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An Adaptation of Reading Materials for Students of Science in English as a Second Language

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AN ADAPTATION OF READING MATERIALS

FOR STUDENTS OF SCIENCE

IN

ENGLISH AS A SECOND LANGUAGE

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ABSTRACT

This project is an updating of the reader Scientific English Practice. It's purpose is to substitute outdated subjects, and expand others with more recent scientific information.

Vocabulary lists, comprehension questions, and grammar exercises were written to accompany several substituted essays. Vocabulary lists and exercises thereof were developed for the remaining essays, some of which were expanded upon.

E.R.I.C. Descriptors:

ENGLISH (SECOND LANGUAGE) 300
RT Language Skills

SCIENTIFIC MATERIALS 460
RT Reading Materials

INSTRUCTIONAL MATERIALS 050
UF Adapted Materials
NT Science Materials

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INTRODUCTION

Materials seldom seem to be perfectly suited to the needs of the class whether in respect to the subject matter, its presentation, or contemporaneity. Most materials do offer, however, some basis for expansion to wherever the needs may lie. Upon examination and use one may discover that the materials at hand lend themselves to reconstruction which can be an economical asset as well as an educational one. Serious non-native English-speaking students preparing to embark upon, or continue scientific study in English, come into the English class, in all likelihood, with a store of knowledge of the sciences learned in their native tongues. It is necessary for them now to be able to transfer their scientific thought processes into ones in English and to be able to comprehend and respond to new, complex, or unfamiliar ideas. Books of scientific readings, in English, with grammar exercises, aid the students in accomplishing this task. There is, however, one drawback to such technical writings, that of being out-dated. Although much of its information may be applicable, new advancements in the many fields of science render some kinds of data almost useless, except perhaps in an historical sense. It is therefore necessary for the teacher to constantly review, and if possible revamp materials in order to keep the students abreast of changes. I here present such a book along with my revisions.

Scientific English Practice by G. C. Thornley, copywrited in 1966, offers passages related to the astronomical, chemical, electrical, geological, mechanical, medical, natural, nuclear, and physical sciences. Topics range from universal concepts, e.g. "Temperatures and Thermometers" to less well-known areas, e.g. "Edison's Early Life"; however, some stories are not as useful to the class being either out of date, not in-depth enough, or too speculative. These passages should be substituted

by ones which are more contemporary, detailed, factual, or simply more interesting. Likewise, the teacher may wish to raise the consciousness of the students concerning scientists who are of a particular ethnic background, color, or sex, in which case a story such as "An Astronomer" p. 65 would be included. In contrast, one might find a passage to be interesting and pertinent, but lacking in the most recent information available. In this instance, the addition of one paragraph could be made to broaden the article's scope, e.g. "The Migration of Birds" p. 10 and "Comets" p. 101. One other consideration is that part of the set of exercises following each passage needs strengthening. A similar exercise could be added to the grammar review of each of the book's stories and incorporated into the ones being written. Since my students had difficulty with some of the language of the texts, it was felt that a more comprehensive look at the vocabulary, with simple exercises of review for it, would be helpful throughout the book. The materials having been evaluated, and the priorities having been set, now remains the task of searching out and adapting the new data.

Depending upon where one is located, different kinds of sources are available, scientific journals, newspapers, bulletins, and modern texts. It stands to reason that if one is dealing with students of science, resources will be available in the relatively near vicinity. This, of course, may not be true, in which case a personal contact closer to a library, the USIS, or a materials center might be the only source. Once the subjects have been selected and the sources tapped, the prospective articles should be read for overall acceptability -- they may be too technical, or simply not include the information one had assumed. Then both, or one of two things, can be done; one can edit the passage for length and/or combine it with another (others) for depth. "Jupiter" p. 38 is an example of this; as no one article had all the information available on the most recent observation of the

planet, data from three separate magazines was used. Paraphrasing the passage for clarity is sometimes necessary; however, one must be cautioned against doing this extensively, thus excluding not only authors' different styles, but the pot pourri of grammatical constructions found within these styles. The number of words should then be tabulated to keep within the bounds of the text itself.

Now the types of grammar exercises must be addressed. Assuming that the editor/author had some overall plan for including all types of exercises within the framework of the language of the passages, one could simply note all the kinds of exercises eliminated within the deleted passages, paraphrase the new stories to fit the old scheme grammatically, and keep the exact same kinds of exercises, but with new words. However, we must not lose sight of our goal to foster that environment in which the students will be increasingly able to function in English and science -- from the simple or familiar to the complex or new. Whittling away at styles for the sake of a grammatical plan will not quite prepare one for research in scientific journals. Taking a more flexible approach, one can make notes of the similar recurring patterns and write exercises using them, with some reference to the old passages, e.g. "Jupiter" ex. 7 p.42. With regard to the directions and format for these exercises, one thing should be kept in mind; in the course of their academic lives, these students will meet many different kinds of written exercises; if at this beginning stage, they can be exposed to a variety of ways of being questioned, their future encounters cannot help but be easier.

In conclusion, if the book has a format which is relatively acceptable to the teacher and students alike, it might be advisable to keep the overall plan for the material to be added similar in structure to that of the book itself. The students might subconsciously reject

the teacher-made materials as less professional if they do not possess the continuity and order that the book does. However, if the book's format is less than desirable, any innovative plan on the part of the teacher would be advisable.

While using Scientific English Practice at the Ferdowsi University's Alam High School in Mashhad Iran, I found the book to be informative and challenging. I do feel, however, that each passage deserves more vocabulary practice, and that for the previously mentioned reasons, some stories should be expanded upon or substituted with others. Here, therefore, is a list of the passages I dealt with and a compilation of stories and exercises I adapted to fit the needs of my students and myself:

The Migration of Birds	p. 19*
The Assam Earthquade of 1950	p. 33
Jupiter and the Outer Planets	p. 38
Man's Abilities	p. 65
Exploring the Moon	p. 69
A Warmer or a Colder Earth?	p. 92
Light and Heat on the Moon	p. 96
Comets	p. 101

The researching of this project was begun in February of 1975 and the paper was completed in the summer of 1976.

* of Scientic English Practice

HOW NATURE BREAKS ROCKS p. 1

VOCABULARY LIST

* expand
red-hot - so hot that an object becomes red
* protect
slightly - a little
* surface
* crack
* freeze
* cubic
cork - a light material used in tops of bottles
heaps - small hills of things
scratch - cut small lines on something
worn away - eroded; made small
* mass
cliff - a high rock, sometimes beside the sea
* pile
* powder

LANGUAGE

1. Draw a line from the word to its meaning.

heaps	piles
cliff	a light material for bottle tops
slightly	eroded
cork	not much
wear away	cut lines
scratch	a high rock

2. Fill in the blanks with words from the story.

(a) Heating the surface of the earth causes the cooler rock inside to _____.
(b) One way of breaking rocks in cold places is through _____.
(c) Sand, which is blown, can _____, rub, and _____ larger rocks.
(d) Piles of sand are called _____.
(e) A dry wind in the Sahara is called _____.
(f) At the beach, rocks are broken by the _____ of the sea.
(g) We can keep water in a jar by putting a _____ in it.
(h) Dirt and trees _____ rocks from the hot sun.
(i) An _____ bar will expand $\frac{1}{2}$ inch when it is heated to become red hot.

* **definitions in Glossary of <u>Scientific English Practice</u>** (definitions of those words without asterisks were written, in the simplist language, fot the specific use in the passage)

DR. SIMPSON AND CHLOROFORM p. 5

VOCABULARY LIST

* chloroform ($CHCl_3$)
  despaired - had no hope
* simultaneously
* surgery
  scene - something seen
* inhale
* unconscious
* dose
  alarm - fright; fear
  toil - hard work
* experimenter
  mankind - people
* survive
  resumed - began again
  ether $(C_2H_5)_2O$ - a light colorless liquid
  startled - surprised
  ceasing - stopping
  horror - great fear
  fled - ran away
  light of foot - fast
  deaden - kill
* relief

LANGUAGE

1. Write the number of the definition on the space beside its word.

(a) ether _____
(b) mankind _____
(c) scene _____
(d) deaden _____
(e) horror _____
(f) resumed _____
(g) startled _____
(h) ceasing _____

1. stopping
2. great fear
3. gentle
4. surprised
5. something seen
6. began again
7. a light colorless liquid
8. kill
9. people
10. began

2. Underline the correct word.

(a) One difference between chloroform and ether is that one is (heavy, colorless, a liquid).
(b) The men took chloroform by (inhaling, drinking, tumbling).
(c) Chloroform helps kill suffering in (ether, surgery, relief).
(d) When we stop doing something we (startle, cease, toil).
(e) All the people of the world are called (gentlemen, mankind, creatures).
(f) When one takes chloroform, she becomes (unhappy, undeadened, unconscious).
(g) Hard work is called (broil, soil, toil)
(h) The chemical formula for chloroform is (CH_3Cl, C_3HCl, CHC_3l, $CHCl_3$)

