefined

C-49
1. aberration
2. paroxysm
3. sinuous
4. reciprocation
5. none

1. mediate
2. endemic
3. none
4. delineate
5. boorish
List 1: paroxysm, sinuous, reciprocation, aberration

List 2:

1. ______ trading
2. ______ rectify
3. ______ rarity
4. ______ indirect
5. ______ seizure

List 1: boorish, pedast, delingase, endemic

List 2:

1. ______ scenic
2. ______ shocking
3. ______ depict
4. ______ pre-existing
5. ______ interpose
1. reciprocation
2. none
3. aberration
4. sinuous
5. paroxysm

1. none
2. boorish
3. delineate
4. endemic
5. mediate
List 1: paroxysm, sinuous, reciprocation, aberration

List 2:
1. _______ sprightly
2. _______ peculiarity
3. _______ fit
4. _______ switch
5. _______ winding

List 1: boorish, mediate, delineate, endemic

List 2:
1. _______ referee
2. _______ represent
3. _______ monstrous
4. _______ inherent
5. _______ snobbish

C-51
1. none
2. aberration
3. paroxysm
4. reciprocation
5. sinuous

1. mediate
2. delineate
3. boorish
4. endemic
5. none
List 1: paroxysm, sinuous, reciprocation, aberration

List 2:

1. _______ interchange
   XXXXXXXXXXXXXXXXXXXX
   XXXXXXXXXXXXXXXXXXXX

2. _______ twisting
   XXXXXXXXXXXXXXXXXXXX
   XXXXXXXXXXXXXXXXXXXX

3. _______ rescue
   XXXXXXXXXXXXXXXXXXXX
   XXXXXXXXXXXXXXXXXXXX

4. _______ fever
   XXXXXXXXXXXXXXXXXXXX
   XXXXXXXXXXXXXXXXXXXX

5. _______ eccentricity
   XXXXXXXXXXXXXXXXXXXX
   XXXXXXXXXXXXXXXXXXXX

List 1: boorish, mediate, delineate, endemic

List 2:

1. _______ interfere
   XXXXXXXXXXXXXXXXXXXX
   XXXXXXXXXXXXXXXXXXXX

2. _______ characterize
   XXXXXXXXXXXXXXXXXXXX
   XXXXXXXXXXXXXXXXXXXX

3. _______ gross
   XXXXXXXXXXXXXXXXXXXX
   XXXXXXXXXXXXXXXXXXXX

4. _______ laborious
   XXXXXXXXXXXXXXXXXXXX
   XXXXXXXXXXXXXXXXXXXX

5. _______ innate
   XXXXXXXXXXXXXXXXXXXX
   XXXXXXXXXXXXXXXXXXXX

0-52
1. reciprocation
2. sinuous
3. none
4. paroxysm
5. aberration

1. mediate
2. delineate
3. boorish
4. none
5. endemic
List 1: asseverate, perspicacity, tenuous, redaction

List 2:

1. _______ sagacity
2. _______ revision
3. _______ behave
4. _______ affirm
5. _______ slender

List 1: vapid, ignominious, tensity, paradigm

List 2:

1. _______ birthplace
2. _______ dull
3. _______ model
4. _______ disreputable
5. _______ rigidity

C-54
1. perspicacity
2. redaction
3. none
4. asseverate
5. tenuous

1. none
2. vapid
3. paradigm
4. ignominious
5. tensity
List 1: asseverate, perspicacity, tenuous, redaction

List 2:
1. ________ exceed
2. ________ rare
3. ________ amendment
4. ________ foresight
5. ________ assert

List 1: vapid, ignominious, tensity, paradigm

List 2:
1. ________ dry
2. ________ dishonorable
3. ________ pattern
4. ________ excess
5. ________ rigor
1. none
2. tenuous
3. redaction
4. perspicacity
5. asseverate

1. vapid
2. ignominious
3. paradigm
4. none
5. tensity
List 1: asseverate, perspicacity, tenuous, redaction

List 2:
1. _______ dreamlike
2. _______ insight
3. _______ declare
4. _______ correction
5. _______ manhood

List 1: vapid, ignominious, tensity, paradigm

List 2:
1. _______ manicure
2. _______ standard
3. _______ unrespectful
4. _______ firmness
5. _______ flat
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List 1: asseverate, perspicacity, tenuous, redaction

List 2:
1. _______ state
2. _______ perception
3. _______ illusory
4. _______ sickness
5. _______ edition

List 1: vapid, ignominious, tensity, paradigm

List 2:
1. _______ infamous
2. _______ tasteless
3. _______ lullaby
4. _______ stiffness
5. _______ rule

C-57
1. asseverate
2. perspicacity
3. tenuous
4. none
5. rédaction

1. ignominious
2. vapid
3. none
4. tensity
5. paradigm
List 1: asseverate, perspicacity, tenuous, redaction

List 2:

1. ______ discernment
2. ______ rewrite
3. ______ unreal
4. ______ pronounce
5. ______ absorb

List 1: vapid, ignominious, tensity, paradigm

List 2:

1. ______ tedious
2. ______ abide
3. ______ original
4. ______ discreditable
5. ______ tenseness
1. perspicacity
2. redaction
3. tenuous
4. asseverate
5. none

1. vapid
2. none
3. paradigm
4. ignominious
5. tenacity
List 1: asseverate, perspicacity, tenuous, redaction
List 2:
1. _______ penetration
2. _______ feeble
3. _______ contend
4. _______ wintry
5. _______ rearrangement

List 1: vapid, ignominious, tensity, paradigm
List 2:
1. _______ notorious
2. _______ example
3. _______ tightness
4. _______ unlively
5. _______ wrinkle
1. perspicacity
2. tenuous
3. asseverate
4. none
5. redaction

1. ignominious
2. paradigm
3. tensity
4. vapid
5. none
List 1: nascent, mordant, abrogate, confabulate

List 2:

1. _______ abolish
   XXXXXXXXXXXXXXXXXXX

2. _______ converse
   XXXXXXXXXXXXXXXXXXX

3. _______ new
   XXXXXXXXXXXXXXXXXXX

4. _______ leopard
   XXXXXXXXXXXXXXXXXXX

5. _______ bitter
   XXXXXXXXXXXXXXXXXXX

List 1: duress, salubrious, callow, inane

List 2:

1. _______ lavatory
   XXXXXXXXXXXXXXXXXXX

2. _______ immature
   XXXXXXXXXXXXXXXXXXX

3. _______ restraint
   XXXXXXXXXXXXXXXXXXX

4. _______ wholesome
   XXXXXXXXXXXXXXXXXXX

5. _______ trivial
   XXXXXXXXXXXXXXXXXXX
1. abrogate
2. confabulate
3. nascent
4. none
5. mordant

1. none
2. callow
3. duress
4. salubrious
5. inane
List 1: nascent, mordant, abrogate, conflate

List 2:
1. _______ immature
2. _______ annul
3. _______ harsh
4. _______ talk
5. _______ decency

List 1: duress, salubrious, callow, inane

List 2:
1. _______ confinement
2. _______ healthful
3. _______ youthful
4. _______ shallow
5. _______ decorate
1. nascent
2. abrogate
3. mordant
4. confabulate
5. none

1. duress
2. salubrious
3. callow
4. inane
5. none
List 1: nascent, mordant, abrogate, confabulate
List 2:
1. _______ urgency
2. _______ speak with
3. _______ repeal
4. _______ severe
5. _______ emerging

List 1: duress, salubrious, callow, inane
List 2:
1. _______ juvenile
2. _______ utility
3. _______ beneficial
4. _______ captivity
5. _______ silly
1. none
2. confabulate
3. abrogate
4. mordant
5. nascent

1. callow
2. none
3. salubrious
4. duress
5. inane
List 1: nascent, mordant, abrogate, confabulate

List 2:
1. ________ segment
2. ________ cancel
3. ________ consult with
4. ________ beginning
5. ________ rough

List 1: duress, salubrious, callow, inane

List 2:
1. ________ raw
2. ________ foolish
3. ________ healthy
4. ________ sedentary
5. ________ control
1. none
2. abrogate
3. confabulate
4. nascent
5. mordant

1. callow
2. inane
3. salubrious
4. none
5. duress
List 1: nascent, mordant, abrogate, confabulate

List 2:
1. ______ at the start
2. ______ sharp
3. ______ chat
4. ______ learn
5. ______ erase

List 1: duress, salubrious, callow, inane

List 2:
1. ______ benign
2. ______ legible
3. ______ compel
4. ______ idle
5. ______ crude
1. nascent
2. mordant
3. confabulate
4. none
5. abrogate

1. salubrious
2. none
3. duress
4. inane
5. callow
List 1: nascent, mordant, abrogate, confabulate

List 2:

1. _______ confer
2. _______ remove
3. _______ initially
4. _______ sarcastic
5. _______ tunnel

List 1: duress, salubrious, callow, inane

List 2:

1. _______ frivolous
2. _______ inexperienced
3. _______ good
4. _______ oblige
5. _______ tropic

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RECORD THE FINISH TIME

*This instruction appeared on the last page of every booklet.