VOCABULARY LIST

* combustion
* internal
  plough - a machine used to dig up the earth on farms
  goods - things which have been made
* cylinder
* tyre (tire)
  warn - tell of coming danger
* piston
* invent
* horse-power (H.P.)
  various
* crank
  axle - a bar between two wheels
  spoke - the radius of a wheel
* air-screw
  revolution - one complete turn
* cog-wheel
  common - usual
  efficiency - good, correct work

LANGUAGE

1. Circle the correct word for the definition.

   (a) a farm machine (piston, plough, axle)
   (b) a turn (revolution, spinning, cylinder)
   (c) correct work (job, goods, efficiency)
   (d) the bar between two wheels (axle, piston, air-screw)
   (e) tell of danger (fear, spoke, warn)
   (f) radius of a wheel (crank, spoke, cog)
   (g) usual (same, near, common)

2. Write the correct answer on the space at the right.

   (a) The latest racecar speed record is _____ (a) _____
   (b) The first car with an internal combustion engine appeared around _____. (b) _____
   (c) In a V engine, the cylinders are placed in two _____. (c) _____
   (d) In some engines, the cylinders are placed like the _____ of a wheel. (d) _____
   (e) Most internal combustion engines have no _____. (e) _____
   (f) One good point that internal combustion engines have is that they are _____. (f) _____
   (g) Since the internal combustion engine burns petrol, this is a problem, because petrol is _____. (g) _____

VOCABULARY LIST

* thermometer
* rises
* invar
* dimensions
* pendulums
* vibration

accurate - correct

* scale

atmospheric - of the air
properties - ways of being or working

* contract

freezing point - temperature at which something freezes
shrinks - becomes smaller
sinks - goes down in water
climates - places of one temperature

* mercury (Hg)

bulb - round part
stem - long straight part
bore - hole
engraved - written
standard - unchanging rule
graduate - mark with degrees

* pressure

normal - usual

LANGUAGE

1. Fill in each blank with a correct word.

   (a) When the atmospheric temperature around invar changes, its _____ do not change.
   (b) The colder water that stays on top of a pond and freezes is _____ than the water on the bottom.
   (c) If a whole lake _____ to the freezing point, the fish in it will die.
   (d) Mercury in a thermometer _____ as the temperature rises.
   (e) The boiling point of H_2O in places below sea level is _____ than normal.
   (f) All thermometers have _____ markings.
   (g) The chemical formula for mercury is _____.

2. Draw a line from the word to its definition.

sinks	correct
normal	round part
accurate	usual
bulb	hole
shrinks	of the air
graduate	mark with degrees
engraved	gets smaller
bore	goes down
atmospheric	written

THE MIGRATION OF BIRDS p.19

Delete the last nine lines of the last paragraph and insert the following:

The most common theory, however, is that birds navigate by the stars and sun as well as the magnetic forces. Navigating by the sun and stars is called sun-arc or star-arc navigation, and since the sun and stars shift positions season by season, hour by hour, birds must know what time of year and what time of day it is to use them successfully. In the human world this requires complicated measurements, calculations, and various instruments.

VOCABULARY LIST

* homing
* dye
* feather
  journey - trip
* instinct
  sense - feeling
  familiar - known
* landmarks
* migrate
  mystery - something not understood
  nest - place where birds live
* aluminum
  enormously - very greatly
  theory - idea
* non-stop
  extraordinary
  endurance - staying with something
  navigate - travel
  calculations - measurings using mathematics
  shift - change

COMPREHENSION

Delete questions nine and ten and insert the following:

9. What is the most widely accepted theory of bird migration?
10. What must birds know in order to migrate this way?

LANGUAGE

1. Write original sentences with these words.

   (a) enormously
   (b) shift
   (c) journey
   (d) sense
   (e) familiar
   (f) navigate

2. Write the correct answers on the spaces at the right. Choose one word from those in parenthesis.

   (a) The swallows got to Croydon by (flying - aeroplane - car). (a) _____
   (b) Saying that the birds have (instinct - senses - knowledge) is not the answer. (b) _____
   (c) One of the longest bird migrations measures (100,000 - 2,500 - 6,000) miles. (c) _____
   (d) Navigating by the sun is called (naval - sun-arc - solar) navigation. (d) _____
   (e) When people fly aeroplanes to the same places that birds fly, they need (calculations - instinct - magnetism). (e) _____
   (f) Navigating by stars is difficult because stars change their (brightness - positions - orbits). (f) _____
   (g) Birds return to their homes to (sleep - fly - nest). (g) _____

Source: Snyder, Gorden M. "The Wonders of Bird Migration," Smithsonian 52, November, 1974, pp. 40-43.

VOCABULARY LIST

* resistance
  volts - the measure for electrical force
* diameter
  current - line of electricity
  opposing - going against
  red-hot - very hot
  connecting - coming together
* circuit
  flows - runs like a river
  supplied - given
* temperature
* excessive
  fuse - a device that opens a dangerous circuit
* fireproof
* defect
  main - most important
* breakdown
* device
  molten - melted
  switches - things that turn on something
* electromagnetic
  voltages - amounts of electricity
  immersed - put into
  flash - piece of light
  conducting - carrying
  path - way
  generating - making
  delivered - sent
  prevents - stops
  gap - hole—

LANGUAGE

1. Write the word next to its meaning

(a) a measure for electricity _____
(b) melted _____
(c) things that turn something on _____
(d) stops _____
(e) a piece of light _____
(f) runs like a river _____
(g) put into _____
(h) way _____

2. Circle the letter of the correct word.

(a) It is dangerous if the (main, volt, lead) and the return touch each other.
(b) A good metal for fuses is (iron, lead, silicon).
(c) Another name for a fuse is a (potential difference, current, cut-out).
(d) Positive and negative electricities need a (conducting, oil, defect) path to give up their energies.
(e) If a copper wire had a great electrical current, it would get very hot because the wire could not (potential, resist, align) so much electricity).
(f) (Energy, A cut-out, A gap) is given out when positive and negative electricities unite.

VOCABULARY LIST

likelihood - chance
damp - wet
* methane (CH_4)
* formula
explode - break with a loud noise
* volume
gas works - places where gas is gotten
* proportion
naked - uncovered
* illumination
scales - small thin hard coverings on fish
glowing - giving light
fix - put
faint glimmer - little shining
* spark
* flint
* jagged
edge - the end of something (like a piece of paper)
Vicar - a churchman
pit - a hole in the ground
eminent - famous
* wick
* gauze
alight - on fire
cylinder - shaped like a can
mouth - opening
discharged - gave out
* ventilated

LANGUAGE

1. Fill in the blanks with the correct words.

(a) The formula for fire-damp is _____ and another name for it is _____.
(b) Methane comes out of _____ in the coal mines.
(c) When we mix _____ parts of methane to _____ parts of air, we get a safe flame.
(d) An example of a naked light is a _____.
(e) The miners used to put fish scales on _____ for light.
(f) Before the safety lamp, Spedding invented a dangerous lamp called the _____.
(g) The safety lamp was safe because the products of _____ didn't pass out to the air.
(h) A _____ was used instead of gauze.
(i) They first experimented with the safety lamp _____ the mines.

2. Write the number of the definition on the line beside its word.

(a)	edge	_____	1. shaped like a can
(b)	naked	_____	2. famous
(c)	scales	_____	3. a hole in the ground
(d)	cylinder	_____	4. uncovered
(e)	damp	_____	5. wet
(f)	eminent	_____	6. the end of something
(g)	pit	_____	7. small thin coverings on fish
(h)	glowing	_____	8. a churchman
			9. giving light

Since this story is primarily a narration of personal feelings about experiencing an earthquake, I saw fit to substitute a more detailed, scientific account of the more modern catastrophe in Nicaragua.

THE MANACUA EARTHQUAKE OF 1972

Nicaragua, the largest country in Central America, is an agricultural country whose farmers live in areas of rich volcanic soil near Lake Managua. In the past, Managua, the centrally located capital, was built up in order to help the government relieve the political tension between two rival cities, Granada and León. Managua is situated in a depression lying 30 to 40 kilometers inland from the Pacific Ocean and cut by many fault lines, which are parallel to the coast. It is bounded on the east and south by a major chain of volcanoes. It has experienced severe shaking in 1885, destruction in 1931, severe damage in 1968, and enormous destruction in 1972.

A stress system may persist over a region including most of Nicaragua and Costa Rica. This stress system may be explained as a result of movements between two plates: the Cocos plate on the western side of Nicaragua and the Caribbean plate on the eastern side. One hypothesis is that the Caribbean plate is presently moving eastward, "dragging" eastern Nicaragua with it, while the Cocos plate is moving in a northerly direction.

In addition, the plunging of the Cocos plate beneath the Caribbean plate seems to be the cause of both volcanoes and quakes. As oceanic material descends, it is heated by the earth's interior, and some of it rises again towards the surface. As this material pushes against the colder crustal rock, it may break through in the form of volcanoes, or cause uneven stretching and settling. Sudden settling of the hard rock can result in the kind of earthquake that struck Managua.