C-67
Definition Material Used in Vocabulary Study IV
DIRECTIONS: On the following pages, the meanings of four words are given. Read the definition of each word carefully and then write in the space provided below it a definition in your own words. Remember—try to learn the meaning of each word.

PLEASE RECORD THE TIME

START

FINISH
TRACTIVE

Heavy weights are often moved by using some kind of tractive device which makes it easier for people to accomplish their task. Thus tractive refers to a pulling or hauling capability of something.

LISSOME

Dance instructors would commonly call a ballerina lissome. Hence, lissome means to be lithe or limber or graceful in motion.

GAUCHE

A person who is generally awkward and lacking in social graces is a gauche individual. Thus, gauche means tactless and clumsy in behavior.

SURREPTITIOUS

A burglar has to make a surreptitious approach to the place he plans to rob if he wants to avoid being caught. Thus surreptitious refers to the secretiveness and deceit in carrying out some plan of action.

RECORD THE FINISH TIME.

C-70
JUXTAPOSE

When an architect begins a design of a house, he probably wants to be careful to juxtapose the kitchen and the dining room for the convenience of the homemaker. Juxtapose, therefore, refers to placing things very near to each other or side by side.

ACUMEN

A person who shows he can comprehend a difficult problem quickly and easily can be said to possess acumen. Thus acumen refers to a keenness and quickness of mind.

INVEIGH

An angry man might inveigh bitterly against the cause of his annoyance. Thus to inveigh means to condemn or to blame and implies the making of strong verbal attacks or denunciations of an existing condition.

CELERITY

A man who is in a position of authority often has to act with celerity when immediate difficulties force him to make a decision. Hence, celerity means speed or swiftness.

RECORD THE FINISH TIME.
**TAXONOMY**

It is often easier to understand a multitude of unrelated events by making a taxonomy for them. Hence, taxonomy pertains to a classification or organization of many things and implies meaningful relationships between all these things.

**PARTURITION**

When a mother gives birth to her children, she has performed an act of parturition. Thus parturition is concerned with the bringing forth of young.

**ALACRITY**

A person who performs a task as soon as he perceives it and as though he really wants to do it is acting with alacrity. Thus alacrity implies both immediacy and cheerfulness in the carrying out of some activity.

**CHIVALROUS**

A person who possesses qualities of generosity, honor and courteousness is said to be chivalrous. Thus chivalrous means unselfish and kind, and usually refers to one who is self-sacrificing and has good character.

RECORD THE FINISH TIME.

C-72
**RANCID**

Only in a second-rate restaurant is one likely to be served a salad dressing made from rancid olive oil. Thus, *rancid* means in bad condition because of age or lack of proper care.

**ANTIPODAL**

When a geography teacher speaks of the north and south pole, he is explaining the antipodal regions of the earth. Thus *antipodal* refers to anything which is exactly opposite or contrary.

**EXPLICATION**

If a person wishes to make his argument free of obscurities and unlikely to be misinterpreted, he may make an *explication*. Thus, *explication* refers to an interpretation or clearing up of a doctrine or other statement.

**LIMPID**

A pool of water unruffled by waves and uncontaminated by any sort of trash or mud could be called *limpid*. Thus *limpid* means free of disrupting or clouding elements.

**RECORD THE FINISH TIME.**

C-73
ABERRATION

Patients in mental hospitals almost always exhibit some behavioral aberrations. Thus an aberration is a departure from what is typical or normal.

PAROXYSM

A paroxysm of rage can be fatal to a person who suffers from high blood pressure. Thus, a paroxysm is an extreme response, either emotional or physical, to a given condition.

SINUOUS

Politicians are well-known for their sinuous remarks to reporters who wish to have direct answers to their questions. Therefore, sinuous pertains to the roundabout and deviating manner which people often use to avoid making clearer statements.

RECIPROCATION

When two people exchange or borrow items of clothing back and forth as girls often do, this is called an act of reciprocation. Thus reciprocation refers to mutual giving and taking.

RECORD THE FINISH TIME.
BOORISH

If a guest at a formal dinner party interrupts the activities and insults his hostess, his fellow guests will likely consider him boorish. Thus, boorish usually describes an unrefined, uncultured manner or habit.

MEDIATE

Many industrial strikes are averted when expert advisors mediate the dispute among the groups concerned. Thus mediate refers to the act of intervention or interfering and implies a condition of negotiation to resolve current problems.