On December 22, 1972 the wind was still and the heat oppressive. Scientists have never established a connection between such weather and seismic disturbances, but older people were uneasy. The first shock came in two jolts, lasting only a few seconds, which hurt the peoples' ears, teeth, and bones. Next dust rose like a blanket to about 1,000 feet until one could see nothing but dust and fires.

Three shocks produced most of the damage. They occurred at 12:30, 1:18, and 1:20 a.m., moderate to extensive damage extending everywhere. Damage was caused by shaking, faulting, and fire in the downtown area.

Of the population of about 420,000, at least 1 percent were dead, 4 percent injured, 50 percent jobless, 60 percent fleeing the city, and 70 percent temporarily homeless. Fifty percent of the commercial property and 70 percent of government facilities were inoperable.

Damage to buildings in a particular area varied greatly depending on the type of construction. In general, the severe damage was a result of the fact buildings there are poorly designed for resistance to earthquake vibrations. This is particularly true of the widely used type of construction called "taquezal" (a combination of wood and adobe[1]).

Although it would be foolish to rebuild Managua in the same place, there are no good alternatives in such an unstable zone of the earth's crust. Nicaragua has no solid place to put its capital.

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[1]adobe - unburnt brick dried in the sun

COMPREHENSION

1. Why do the people live near volcanoes?
2. Where is Managua situated?
3. Why was Managua built in such a dangerous place?
4. Why does the land move?
5. How did the people know an earthquake was coming?
6. How many shocks were there and when did they come?
7. What caused the damage?
8. Why was damage in some areas greater than in others?
9. What was the worst type of construction? Why?
10. Will Managua be moved? Why?

COMPOSITION

Describe any natural disaster that you know of, or can imagine.

VOCABULARY LIST I

* volcano
fault line - a cut in the earth
seismic - of earthquakes
plate - a flat piece of material
* interior
stress - a force that holds something
hypothesis - a scientific idea
* shock
* vibrations
unstable - changing
zone - area
depression - lowering; bad times
parallel - lying in the same direction

LANGUAGE

1. Fill in the blanks with one of the given words in its proper form: hypothesis; volcano; fault line; seismic; plate; interior; stress; shock; vibration; unstable; zone; depression; parallel.

   (a) A scientific idea is a _____.
   (b) He got a violent electric _____ when he was mending the motor.
   (c) The table had one short leg, so it was quite _____.
   (d) _____ lines never cross each other.
   (e) When scientists want to measure the shaking of the earth, they take a _____ reading.
   (f) While the building was shaking, many _____ were felt.
   (g) The _____ of the house was modern, the outside, ancient.
   (h) In 1929 the world's economy was in grave trouble, we were in the Great _____.
   (i) San Francisco might some day fall into the sea because it is built on a _____.
   (j) Everyone was upset, there was much tension and _____ among them.

(k) One eats a meal from a bowl or a _____.
(l) The people thought that the mountain was on fire, it was, in fact, a _____.
(m) The Panama Canal is located in the Panama Canal _____.

VOCABULARY LIST 11

agricultural - farming
relieve - take away trouble
rival - enemy
bounded - surrounded
region - place
plunging - going down quickly
descends - goes down
crusted - having a hard surface
stretching - moving
settling - coming to rest
oppressive - overpowering
established - made
uneasy - upset
moderate - not extreme
extensive - great
damage - harm; injury
injured - hurt
fleeing - running from
temporarily - not forever
commercial - business
facilities - departments
alternatives - other ways

LANGUAGE

2. Make your own sentences with these words: (a) fleeing; (b) damage; (c) agriculture; (d) alternative; (e) moderate; (f) uneasy; (g) injured.

3. Write a correct word in the space beside the percentage.

(a) 50% of the _____ was inoperative.
(b) 1% of the people were _____.
(c) 70% of the people were _____.
(d) 60% of the people were _____.
(e) 70% of the _____ were inoperative.
(f) 4% of the people were _____.
(g) 50% of the people were _____.

4. Not all words ending with "ing" are verbs. If they are subjects, objects, or objects of prepositions, they must be nouns. They are called verbal nouns (gerunds).

Point out the verbal nouns below:

(a) Damage was caused by shaking, faulting and fire.
(b) The plunging of the Cocos plate seems to be the cause of both volcanoes and earthquakes.
(c) Managua is situated in a depression lying 30 to 40 kilometers inland from the Pacific Ocean.

(d) The first shock came in two jolts lasting only a few seconds.
(e) Sudden setting of the hard rock can result in an earthquake.
(f) The Caribbean plate is presently moving eastward.
(g) .... it may cause even stretching.

5. Point out the subordinate clauses in each sentence if there are any. Underline the connectives.

(a) Although it would be foolish to rebuild Managua in the same place, there are no good alternatives.
(b) Scientists have never established a connection between such weather and seismic disturbances.
(c) The first shock came in two jolts which hurt peoples' ears.
(d) As oceanic material descends, it is heated by the earth's interior.
(e) Nicaragua is a country whose farmers live in areas of rich volcanic rock.
(f) The stress system may be explained as a result of movements between two plates.

6. Form other words from the following and say what parts of speech your words are:
(a) construct; (b) poor; (c) ocean; (d) connect; (e) crust; (f) west; (g) north; (h) central; (i) destruct; (j) geography; (k) vibrate; (l) fool.

7. Explain the following in any way you like:
(a) dust rose like a blanket; (b) two rival cities; (c) centrally located; (d) widely used; (e) particularly true.

8. Complete these verb phrases by putting the correct preposition after each verb:
(a) built _____; (b) is situated _____; (c) are parallel _____;
(d) is bounded _____; (e) pushes _____; (f) break _____;
(g) can result _____; (h) occur _____; (i) be caused _____.

Source: Reed, David. "The Night Managua Died," Readers' Digest 102, May, 1973, pp. 127-132

JUPITER AND THE OUTER PLANETS p.38

Since"Jupiter and the Outer Planets" was taken from a work written in 1960 and since the Apollo journey to Jupiter took place in 1974, the passage has been substituted by a review of more up-to-date findings.

JUPITER

Jupiter is unlike the Earth in almost every way. Astronomers used to think that it was made of a central rocky core, surrounded by a layer of ice over which lies a deep, dense atmosphere. But now that a satellite has entered Jupiter's region, we know that the planet is a gigantic sphere of liquid hydrogen, with the depth of 44,000 miles, without any detectable solid surface except for possibly a small, perhaps molten, rocky core thousands of miles below its turbulent cloud tops.

The gases ethane (C_2H_6) and acetylene (C_2H_2) have been detected somewhat in the upper atmosphere. Previously detected gases are methane (CCH_4) and ammonia (NH_3), hydrogen (H_2) and helium ammonia hydrosulfide, which all add up to a quite poisonous atmosphere.

In its core, Jupiter has a temperature of 54,000°F, more than six times hotter than the surface of the sun. Because of the tremendous pressures of the interior, the hydrogen is compressed into a metallic phase, and is molten at the high temperatures of the interior.

Weather systems on Jupiter stretch entirely around the planet and account for the alternating grayish-white "zones" and darker, lower and warmer brownish-red "belts." The light color is probably

that of ammonia crystals, while the darker stripes may mark the presence of sulfur.

The famous Great Red Spot is a tremendous patch 30,000 miles long, large enough to swallow up three Earths. It is a huge weather disturbance; a towering cloud mass, warmest in its central region, but cooling and subsiding at the edges.

Because of its very rapid rotation, giving it a day of only 9 hours and 55 minutes, Jupiter is wider at the equator. Its equatorial diameter of 89,000 miles is about 12,000 miles greater than its polar diameter.

The planet has an inner and outer magnetic field, but the center of the inner field and the center of the outer field do not coincide, the inner field being tilted 10 degrees to the axis of rotation and the outer one parallel to the geographic center. Because of this tilt, the inner field as seen from space, wobbles up and down through an arc of 20 degrees once every 10 hours of rotation. The poles of Jupiter's field are reversed so a compass on Jupiter would point south.

The planet's four major satellites (moons) revolve around Jupiter very close to the plane of its equitorial rotation. Because they decrease in density, the denser ones being closer to the planet, and they have regular spacing between their orbits, it is thought that they condensed from the same cloud of gas and dust as Jupiter itself. A similar process is thought for the density distribution of our inner solar system which increases from Mercury out to Mars, followed by the four "gas giants" - Jupiter, Saturn, Neptune, and Uranus. Jupiter and its planets form a striking analogy with the sun and the inner planets because of its moons.

EXERCISES

COMPREHENSION

1. Might Jupiter have a rock core? Where?
2. What is the temperature of Jupiter's core?
3. Describe the hydrogen in Jupiter's core?
4. What are the names of the light and dark bands and how do they differ?
5. What is the Great Red Spot?
6. How long is a day on Jupiter?
7. How many magnetic fields does Jupiter have? Where are they?
8. What would happen to a compass on Jupiter? Why?
9. How many satellites does Jupiter have?
10. How is Jupiter and the moons it has like the sun and its moons?

VOCABULARY LIST I

* dense
* atmosphere
* planet
* magnetic

sulfur - (s) a yellow element

* rotation

equator - a line which divides a body into two halves

* polar
* diameter

revolve - go around

* solar

belt - line
axis - a straight line which a body rotates around
arc - part of a circle

LANGUAGE

1. Fill in each space with one of the words in its correct form: dense; atmosphere; planet; sulfur; magnetic; rotation; equator; diameter; polar; revolve; solar; belt; axis; arc.

   (a) The _____ of Jupiter has poisonous gas in it.
   (b) The temperatures of cities on the _____ are very high.
   (c) The earth spins on its _____.
   (d) Our sun has nine known _____ and one which has been found mathematically.
   (e) The gas at the center of Jupiter is _____ than the Earth's air.
   (f) Our moon is _____ around us in a twenty-eight day orbit.
   (g) The _____ regions of the Earth are very cold.
   (h) _____ is an element used to cure skin disease.
   (i) The _____ of a circle equals 2(r).
   (j) The earth, moon, and sun are all parts of the _____ system.

patch - area
swallow - eat
disturbance - trouble; storm
subsiding - becoming rested
core - middle
compressed - pressed together
metallic - of metal
alternating - coming one after the other
sphere - round object
turbulent - stormy
coincide - come together on the same place
tilted - pointed to one side
wobbles - moves unevenly
reversed - in an opposite direction
condensed - became less in volume but not in weight
density - how much of something is in a given space

LANGUAGE

2. Write the correct word after its definition.

(a) press together _____
(b) become less in volume (not in weight) _____
(c) come together on the same place _____
(d) in an opposite direction _____
(e) coming one after the other _____
(f) round object _____
(g) becoming rested _____
(h) how much of something is in a space _____

3. Circle the word of the correct answer.

(a) Jupiter has a depth of _____ miles.
i) 4,000
ii) 44,000
iii) 444,000

(b) Ammonia's formula is _____.
i) NH_3
ii) NH_4
iii) N_4H_3

(c) Jupiter's core has a temperature which is _____ times hotter than the surface of the sun.
i) 9
ii) 4
iii) 6

(d) The darker stripes we see on Jupiter may have _____ in them.
i) ammonia
ii) sulfur
iii) methane

(e) The Great Red Spot is _____ miles long.
i) 30,000
ii) 3,000
iii) 300,000

(f) Jupiter's equatorial diameter is _____ its poles in length.
i) greater than
ii) less than
iii) the same as

(g) Jupiter's inner magnetic field is tilted _____ degrees to the axis of rotation.
i) 20
ii) 5
iii) 10

(h) The moons closer to Jupiter are of _____ density in comparison to the outer ones.
i) the same
ii) higher
iii) lower

4. The adjectives in List A are formed from the words in List B. Say which adjective is formed from each word.

LIST A	LIST B
(a) metallic	1. axis
(b) alternating	2. please
(c) detectable	3. pole
(d) equatorial	4. magnet
(e) magnetic	5. metal
(f) axial	6. alternate
(g) unpleasant	7. equator
(h) polar	8. detect
(i) molten	9. melt

5. "A temperature of 54,000° Fahrenheit."

On the Fahrenheit scale, ice melts at 32 degrees and water boils at 212 degrees.

On the Centigrade (C) scale, also called Celsius, ice melts at 0°C., and water boils at 100°C. Therefore 32°F. = 0°C.

If part of a degree must be mentioned, we use tenths, and in English books the point which shows the end of the whole number is a period (not a comma). Thus, 98.4°F. is read as ninety-eight point four degrees Fahrenheit, and means 98 and four tenths (4/10) of a degree. (Note: 98.825 is read as ninety-eight point eight two five.)

Read aloud, or write down, the following in full: (a) 32°F.; (b) 75°F.; (c) 10°C.; (d) 37.75°C.; (e) 102.5°F.; (f) 259,370.52°C.

6. Write original sentences containing the following phrases from the passage:
(a) mark the presence of; (b) large enough to; (c) as seen from; (d) more than "x" times hotter than; (e) because of the tremendous _____; (f) once every _____ hours; (g) is thought responsible for.

7. "and ammonia hydrosulfide"
hydro = water (Greek)
Explain the following:
(a) the hydrosphere; (b) hydrodynamics; (c) a hydroplane landed on the lake; (d) hydrous; (e) the child rode a hydrocycle.

LANGUAGE (cont'd)

8. "brownish-red belts"
brownish - rather brown; not exactly brown.
Write sentences containing the following words: (a) reddish; (b) roundish; (c) greenish; (d) bluish; (e) smallish.

SOURCES: Simmons, Henry T. "Mighty Jupiter Could Be Star That Didn't Make It," Smithsonian 5, September, 1974, pp. 30-39.

"Amazing Jupiter Gets More So," Science News 106, December 14, 1974, p. 375.

"Planet Jupiter Consists of Liquid Hydrogen," Aviation Week and Space Technology 101, September 16, 1974, pp. 40-41.

VOCABULARY LIST

* colorless
* molecules
* vapor
* atoms
* hydrogen - (H)
* oxygen - (O)

chemically - about the relationships of elements
exist - be; live
melt - become a liquid
permanent - unchanging

* freeze
* condense

familiar

* planet

state - condition
required - needed
bonds - something that makes things stay together
arrangement - position

LANGUAGE

1. Underline the correct word in parenthesis.

(a) The name for vaporous water is (gas, steam, air)
(b) There is no difference between water and ice (chemically, bondly, physically.)
(c) The reason that H_2O has three names, is that it is so (water, familiar, good.)
(d) We could melt snow and get some (water, ice, ozone.)
(e) On Jupiter, mercury would be a (solid, liquid, gas.)
(f) On Pluto, mercury would be a (solid, liquid, gas.)
(g) On Mercury, iron would be a (solid, liquid, gas.)
(h) The arrangements of the H_2O (atoms, molecules, formulae) is the difference between water, ice, and steam.

2. Write the number of the definition on the line beside the word.

(a) bonds _____
(b) arrangements _____
(c) required _____
(d) chemically _____
(e) permanent _____
(f) state _____
(g) melt _____

1. needed
2. about the elements
3. position
4. known
5. become a liquid
6. something that makes things stay together
7. unchanging
8. condition

VOCABULARY LIST

caution - care
* radiation
* tissue
destroys - kills
diseased - sick; unhealthy
exposure - positioned near something
* aware
swollen - bigger than usual
* peel
* tube
burn - hurt with fire
chest - upper part of the body below the neck
injuries - pain, problems
harm - hurt
signal - something that shows something else
handling - touching
* counters
badge - a small object that the police wear
* radioisotopes
* plastic
protect - cover from harm
transmit - carry
motion - movement
released - freed

LANGUAGE

1. Draw a line from the definition to its word.

upper part of the body	caution
touching	injuries
cover from harm	protect
pain; problems	chest
something that shows something else	handling
sick, unhealthy	swollen
care	diseased
bigger than usual	signal

2. Write the correct answer in the space.

(a) Radioactivity is _____ dangerous. (not very, somewhat, extremely)
(b) _____ are used to tell how much radioactivity is in the area. (magic hands, counters, screw caps)
(c) Magic hands _____ the work of the scientists. (carry, show, hurt)
(d) The radioactive material cannot be touched, so it is handled by _____. (isotopes, remote control, molecules)

(e) Rays are sent out by _____. (badges, counters, radioisotopes)

(f) If a person has cancer, the radioactive material can destroy _____. (only the bad tissue, only the good tissue, both the good and the bad tissue)

(g) Pain is a _____. (big bother, warning signal, injury)

VOCABULARY LIST

liquefy - make into a liquid
* molten
poured - put a liquid into something
cavities - holes
assuming - taking
* mould (mold)
* archaeologist
swords - long knives
weapons - things used for fighting
* casting (cast)
* alloy
varying - changing
implements - devices
vessels - things used to hold liquids
coffins - boxes to put dead people into
coinage - money
noble - high class
* characteristic
owing to - because of
alchemy - changing one metal into another
prospered - grew
solid - real
* smelt
charcoal - black pieces of burned wood
transform - change
* impurities
harmful - bad
* ore
cobalt - (Co)
* nickel - (Ni)
evil - very bad

LANGUAGE

1. Underline the correct word for the definition given.

a. high class - (holes, noble, grundle)
b. evil - (very bad, long knives, money)
c. varying - (changing, shown, taking)
d. coffins - (black pieces of wood, things used for fighting, boxes to put dead people into)
e. nickel - (Na, Ni, Nk)
f. Poured - (changed a metal, put a liquid into something, used a weapon)
g. solid - (real, bad, high class)
h. Cobalt - (Cb, C, Co)

LANGUAGE (cont'd)

2. Fill in the blanks with correct words from the passage.

a. In the past people used _____ in rocks for molds.
b. Because people had no guns, they made _____ by casting them, probably in bronze.
c. In a bronze alloy, if more tin is added, the alloy becomes _____.
d. The Romans used copper for their _____ which kept water.
e. Metals which were not noble were _____.
f. The art of trying to change copper to gold is called _____.
g. In some countries they think that difficulties with smelting is from the _____ _____, but this is not true.