DELINEATE

The teacher asked one of his students to delineate carefully one of the characters in the play so that the rest of the class would understand the role of this individual. Thus, delineate means to describe or portray, usually in a careful or detailed manner.

ENDEMIC

Revolt against the established order seems to be endemic among adolescents of most countries. Hence, endemic pertains to any condition which exists among a particular group or a specific locality.

RECORD THE FINISH TIME.

C-75
ASSERVATE

A person having a strong commitment to a personal ideal is likely to asservate his position with conviction. Thus, to asservate means to state or assert positively and earnestly.

PERSPICACITY

When a person has an unusual ability to understand the nature of things in depth, he can be said to possess a great deal of perspicacity. Thus, perspicacity refers to the insight and penetration of matters which are complex and hard to comprehend.

TENUOUS

A mental patient usually has only a tenuous hold on reality. Thus, tenuous refers to something that is unstable or weak.

REDACTION

Members of the United States Congress often make redactions to much of the legislation because of faulty wording of ideas. Thus redaction refers to making revisions or corrections to written material.

RECORD THE FINISH TIME.

C-76
VAPID

A poor teacher is often criticized for his vapid presentation of what ordinarily is extremely interesting material. Hence, vapid describes a dull and dry event.

IGINOMINIOUS

A commander in battle who deserts a position before he is forced to retreat can be criticized for his ignominious retreat. Therefore an ignominious act is one which cannot be respected or honored.

TENSITY

When a student is told he must do well on the next exam in order to pass the course, a state of tensity will develop as the exam day and hour approach. Tensity, then, refers to the state of being tense or anxious.

PARADIGM

A teacher is sometimes referred to as a paradigm of a good citizen. Hence paradigm usually pertains to a model or an example.

RECORD THE FINISH TIME.

C-77
**NASCENT**

When any thing or idea is in the very first stages of its development, it is said to be nascent. Therefore nascent means just coming into existence.

**MORDANT**

When a person criticizes other people with mordant remarks, he may learn later on that he is not very well liked. Thus mordant means harsh or severe and implies bitter and cutting statements to other persons.

**ABROGATE**

When students wish to remove the present way of grading through an act of the Student Government, their intention is to abrogate this system of evaluation. To abrogate means, then, to abolish or annul by an authoritative act an unacceptable or unsatisfactory condition.

**CONFABULATE**

People often get together casually and confabulate about the events of the day. Thus, confabulate means to converse or talk informally.

**RECORD THE FINISH TIME.**
Please record the time written on the board.

Time __________________

Please record the time written on the board.

Time __________________
APPENDIX D

Table of Contents

LEARNING MATERIALS FOR MATHEMATICAL OPERATIONS
STUDIES ........................................... D-2
You are asked to participate in an experiment the purpose of which is to determine which of several ways is most efficient in teaching students certain operations.

Name: __________________

Sex: Male ___ Female ___

Class: __________________

Previous mathematics courses: __________________

__________________________

__________________________

You are asked to participate in an experiment the purpose of which is to determine which of several ways is most efficient in teaching students certain operations.

Name: __________________

Sex: Male ___ Female ___

Class: __________________

Previous mathematics courses: __________________

__________________________
Please record the time written on the board.

Time

Please record the time written on the board.

Time

D-3
You are going to be presented with certain concepts. After being given an opportunity to study these concepts you will be tested on some combinations of these concepts. Please read the material carefully, respond in the blanks provided and then check your answers on the following page.
Definition:

$|\begin{pmatrix} x_1 \\ x_2 \end{pmatrix}|$ is a symbol for a vector. $x_1$ and $x_2$ are symbols that stand for certain real numbers. $x_1$ is in the first position and $x_2$ is in the second position.

Definition:

A vector is an ordered pair of real numbers. A vector is said to be ordered because one member of the pair is said to be in a first position while the other member of the pair is said to be in a second position.
An ordered pair of real numbers is a ________________.

It is said to be ordered because one number is in the ________________ position while the other number is in the ________________ position. The numbers that make up the vector are certain real ________________.
vector
first
second
numbers

vector
first
second
numbers
\[
\begin{bmatrix}
 y_1 \\
 y_2
\end{bmatrix}
\]
is a symbol for a ________

\( y_1 \) is in the ________ position.

\( y_2 \) is in the ________ position.

\( y_1 \) and \( y_2 \) are symbols for certain ________ numbers.

Any ordered pair of real numbers is a ________

Any pair of numbers that form a vector is said to be ordered because one number is in the ________ position while the other number is in the ________ position.