SIR ISAAC NEWTON p. 57

VOCABULARY LIST

* law
motion - moving
* contribution
universally - everywhere
* surpassed
window-sill - bottom wooden part of a window
* genius
dull - not intelligent or bright
beating - hitting
fond of - liked
windmills- devices that catch wind
skill - something one does very well
tradition - old ways; customs
* maintained
undergraduate - college student
branch - part
* calculus
post - position
* knighted - honored
mathematician
* solve
* binomial
challenge - a difficult thing to be done
sought - looked for (seek)
* interval
absent-mindedness - always forgetting things
criticism - say how good or bad something is
pebble - small rock
shell - a small white thing from the sea
unbounded - having no sides

LANGUAGE

1. Put the number of the word next to its definition.

a.	everywhere _____	1.	undergraduate
b.	looked for _____	2.	criticism
c.	college student _____	3.	skill
d.	customs _____	4.	universally
e.	how good something is _____	5.	tradition
f.	not intelligent _____	6.	fond of
g.	liked _____	7.	sought
h.	something you do very well _____	8.	dull
		9.	unbounded

2. Underline the correct answer.

a. Newton contributed the Laws of _____ to physical science.
(Physics, Motion, Nature)

LANGUAGE (cont'd)

b. A _____ is used to catch moving air, to be used for power. (model machine, binomial theorum, windmill)
c. Newton wrote his name with a knife on the _____. (window sill, classroom door, desk and chair)
d. Calculus is part of _____. (Physics, Mathematics, the Laws of Nature)
e. Newton was a genius, but he could never remember where he put things, so they called him _____. (forgettedly, absent-minded, cholera)
f. Newton felt that his binomial theorem was like a pebble and mathematics like the _____. (shells, sea, child)

HEAT AND ITS EFFECTS p. 60

VOCABULARY LIST

* conversion
  convenient - easy
  designed - made
* radiators
* mechanical
* bunsen
* apparatus
  esential - necessary
* junction
* chemical
* furnace
  is preferred - is liked more
  settled - standard
* Fahrenheit
  bitterly - very
  convey - carry
  steadily - not changing wildly
* stationary
  evaporation - the changing of a liquid to a gas
  tap - the device that we turn on to get water
  flows - comes
  react - move; change
  flame - yellow part of a fire
  flicker - movement

LANGUAGE

1. Draw a line from the word to its definition.

a. convenient	1. carry
b. designed	2. come
c. flame	3. liked more
d. evaporation	4. made
e. preferred	5. move
f. essential	6. easy
g. convey	7. yellow part of a fire
h. flow	8. necessary
i. react	9. the changing of a liquid to a gas
	10. standard

2. Fill in the blanks with correct words from the passage.

   a. The electric lamp produces light and _____.
   b. The steam engine changes heat into _____ energy.
   c. Another way to say that the water "got hot" is to say, the water's _____ rose.
   d. Heat can change a _____ to a gas.

e. Heat can change a solid to a _____.
f. When we put a lit match near gas and air, we cause a _____ reaction.
g. When the _____ of liquids are reached, they turn to gases.
h. A fire is an example of heat producing _____.

MAN'S ABILITIES p.65

Since the passage "Man's Abilities" seemed to be rather general, the following passage, more contemporary in kind, was substituted.

AN ASTRONOMER

Caroline Lucretia Herchel was born on March 16, 1750 in Hanover, Germany into an era when education for women of her class was rare. When her father died, Caroline's older brother, William, whom the scientific world now regards as "the father of stellar astronomy" was less a stargazer than a musician. Since he had a well paying career as an organist and music teacher in a resort city, he decided that his young sister deserved better than a job as servant and made up his mind to bring her to England to train for a concert career.

In 1781, while looking up at the stars from his garden, William discovered the planet Uranus[1], which brought him international fame both as an astronomer and a designer and builder of the telescopes to see them by.

William and Caroline left the resort city for it was in the stars that she too was to find her true calling. She and William worked together in collaboration, as close as that of Marie and Pierre Curie, for the next 40 years.

Caroline became adept at calculating the positions of distant sky objects and she also became an expert at the intricacies of telescope making. She had her own small seven-foot telescope to use as a "sweeper" through which she could observe and record all noteworthy

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[1]Uranus - the 7th planet

AN ASTRONOMER (cont'd)

objects in successive zones of the sky. Her own special talent turned out to be the ferreting out of comets. In 1786 she made her first discovery on an August night which impressed the scientific community. At the time of her second cometary discovery in 1788 she received notes from Sir Joseph Banks, who was a distinguished natural scientist and the British Astronomer Royal.

Caroline continued to discover comets and in a move unprecedented in the male-dominated world of English science, George III offered her his royal patronage with the very small grant of £50 a year.

In the course of her four nonstop decades of minding the heavens she personally discovered eight comets in a span of eleven years, helped in building the giant telescope that became the "Eighth Wonder" of her century, and assembled the most comprehensive catalogue of unusual deep-sky objects up to her time. She was rewarded with a Gold Medal for Science by the King of Prussia and voted an honorary member of England's all-male Royal Astronomical Society.

She returned to Germany and wrote her memoirs and continued a wide scientific correspondence that continued almost up to the time of her death on January 9, 1848, two months before her ninety-eighth birthday.

EXERCISES

COMPREHENSION

1. What was education for women like when Caroline Herschel was born?
2. What career did she and her brother plan to go into?
3. What did her brother do in 1781 in his garden?
4. How did this affect their lives?
5. In what areas did Caroline work?
6. What was Caroline's discovery and when did it happen?
7. How many comets did she discover and in how many years?
8. Why was the telescope called the "Eighth Wonder?"
9. What else besides "stargazing" did Caroline do?
10. What famous men recognized her work?

VOCABULARY LIST I

stellar - of the stars
astronomy - the study of things in the sky
career - a lifetime job
planet - an object in the sky that does not give light
concert - music performance
telescope - an instrument used to see distant objects
calculate - find answers
comet - an object in the sky that has an orbit and gives light
royal - of the king or queen
decade - ten years
catalogue - a book of listings
memoirs - a story of what one has done

LANGUAGE

1. Fill in each space with one of the words in its proper form: stellar; astronomy; career; planet; concert; telescope; calculate; comet; royal; decade; catalogue; memoirs

   (a) One might go to a _____ to hear classical music.
   (b) There are ten _____ in a century.
   (c) Most famous people have written their _____.
   (d) _____ is probably one of the oldest sciences on earth.
   (e) One can sometimes see _____ in the sky without the help of special devices.
   (f) Leonardo daVinci designed many _____.
   (g) Scientists are always mathematically _____ the positions of the bodies in the solar system.
   (h) By looking into a clear sky at night, we become _____ observers.
   (i) People sometimes think of a _____ before deciding what to study in college.
   (j) One can look in a _____ for prices before buying an object.
   (k) The 10th _____ has been found mathematically but not seen yet.

rare - seldom found
stargazer - one who looks at stars
resort - place of fun
collaborator - worker on the same project
adept - good at doing something
intricacies - small points
observe - see
talent - something one does very well
ferreting out - finding something from many objects
distinguished - special
unprecedented - never done before
grant - prize
patronage - someone special's guiding
rewarded - gave a prize
male - man
correspondence - writing and receiving letters

LANGUAGE

2. Write the words on the lines before their definitions.

a.	_____	see
b.	_____	distinguished
c.	_____	seldom found
d.	_____	never done before
e.	_____	gave a prize
f.	_____	small points
g.	_____	something one does well

3. Cross out the wrong answer.

(a) Caroline and William were both (astronomers; musicians; organists).
(b) They worked together for (4 centuries; 40 years; 4 decades).
(c) Caroline was adept at (discovering planets; the intricacies of the telescope; discovering comets).
(d) She worked at (building England's "Eighth Wonder"; discovering Uranus; assembling a catalogue of sky objects).
(e) She received recognition from (France; Prussia; England).
(f) Men were surprised at Caroline's work because she was (a woman; so adept; married to a scientist).

4. Put the following into the simple present tense:

The King of Prussia rewarded her work and the Royal Astronomical Society noted her an honorary member. She returned to Germany and wrote her memoirs and continued a wide scientific correspondence. They were glad that they had left the resort city, for it was in the stars that they were to find their callings.

5. Change the following to questions:

(a) Caroline continued to discover comets.
(b) She had her own seven foot telescope.
(c) Caroline was born March 16, 1750.
(d) The scientific world now regards him as "the father of stellar astronomy."
(e) Caroline became adept at calculating their positions.

LANGUAGE (cont'd)

6. Write original sentences containing the following:

(a) a well paying career (b) became adept (c) in a span of _____ years (d) as close as (e) male-dominated

7. "William, whom the scientific world now regards as 'the father of modern stellar astronomy'..."

Relative clauses are independent clauses usually introduced by a relative pronoun or relative adverb. Point out the relative clause and its connective.

(a) Caroline was born into an era when education for women in her class was rare.
(b) William discovered Uranus which brought him international fame.
(c) She made her discovery on an August night, which impressed the scientific community.
(d) She had a hand in building the giant telescope that became the "Eighth Wonder."
(e) She received notes from Sir Joseph Banks, who was the distinguished natural scientist.