The numbers that make up the vectors are certain ________ numbers.
is a symbol for a ________.

3 is in the ________ position.

4 is in the ________ position.

3 and 4 are symbols for certain ________ numbers.

An ordered pair of numbers with a three in the first position and a four in the second position is a ________.

The three is in the ________ position.

The four is in the ________ position.

The three and the four are certain ________ numbers.
vector
first
second
real

vector
first
second
real

D-11
Definition:

The product of two vectors \( \vec{x} \) and \( \vec{y} \), written \( \vec{x} \times \vec{y} \), is defined by:

\[
\vec{x} \times \vec{y} = (x_1 \cdot y_1) + (x_2 \cdot y_2)
\]

Definition:

The product of two vectors, when the two vectors are expressed as ordered pairs of real numbers, is defined by the following three steps:

1. multiply the first number in one of the vectors by the first number in the other vector.
2. multiply the second number in one of the vectors by the second number in the other vector.
3. add together the results of steps number 1 and 2.
Examples:

1. \[ \begin{pmatrix} 2 \\ 4 \end{pmatrix} \cdot \begin{pmatrix} 2 \\ 3 \end{pmatrix} = 3.5 + 4.6 = 15 + 24 = 39 \]

2. \[ \begin{pmatrix} 2 \\ 3 \end{pmatrix} \cdot \begin{pmatrix} 4 \\ 7 \end{pmatrix} = 2.4 + 3.7 = 8 + 21 = 29 \]

Examples:

1. The product of a vector which has a three in the first position and a four in the second position, with a vector which has a five in the first position and a six in the second position equals 39, which is the sum of three times five and four times six.

2. The product of a vector which has a two in the first position and a three in the second position, with a vector which has a four in the first position and a seven in the second position equals 29, which is the sum of two times four and three times seven.
The product of a vector which has a six in the first position and a two in the second position, with a vector which has a three in the first position and a four in the second position equals

______ times ______ plus ______ times ______ which equals

______ plus ______ which equals ______.
\[6 \times 3 + 2 \times 4 = 18 + 8 = 26\]

6 times 3 plus 2 times 4 which equals 18 plus 8 which equals 26.
The product of a vector which has a five in the first position and a three in the second position, with a vector which has a nine in the first position and a seven in the second position equals ______ times ______ plus ______ times ______ which equals ______ plus ______ which equals ______.
6x^4 y^3 is an expression, where 

where a = , m = and n = .
Please record the time written on the board.

Time

D-18
You are going to be presented with certain additional concepts. After being given an opportunity to study these concepts you will be tested on some combinations of these concepts. Please read the material carefully, respond in the blanks provided and then check your answers on the following page.
Definition:

\[ ax^m y^n \] is an algebraic expression.

\( a, m \) and \( n \) are symbols for certain real numbers.

\( x \) and \( y \) are variables. Note that \( m \) and \( n \) are exponents.

Examples:

- \( 3x^4y^8 \) where \( a = 3, m = 4, \) and \( n = 8. \)
- \( 5x^2y^4 \) where \( a = 5, m = 2, \) and \( n = 4. \)
- \( 2x^9y^5 \) where \( a = 2, m = 9, \) and \( n = 5. \)
- \( 19x^7y^{42} \) where \( a = 19, m = 7, \) and \( n = 42. \)

Definition:

An algebraic expression is composed of letters of the alphabet which stand for certain real numbers. It is written in the form \( ax^m y^n \). Note that \( m \) and \( n \) are exponents.

Examples:

- \( 3x^4y^8 \) where \( a = 3, m = 4, \) and \( n = 8. \)
- \( 5x^2y^4 \) where \( a = 5, m = 2, \) and \( n = 4. \)
- \( 2x^9y^5 \) where \( a = 2, m = 9, \) and \( n = 5. \)
- \( 19x^7y^{42} \) where \( a = 19, m = 7, \) and \( n = 42. \)
$6x^4y^3$ is an expression, where $a = \underline{\hspace{2cm}}$, $m = \underline{\hspace{2cm}}$ and $n = \underline{\hspace{2cm}}$. 

$6x^4y^3$ is an \underline{\hspace{2cm}} expression, where $a = \underline{\hspace{2cm}}$, $m = \underline{\hspace{2cm}}$ and $n = \underline{\hspace{2cm}}$. 
algebraic
6, 4, 3

algebraic
6, 4, 3

D-22
$5x^9y^3$ is an algebraic __________.

where $a = \underline{\hspace{2cm}}$, $m = \underline{\hspace{2cm}}$ and $n = \underline{\hspace{2cm}}$. 
expression

5, 9, 3
Definition:

\( D_x(\quad) \), read as the derivative with respect to \( x \), is a symbol that stands for a certain operation on whatever algebraic expression appears in the parentheses. That is, \( D_x(ax^m y^n) \) is read as the derivative of \( ax^m y^n \) with respect to \( x \).