8. "was less a stargazer than a man of music."

This means that he was a man of music first, a stargazer second.

Complete the following:

(a) She was less a _____ than a chemist.
(b) He was less a father than a _____.
(c) They were less inventors than _____.
(d) The cat seemed less a _____ than a sleeper.
(e) The position seemed less _____ than good.

SOURCE: Pierce, Elizabeth. "Caroline Herschel: Tale of a Comet," Ms 7, January, 1974, pp. 16-17.

EXPLORING THE MOON p.69

Since "Exploring the Moon" was taken from a work written in 1962, and since the Apollo journey took place in 1974, the passage has been substituted by a more contemporary subject.

QUASARS

During more than a decade of observation, astrophysicists have wondered what quasars are. On the whole they have made slow progress with the questions. Quasars look like stars but radiate as much energy as galaxies; therefore, much of the guessing about them has linked them to galaxies.

One suggestion is that quasars are evolutionarily connected to galaxies; that they represent a time in the development of a galaxy when it is all center -- before its outer parts have developed. A similar view sees a quasar as a galactic center whose outer parts, for some reason, never developed but which are not necessarily evolving into a more usual type of galaxy.

Finally there is the view that quasars are violent events, explosions, in the centers of already developed galaxies. This last hypothesis explains the starlike appearance of quasars by stating that the brightness of the center washes out the light from the surrounding galaxy. Astronomers who support this hypothesis have in recent years shown photographs in which the images of some quasars were surrounded by fuzzy nebulosities [1] that might be galaxies. And now J. B. Oke and

[1] nebula - a cloudy luminous patch in the heavens which consists of a galaxy of stars, or of material from which galaxies are made.

QUASARS (cont'd)

James Gunn have obtained spectra[2] from the quasar-like object, BL Lacerta, that are characteristic of old stars in spherical galaxies.

But what do we really know about quasars? Not much. Quasars are both incredibly bright and incredibly tiny; they are far more luminous than the largest galaxies, which contain many billions of stars, yet they are much smaller than a normal galaxy. The brightest quasar, 3C273, radiates a thousand times more energy into space than our entire galaxy of 200 billion stars, but it occupies less than one trillionth of our galaxy's volume. They can be seen at a greater distance than any other object in the sky.

One bizarre theory suggests that the huge energy output of a quasar comes from the annihilation of matter and antimatter. Ordinary matter makes up most of the material in our universe. Antimatter - composed of the counterparts of ordinary matter is a rare and exotic substance. When antimatter and matter meet, the two immediately annihilate each other in a burst of pure energy. The energy so released is hundreds of times greater, pound for pound, than the energy given off by nuclear reactions in atomic bombs and easily adequate to account for the energy output of quasars. The question is: Where would large amounts of antimatter come from? This theory suggests that an antimatter universe exists side by side with ours, perhaps in another dimension, and that what we see as quasars are simply holes in the "fabric" of our universe, through which antimatter is pouring from that universe.

Research which has been and is being done on quasars tends to favor the hypothesis that quasars are events in the nuclei of galaxies, but the cause of such explosions has yet to be determined.

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[2] spectrum - the result obtained when electromagnetic radiations are resolved into their constituent wavelengths or frequencies

COMPREHENSION

1. Who has been researching quasars?
2. Why is it difficult to make a definite definition of quasars?
3. What are three theories as to what quasars are?
4. How does one hypothesis try to explain quasars' starlike appearance?
5. What do they have for proof of their theory?
6. What are some characteristics of quasars?
7. Name two quasars.
8. How well can they be seen?
9. Why is one theory called "bizarre?"
10. When is the great amount of energy produced?

COMPOSITION

Do you think we will ever be able to use the energy of quasars? How?

VOCABULARY LIST I

astrophysicist - one who studies the laws of physics as applied to astronomy
radiate - give light
galaxies - systems of stars, nebulae, gases, and dust
evolution - process of changing, from an early stage
nebula - a cloud of dust and gas
spherical - round
luminous - bright
annihilation - complete destruction
universe - everything that exists
antimatter - matter which is the opposite of other matter
* nuclear
* atomic

LANGUAGE

1. Fill in each space with a word from the list in its right form: astrophysicist; radiate; galaxies; evolution; nebula; spherical; luminous; annhilation; universe; antimatter; nuclear; matter.

   (a) Stars are _____ bodies.
   (b) The sun, planets, stars, and moons make up the _____.
   (c) When there is no more oil, coal, or gas, we might be using wind, solar, and _____ power.
   (d) Our moon's shape is _____.
   (e) Both the sun and phosphorus _____ light.
   (f) The negative of all matter is _____.
   (g) Our solar system is part of our _____.
   (h) Charles Darwin developed the Theory of _____.
   (i) An _____ would have a lot of information about holes in the universe.
   (j) A large amount of energy can be produced from a small amount of _____.
   (k) There exist many _____ outside our galaxy.
   (l) _____ occurs when all of something is killed.

VOCABULARY LIST II

link - connect
evolving - changing
violent - extreme
washes out - erases
recent - near to now
images - shapes
fuzzy - unclear
incredibly - not to be believed
tiny - small
bizarre - very strange
exotic - very different
pure - unmixed
adequate - enough
output - something given out
fabric - material

LANGUAGE

2. Write original sentences with these words:
(a) violent (b) recent (c) fabric (d) bizarre (e) tiny
(f) image (g) adequate

3. Circle the correct answer.

(a) Quasars have been being researched for _____ years.
i) 100 ii) 20 iii) 30
(b) Cloudy patches in the heavens from which galaxies were made are _____ i) universe ii) planets iii) nebulae
(c) The largest galaxies contain many _____ of stars.
i) millions ii) billions iii) zillions
(d) Quasar 3C273 occupies less than one _____ of our galaxies' volume. i) 1,000,000,000th ii) 1,000,000th iii) 1,000,000,000,000th
(e) When matter and antimatter meet, they burst into _____.
i) nil ii) energy iii) zero
(f) Wavelengths which have been resolved from electromagnetic radiations are called _____. i) spectra ii) ionosphere iii) nebula
(g) The energy given off by quasars is greater than the energy given off by _____. i) the earth ii) atomic bombs iii) the moon iv) all of these

4. "more than a decade." A decade (pronounced DEKAD) = ten years. A century = 100 years. A millennium = 1,000 years. The plural of "millennium" is "millenniums" or "millennia." The plural of "phenomenon" is "phenomena." Several other scientific terms have plurals from Greek or Latin. "Nucleus"; plural "nuclei." "Spectrum"; plural "spectra." "Nebula"; plural "nebulae." Thus:

Singular	Plural
-um, -on	-a
-us	-i
-a	-ae

How long are the following? (a) A century (b) Six millennia (c) Nine centuries (d) Eight decades (e) Half a decade

Say whether each of the following is singular or plural:
(f) formulae (g) alumni (h) data (i) alumnus (j) formula (k) datum

5. "One bizarre theory suggests that the huge energy output of a quasar comes from the annihilation of matter and antimatter. (Subjective complement)

Noun clauses may function as a noun. Name the noun clauses and give their functions:

(a) Finally there is a view that quasars are violent events....
(b) One suggestion is that quasars are evolutionarily connected to galaxies...
(c) This theory proposes that an antimatter universe exists side by side with ours...
(d) Research tends to favor the hypothesis that quasars are events in the nuclei of galaxies.
(e) ... by stating that the brightness of the center washes out light from the surrounding galaxies.

6. Give the nouns of the following:
(a) galatic (b) atomic (c) fuzzy (d) spherical (e) starlike

Give the adjectives of the following:
(a) favor (b) universe (c) distance (d) type (e) theory

7. Fill in each space with the proper preposition:
(a) It is evolving _____ a larger mass.
(b) Acorns come _____ oak trees.
(c) Ammonia is composed _____ nitrogen and hydrogen.
(d) When the men arrived, they had to account _____ what they had done.
(e) Work is being done _____ the new machines for the shop.

Write sentences containing the following verbs and prepositions:
(a) washes out (b) surrounded by (c) pick up (d) run back (e) walk away

8. "Antimatter - composed of the counterparts of ordinary matter....."
Anti; = opposite; opposed (Latin)

Explain the following:
(a) Put antifreeze in your car. (b) An antimagnetic alloy (c) The antiaircraft missile shot two jets. (d) The antivitamin made the orange of no use. (e) An antineutron

9. "Less than one trillionth of our galaxy's volume "
one trillionth = 1,000,000,000,000th

Write these words in numbers:
(a) twenty-third (b) two hundred and fiftieth (c) six billionth
(d) nine hundred and seventy-first (e) twelve thousandth
(f) one million, six hundred and seventy-four thousand, eight hundred and twenty-fifth.

Write the following in words:
(g) 9,7532th (h) 8,000,000,000th (i) 7,777,777th (j) 6,203rd
(k) 2,001st

10. "at a greater distance than"

The comparative degree is used with "than" when the comparison is made between two items. Point out the comparatives and their position in relation to "than":

(a) They are far more luminous than the largest galaxies.
(b) 3C273 radiates a thousand times more energy to space than our entire galaxy.
(c) ... it occupies less than one trillionth of our galaxies volume.
(d) They can be seen at a greater distance than any other object in the sky.
(e) The energy released is hundreds of times greater than the energy given off by nuclear reactions.
(f) They are much smaller than the largest galaxy.