\( D_x(ax^m y^n) \) transforms the given algebraic expression, \( ax^m y^n \), into another algebraic expression by use of the rule

\[
D_x(ax^m y^n) = m \cdot ax^{m-1} y^n.
\]

Definition:

The derivative of an algebraic expression, with respect to \( x \), transforms the given algebraic expression, \( ax^m y^n \), into another algebraic expression. This transformation is accomplished by complying with the following two steps

1. Multiply the given algebraic expression by the exponent of \( x \);

2. Reduce the exponent of \( x \) in the algebraic expression resulting from step 1 by one.
Examples:

(1) \( D_x(3x^4y^6) = 4 \cdot 3x^{4-1}y^6 = 12x^3y^6 \)

(2) \( D_x(4x^5y^3) = 5 \cdot 4x^{5-1}y^3 = 20x^4y^3 \)

Examples:

(1) The derivative of \( 3x^4y^6 \) with respect to \( x \)
gives \( 4 \cdot 3x^4y^6 = 12x^4y^6 \) by the first step and \( 12x^4-1y^6 = 12x^3y^6 \) by the second step.

(2) The derivative of \( 4x^5y^3 \) with respect to \( x \)
gives \( 5 \cdot 4x^5y^3 = 20x^5y^3 \) by the first step and \( 20x^5-1y^3 = 20x^4y^3 \) by the second step.
\[ D_x(6x^5y^4) = \quad = \quad . \]

The derivative of \(6x^5y^4\) with respect to \(x\) equals

\[ \quad . \]
\[ 5.6x^{5-1}y^4 = 30x^4y^4 \]
The derivative of $5x^3y^2$ with respect to $x$ equals

$\frac{d}{dx}(5x^3y^2) = \text{________} = \text{________}$. 

D-29
5 \cdot 5x^{3-1}y^2 = 15x^2y^2

15x^2y^2

D-30
6.5 \times 2 - 1 = 30 \times 2^5
Examples:

(1) \( D_y(3x^4y^6) = 6 \cdot 3x^4y^{6-1} = 18x^4y^5 \)

(2) \( D_y(4x^5y^3) = 3 \cdot 4x^5y^{3-1} = 12x^5y^2 \)

Examples:

(1) The derivative of \( 3x^4y^6 \) with respect to \( y \) gives \( 6 \cdot 3x^4y^6 = 18x^4y^6 \) by the first step and \( 18x^4y^{6-1} = 18x^4y^5 \) by the second step.

(2) The derivative of \( 4x^5y^3 \) with respect to \( y \) gives \( 3 \cdot 4x^5y^3 = 12x^5y^3 \) by the first step and \( 12x^5y^{3-1} = 12x^5y^2 \) by the second step.
The derivative of $5x^2 y^6$ with respect to $y$ equals

$\frac{d}{dy}(5x^2 y^6) = \underline{} \underline{}$. 
6 \cdot 5x^2 y^6 - 1 = 30x^2 y^5
The derivative of $2x^3y^5$ with respect to $y$ equals

\[ d_y(2x^3y^5) = \quad \quad \quad \quad \quad . \]
5 \cdot 2x^3y^{5-1} = 10x^3y^4

10x^3y^4

D-36
Note that $\frac{d}{dx}(6x^3y^5) = 18x^2y^5$ while $\frac{d}{dy}(6x^3y^5) = 30x^3y^4$.

$D_x(6x^3y^5)$ requires a certain operation with the exponent of $x$.

$D_y(6x^3y^5)$ requires a certain operation with the exponent of $y$.

Note that the derivative of $6x^3y^5$ with respect to $x$ equals $18x^2y^5$ while the derivative of $6x^3y^5$ with respect to $y$ equals $30x^3y^4$.

The derivative of $6x^3y^5$ with respect to $x$ requires a certain operation with the exponent of $x$.

The derivative of $6x^3y^5$ with respect to $y$ requires a certain operation with the exponent of $y$.

D-37
Please record the time written on the board.

Time ________________________
You are now ready to take a test on the preceding material. You may refer back to the preceding material if necessary.
1. Multiply the vector which has an eight in the first position and a seven in the second position by a vector which has a three in the first position and a five in the second position.

Answer

2. Multiply the vector which has a six in the first position and a four in the second position by the vector which has a five in the first position and a two in the second position.

Answer
3. Multiply the vector which has a five in the first position and an eight in the second position by a vector which has a six in the first position and a three in the second position and then, to this result, add four.

\[
\begin{align*}
\left[ \frac{5}{8} \right] & \times \left[ \frac{6}{3} \right] + 4 = \_\_\_\_\_\_\_\_\_ ?
\end{align*}
\]
4. Multiply the vector which has a twelve in the first position and a five in the second position by a vector which has a two in the first position and a one in the second position and then, from this result, subtract six.

\[ \begin{bmatrix} 12 \\ 5 \end{bmatrix} \times \begin{bmatrix} 2 \\ 1 \end{bmatrix} - 6 = \text{?} \]

Answer
5. Multiply the vector which has a seven in the first position and a three in the second position by a vector which has a four in the first position and a five in the second position and then multiply this result by three.
6. Multiply the vector which has a six in the first position and a nine in the second position by a vector which has a three in the first position and an eight in the second position and then multiply this result by five.

Answer

5( \[ \|6\| \times \|3\| \] ) =
7. Multiply the vector which has a four in the first position and a six in the second position by a vector which has a nine in the first position and a three in the second position, and add the result to the number obtained by multiplying a vector which has a six in the first position and a seven in the second position by a vector which has a two in the first position and an eight in the second position.

Answer

D-45
8. Multiply the vector which has a three in the first position and a seven in the second position by a vector which has a five in the first position and a nine in the second position, and add the result to the number obtained by multiplying a vector which has an eleven in the first position and a ten in the second position by a vector which has a seven in the first position and a twelve in the second position.

Answer

D-46
9. Find \( x \) so that \( |\mathbf{a}| \cdot |\mathbf{b}| = 30 \).

9. The product of two vectors is thirty. If one of the vectors has a three in the first position and a four in the second position while the other vector has a six in the first position then what is in the second position of the latter vector?

Answer
Find $x$ so that $|\mathbf{B}| \times |\mathbf{E}| = 47.$

10. The product of two vectors is forty seven. If one of the vectors has a three in the first position and an eight in the second position while the other has a five in the first position then what is in the second position of the latter vector?
11. Multiply a vector with a three in the first position and a four in the second position by a vector which has a seven in the first position and a two in the second position; then divide this result by a number obtained from multiplying a vector with a two in the first position and a nine in the second position by a vector which has a six in the first position and a three in the second position.

Answer

D-49
12. Form a vector such that the number in the first position is the product of a vector which has a six in the first position and a four in the second position with a vector which has a seven in the first position and a one in the second position; and such that the number in the second position is the product of a vector which has a two in the first position and a three in the second position with a vector which has a six in the first position and a nine in the second position.

Answer
Please record the time written on the board.

Time ____________________________

Please record the time written on the board.

Time ____________________________

D-51
TEST

1. $D_x(3x^4 y^6) =$ ________________?

2. $D_y(5x^3 y^4) =$ ________________?

3. $D_x(7x^5 y^3) =$ ________________?

4. $D_y(9x^6 y^7) =$ ________________?

TEST

1. The derivative of $3x^4 y^6$ in respect to $x$ equals ________________.

2. The derivative of $5x^3 y^4$ in respect to $y$ equals ________________.

3. The derivative of $7x^5 y^3$ in respect to $x$ equals ________________.

4. The derivative of $9x^6 y^7$ in respect to $y$ equals ________________.

D-52
5. \( \frac{d_y}{d_x}(2x^8y^6) = \) ____________?

6. \( \frac{d_x}{d_y}(5x^3y^7) = \) ____________?

5. The derivative with respect to \( y \) of the derivative with respect to \( x \) of \( 2x^8y^6 \) equals ____________.

6. The derivative with respect to \( x \) of the derivative with respect to \( y \) of \( 5x^3y^7 \) equals ____________.
7. Find $ax^m y^n$ so that $D_x(ax^m y^n) = 16x^3y^5$.

Answer

8. Find $ax^m y^n$ so that $D_y(ax^m y^n) = 32x^5y^7$.

Answer

7. For what algebraic expression, $ax^m y^n$, does the derivative in respect to $x$ equal $16x^3y^5$?

Answer

8. For what algebraic expression, $ax^m y^n$, does the derivative with respect to $y$ equal $32x^5y^7$?

Answer

D-54
9. Find \( ax^m y^n \), so that \( D_x(ax^m y^n) = 15x^4 y^3 \).