Source: "Nearest Quasar: An Explosive Birth," Science News 105, April 6, 1974, p.222.

VOCABULARY LIST

juvenile - young
enterprises - ideas and jobs
* telegraphist
inventor - one who makes something new
* laboratory
cellar - room below a house
* chemical
printing - marking with ink
bits - small pieces
local - about near places (not far places)
conclusion - ending
rounding - going around
track - the road of the train
* phosphorous
* ignite
extinguish - put out; stop
deafness - not hearing
career - lifetime job
dived - jumped down
giving up - leaving
income - money from working
unearning - not having money paid
speediest - fastest
rivals - people not on the same team
* device
* operator
* signal
researches - information gotten for college or work
mystified - not understood
* rim
dots - signals used in telegrams

LANGUAGE

1. Write the word after its definition.

(a) room below a house _____
(b) marking with ink _____
(c) lifetime job _____
(d) not having money paid _____
(e) the road of the train _____
(f) getting information _____
(g) put out a fire _____

2. Fill in the blanks with correct words from the passage.

(a) Edison had his first laboratory in his father's _____ and another laboratory in a _____.
(b) When Edison was older he became a _____.
(c) The train was dangerous because it had no _____.
(d) When Edison was learning the telegraph, he had no _____.
(e) Because Edison was the fastest telegraphist, he always won over his _____.
(f) Edison's device always answered the hourly messages, but it didn't answer the _____ ones.

VOCABULARY LIST

* ward
  jaw bones - the bones that move when we talk
  utter - say
  mirrors - glass in which we can see ourselves
  forbidden - not permitted
  spirits - powers of the mind
  stage - a point in time
* colleague
  confidence - sureness
  cheerful - happy
* surgeon
* operation
* disfigured
  forehead - top front of the head
  damaged - hurt
  graft - grow one thing onto another
  repair - fix
  fortune - chance
  delight - make happy
  reconstructed - built again
* principles
* diagrams
  wounds - cuts
  to face - to meet
* tremendous
  sculptor - one who make statues
* muscle

LANGUAGE

1. Draw a line from the word to its definition.

(a)	utter	1.	make happy
(b)	fortune	2.	chance
(c)	sculptor	3.	sureness
(d)	wound	4.	happy
(e)	confidence	5.	say
(f)	forbidden	6.	one who makes statues
(g)	delight	7.	not permitted
(h)	cheerful	8.	cuts

2. Underline the correct answer.

(a) Men could not eat because they had broken (arms, jaws, noses)
(b) The men could not speak because they had (sepsis, bandages, plastic) on their faces.
(c) Susruta Samhita's Hindu method showed a piece of skin from the (arm, jaw, forehead) folded to the disfigured nose.
(d) Tagliacozzi's method used skin cut from the arm to be (surgeon, colleague, grafted) on to the damaged nose.
(e) In the 18th century an Indian surgeon did a new thing when he (reconstructed, exploded, repaired) a missing nose.
(f) Some things grafted were (eyes, hearts, bones).
(g) Another word for surgery is (reconstructive, grafted, sepsis) surgery.

ELECTRICITY IN EARLY DAYS p.83

VOCABULARY LIST

jar - a bottle with a wide top
* condenser
merely - only
* mercury - (Hg)
* alcohol - (CH_3OH)
practical - useful
amusement - fun
accounts - stories
monks - religious men
company - group
* contact
* battery
leaped - jumped
kite - a paper apparatus that flies
sparks - pieces of fire
* electrocuted
puzzled - make someone not understand
nerve - a part of the body that lets us feel
* chemicals
parent - mother or father
maintain - keep
* pioneer
relationship - contact
* magnetism
compass - an instrument that shows magnetism
patient - slow and careful
govern - control
* coil
rotated - moved around
poles - ends

LANGUAGE

1. Circle the letter(s) of the correct word for the given definition.

a. group
i) patient
ii) contact
iii) company

b. slow and careful
i) patient
ii) puzzled
iii) pioneer

c. keep
i) maintain
ii) relationship
iii) account

d. an instrument that shows magnetism
i) jar
ii) compass
iii) kite

e. control
i) maintain
ii) govern
iii) amuse

f. move around
i) rotate
ii) useful
iii) monk

g. part of the body that lets us feel
i) parent
ii) pole
iii) nerve

LANGUAGE (cont'd)

2. Write the name of the man beside what he did.

Franklin Faraday Galvani Ampere Oersted Volta

(a) _____ found that a relationship exists between electricity and magnetism.
(b) _____ discovered that a dead frog's legs would move from contact with electricity from a jar.
(c) _____ discovered than an electric current will flow in a coil of wire when the coil is rotated between the poles of a magnet.
(d) _____ flew a kite in a thunderstorm.
(e) _____ fixed the laws which govern electromagnetic effects.
(f) _____ produced the parent of modern batteries.

VOCABULARY LIST

* pendulum
cathedral - big church
attendant - worker
* consecutive
swing - a movement from one side to another
stop watch - a watch that can stop, for racing
* pulse
* duration
given - standard
* oscillation
* device
patients - sick people
contemporary - of the times
forerunner - the first of something
clad - dressed
* dynamics
independent of - free of
period - a duration of time
theory - idea
formulation - making
force - power
gravity - the pull of the earth
* release
* attach
* arc
spheres - round objects
spectators - people who watch

LANGUAGE

1. Write the number of the correct definition next to its word:

(a) formulation	1. sick people
(b) force	2. free from
(c) spectators	3. making
(d) patients	4. power
(e) swing	5. something that's first
(f) contemporary	6. dressed
(g) theory	7. people who watch
(h) period	8. duration of time
(i) forerunner	9. of the times
	10. idea

2. Fill in the blanks with words from the passage:

(a) Galileo noticed the _____, swinging in the cathedral.
(b) Although their swings were becoming shorter, their time was _____.
(c) If we take two pieces of equal length string and put a heavy stone on the end of one, and a light stone on the end of the other, then swing them, their oscillation period will be _____.
(d) Galileo used a _____ to measure patients' pulse.
(e) The period of the pendulum is _____ of the size of the pendulum.
(f) The pendulum's motion is caused by the force of _____.
(g) If we want to try Galileo's experiment, we must use two _____.

A WARMER OR A COLDER EARTH p.82

Since the passage "A Warmer or a Colder Earth" had insufficient information, a more conclusive passage was substituted.

CHANGES IN THE WORLD'S WEATHER

Present changes in the Earth's weather began with a warming after about 1890. Mean temperatures rose in 1945 and have been dropping ever since. The total drop since the Forties is about 2.7°F. The effects have been large in altering the vast integrated system of winds that move around the planet. The saddest part of the new wind pattern has been the blocking of necessary monsoon rains upon which large sections of Africa, Asia, and Central America depend. Elsewhere in the world there seems to be a return to the more extreme and variable weather conditions, including floods, droughts, and great winter blizzards.

What makes the temperature change? The earth's orbit around the sun and the axis on which it spins; the amount of solar radiation that gets absorbed by the earth and the atmosphere; and particles in the air such as dust which dim the sunlight. Large amounts of CO_2 in the atmosphere from fires, furnaces, and engines serve to entrap heat waves in a "greenhouse effect" but this seems to be overpowered by the cooling affect of the dust.

The agreement among meteorologists is that the earth is now heading very slowly into another major ice age such as the ones that brought the glaciers deep into North America before it retreated some 10,000 years ago. One of climatology's conclusions is that for at least the past 700 thousand years, global mean temperatures have been as high as they

are now only about five percent of the time. Poleward-trending air hits great caps of heavy, cold air extending outward from either pole. Together, the westerly winds and the polar air make up what meteorologists call the "circumpolar vortex." It resembles a great skirt around the poles. The lower hem is full of waves and turbulence, particularly in the Northern Hemisphere where there are numerous mountain ranges. Instead of going northward as the Northern Hemisphere warms up each summer, the lower hem of the vortex has stayed unusually far south. In turn, the great desert-forming belts of descending air have been pushed farther south into heavily populated regions. The air from these high pressured zones has prevented the moisture-laden summer monsoon winds from penetrating into grazing lands that are dry the rest of the year. So the blocked monsoons have dropped their rainfall into the ocean or into regions that have too much rain anyway. If these weather patterns continue, they will shift entire deserts, such as the Sahara, southward, and all efforts to stop them will be futile.

No one has much idea as to how long this new pattern will last or how far it will proceed, but if the Earth is cooled it will take decades to warm back up.

EXERCISES

COMPREHENSION

1. What types of things affect the weather?
2. Describe the "greenhouse effect."
3. When did temperatures rise? When did they begin to fall?
4. What has been an unfortunate result in the new wind pattern?
5. What kind of things can we expect from the new kind of weather?
6. What does the circumpolar vortex consist of?
7. Describe the lower part of this.
8. What has happened because the lower part of the vortex has stayed far south?
9. Why doesn't India get the monsoon rains of the past?
10. What is happening to the Sahara Desert?