Answer

10. Find \( ax^m y^n \) so that \( D_y(ax^m y^n) = 18x^9 y^8 \).

Answer

9. For what algebraic expression, \( ax^m y^n \), does the derivative with respect to \( x \) equal \( 15x^4 y^3 \)?

Answer

10. For what algebraic expression, \( ax^m y^n \), does the derivative with respect to \( y \) equal \( 18x^9 y^8 \)?

Answer
11. Find the value of $D_x (7x^3y^8)$ when $x = 5$ and $y = 3$.

Answer

11. Find the value of the derivative of $7x^3y^8$, with respect to $x$, when $x$ equals five and $y$ equals three.

Answer

D-56
12. Find the value of \( D_y (6x^9y^3) \) when \( x = 3 \) and \( y = 2 \).

__________________________ Answer

__________________________ Answer

12. Find the value of the derivative of \( 6x^9y^3 \), with respect to \( x \), when \( x \) equals three and \( y \) equals two.

__________________________ Answer

D-57
13. The derivative of $8x^3y^9$ with respect to $x$ plus the derivative of $4x^7y^4$ with respect to $y$ equals ______.
14. Find the value of $D_x(6x^3y^3) + D_y(8x^5y^3)$ when $x = 2$ and $y = 3$.

Answer

14. Find the value of the derivative of $6x^3y^3$ with respect to $x$ plus the derivative of $8x^5y^3$ with respect to $y$ when $x$ equals two and $y$ equals three.

Answer

D-59
Please record the time written on the board.

Time ________________

Please record the time written on the board.

Time ________________
1. $D_x(3x^m y^n) = \text{___________}$ when $m = \begin{bmatrix} 2 \\ 2 \end{bmatrix}$ and $n = \begin{bmatrix} 3 \\ 3 \end{bmatrix}$.

1. The derivative of $3x^m y^n$ with respect to $x$ equals $\text{___________}$ when $m$ is the product of a vector which has a three in the first position and a four in the second position with a vector which has a two in the first position and a one in the second position, and $n$ equals the product of a vector which has a four in the first position and a one in the second position with a vector which has a two in the first position and a three in the second position.
2. Multiply the derivative of $5x^6y^4$ with respect to $x$ by the product of a vector which has a three in the first position and a four in the second position with a vector which has a two in the first position and a five in the second position.

\[
\begin{pmatrix} 3 \\ 4 \end{pmatrix} \cdot \begin{pmatrix} 2 \\ 5 \end{pmatrix} \frac{d}{dx} (5x^6y^4) = \text{__________?}
\]
3. Find the value of $D_y(D_x(6x^2y^3))$ when

$$x = \begin{bmatrix} 1 \\ 2 \end{bmatrix} \ast \begin{bmatrix} 3 \\ 2 \end{bmatrix} \text{ and } y = 3.$$
4. Find the value of $ax^m y^n$ when $D_x(ax^m y^n) = 8x^3 y^4$, 

$$x = \left|\begin{array}{c} 3 \\ 4 \end{array}\right| \cdot \left|\begin{array}{c} 5 \\ 2 \end{array}\right|, \text{ and } y = \left|\begin{array}{c} 2 \\ 1 \end{array}\right| \cdot \left|\begin{array}{c} 3 \\ 6 \end{array}\right|.$$

Answer
5. \( ax^m y^n \) = __________________ when \( D_x(ax^m y^n) = 6x^r y^3 \)

and \( r = \begin{vmatrix} 2 \end{vmatrix} \times \begin{vmatrix} 4 \end{vmatrix} \).

5. Find the algebraic expression \( ax^m y^n \) such that the derivative of \( ax^m y^n \) with respect to \( x \) equals \( 6x^r y^3 \) when \( r \) equals the product of a vector which has a two in the first position and a three in the second position with a vector which has a four in the first position and a one in the second position.

__________________________ Answer

D-65
6. \( a^{m}y^{n} = \) \underline{\hspace{2cm}} \text{ when } D_x(a^{m}y^{n}) = 5x^3y^r \\

\text{and } r = \|3\| \times \|6\|.

6. Find the algebraic expression \( a^{m}y^{n} \) such that the derivative of \( a^{m}y^{n} \) with respect to \( x \) equals \( 5x^3y^r \) when \( r \) equals the product of a vector which has a three in the first position and a two in the second position with a vector which has a six in the first position and a one in the second position.

\underline{\hspace{5cm}} \text{Answer}

D-66
You have completed a portion of the experiment. Please record the time written on the board.

Time __________________________