COMPOSITION

1. Changes in My Country's Climate
2. The Effects of the Use of Coal and Oil.

VOCABULARY LIST I

monsoon - a wind system in which wind blows from land to sea for six months and from sea to land six months
* meteorologist
* glaciers
climatology - the study of climate
vortex - a place of fast curving motion
hemisphere - half of the earth
zone - area
desert - a dry, hot region
moisture - wetness
tropics - area above and below the equator
* orbit
* dioxide
* absorb

LANGUAGE

1. Fill in each space with one of the words from the list in its right form: monsoon; meteorologist; climatology; glacier; vortex; hemisphere; zone; desert; moisture; tropics; orbit; dioxide; absorb.

(a) Africa is in the southern _____.
(b) The camel is an animal which can exist well in the _____.
(c) People who forecast the weather are called _____.
(d) If one were caught in a _____ in water, one might die.
(e) Our moon _____ the earth every 28 days.
(f) _____ are found in the polar regions.
(g) When steam condenses we get _____.
(h) The Panama Canal is located in the Canal _____.
(i) When the _____ come, there is no dry land to be found.
(j) A meteorologist would have studied _____.
(k) People who live in the _____ might never have seen snow.
(l) Carbon _____ is not the only compound of C and O.
(m) A sponge _____ water.

VOCABULARY LIST 11

dim - make less bright
trapping - catching and holding
alternating - changing
integrated - different; mixed
blocking - stopping like a wall
variable - changeable
retreated - went back
mean - average
circumpolar - around the pole
hem - bottom of a skirt
populated - full of people
penetrating - going into
laden - full
grazing lands - places where animals eat grass
shift - change
futile - useless

LANGUAGE

2. Draw a line from the word to its definition.

(a)	futile	1.	bottom of a skirt
(b)	dim	2.	catching and holding
(c)	trapping	3.	make less bright
(d)	populated	4.	changing
(e)	laden	5.	useless
(f)	hem	6.	full of people
(g)	alternating	7.	mixed
(h)	integrated	8.	went back
		9.	different

3. Write the correct answer in the space.

(a) The total drop in the earth temperature since the forties is about _____. (1.7°F.; 2.3°F.; 2.7°F.)
(b) Meteorologists believe that we are going to have another _____. (ice fall; ice age; ice vortex)
(c) For the past _____ years, global mean temperatures have been as high as they are now only 5 percent of the time. (10,000; 700,000; 1,000,000,000)
(d) The lower part of the vortex is quite turbulent, especially in the Northern Hemisphere where there are many _____. (deserts; oceans; mountains)
(e) Because the monsoons don't reach the _____ they are drying up. (grazing lands; vortex; deserts)
(f) The monsoons have been dropping their rain in the _____. (deserts; ice age; oceans)

4. "circumpolar vortex" = a vortex that goes around the poles
The prefix Circum (from the Latin) - around

Guess the meaning of each word that has <u>circum</u> in it.

(a) The circumference of a circle
(b) circumrotate
(c) circum-Saturn
(d) Magellan circumnavigated the world.
(e) circumorbital

5. "If the Earth is cooled, it will take decades to warm back up."
The use of the present (is) and <u>will</u>, instead of the past (were) with <u>would</u>, makes the event seem unlikely. The writer here <u>does</u> think that Earth can be cooled.

By changing the verbs, make the IF-clause seem unlikely, or hypothetical.

(a) If we use a very short wavelength, we shall do better.
(b) We shall see something interesting if we watch Mars next week.
(c) Those men will see a lot of ice if they go to the South Pole. But they are probably going to the equator.
(d) The jet plane will fly faster if it goes higher.
(e) If the professor heats the material to a temperature of 1,000°C. this afternoon, it will melt.

6. "Poleward" = in the direction of the Pole

Make sentences with these words:

(a) southward
(b) forward
(c) inwardly
(d) westward
(e) backwards

7. "decades to warm pack up" - A decade (pronounced DEKĀD) = 10 years. A century = 100 years. A millennium = 1,000 years.

The plural of millennim is millenniums or millennia. The plural of phenomenon is phenomena. Several other scientific terms have plurals from Greek or Latin: nucleus; plural nuclei. spectrum; plural spectra. nebula; plural nebulae. Thus:

Singular	Plural
-um,-on	-a
-us	-i
-a	-ae

How long are the following? (a) a decade (b) two millennia (c) five centuries (d) four decades (e) a quarter of a century

Say whether each of the following is singular or plural:
(f) phenomenon (g) phenomena (h) nuclei (i) nebula (j) spectra

8. The following are the answers to some questions. Give the answers:
(a) 10,000 years ago (b) a great skirt (c) high pressured zones
(d) futile (e) more extreme weather conditions

9. "in the past 700 thousand years" - a thousand = 1,000. Like million and hundred, it is not put into the plural before a noun or after a number. So we can say five thousand people (not thousands). But when it stands alone, it can take the -s: There are thousands and thousands of pieces of sand in one shoe box.

In each space put hundred/s, thousand/s or million/s:

(a) There are three _____ books in the library.
(b) Five _____ students attended the lecture.
(c) He said that there are _____ of stars in the universe.
(d) The doctor has _____ of patients: probably four hundred.
(e) The airplane covered four _____ miles in eight hours.

Write the following words:
(f) 2,000 books (g) 7,000,000 people (h) 186,000 miles.

Write the following in figures:
(i) two hundred and forty-five thousand, seven hundred and ninety-one.
(j) six million, six hundred thousand.

SOURCE: Alexander, Tom. "Ominous Changes in the World's Weather," Fortune 89, February, 1974, pp. 90-95

LIGHT AND HEAT ON THE MOON p.96

Since this piece was written in 1931, it was deemed necessary to substitute a more up-to-date passage.

HOW THE MOON BEGAN

Capture of a foreign body by the earth is gaining new popularity as a theory for the origin of the moon. At the same time, a trend is also coming out to see a growing popularity in the commonality of the earth and the moon - and in all the inner solar system planets.

Geophysicists first began to note great similarities between the earth and moon a while ago, but the chemistry of the two planets was considered almost unconnected based on Apollo sample analysis. While the chemistry remains distinct, there is a tendency now to find a way to consider a common starting material for all the terrestial planets. Evolutionary and environmental differences after formation thus may account even for wide detail variations.

Fission from the earth, the second of the three lunar origin hypotheses, is having a difficult time despite any new ideas of commonality. Dynamic problems are the biggest ones, but there are also chemical objections.

Binary formation - condensation of the earth and moon from the same solar nebula gas cloud - is clear and straightforward and has support among lunar scientists because it's simple. However, it also runs into compositional objections. If the earth and the moon condensed from the same cloud, the question follows why the earth ended with so much and the moon so little iron.

HOW THE MOON BEGAN (cont'd)

Capture has dynamic and possibly time-scale obstacles, too. One is the so-called Roche limit[1] of earth, which varies with density of a passing body but is in the 14,000-19,000 km. range. If a protomoon passed within this limit, tidal forces[2] would cause its disintegration. It is thought that a passage of a body just at the Roche limit would result in selective disintegration. Most of the fragments would escape the earth in orbits; however, almost half would be captured. Fragments of this and possibly numerous other encounters in an early solar system would eventually add up to the earth's present moon. Of course, a gathering of fragments orbiting the earth in orbits of various inclinations, some even in retrograde, would take a long time to assemble into the ultimate moon.

These theories are only that, however, and none has been proven to satisfy all astronomers yet. The most ancient lunar rocks brought back from the moon are reported to be 4.1 billion years old compared to the oldest earth rock which is 3.5 billion years old. This does not mean, however, that Earth is younger than the moon. On the earth, wind and water have had time to destroy all that was on the surface more than 3.5 billion years ago. But what happened to the moon?

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[1]Roche's limit - the least distance from a planet at which a liquid satellite could revolve without being disrupted by tidal forces

[2]tidal forces - gravitational attraction of the sun and the moon

EXERCISES

COMPREHENSION

1. How many billions of years old are the earth and its moon?
2. What are three theories of the earth's moon? Explain them.
3. What is the problem with the fission theory?
4. When was the fission theory seriously challenged?
5. What are some scientists saying about all terrestial planets?
6. What is the problem with the binary formation theory?
7. Why did scientists like it before?
8. Why does the Roche limit present a problem?
9. What might have made up the moon under the captive theory.
10. Is the earth older than the moon?

VOCABULARY LIST I

theory - idea
geophysicist - one who studies the motion, constitution and structure of the earth
analysis - proving by working from the conclusion to the given condition
terrestial - of the earth
environmental - conditions around something
fission - separation
lunar - of the moon
binary - two
protomoon - first (original) moon
retrograde - in an opposite direction
disintegration - breakdown into smaller parts

LANGUAGE

1. Fill in each space with one of the words in its proper form: theory; geophysicist; analysis; terrestial, environmental; fission; lunar; binary; protomoon; retrograde; disintegration; tidal force.

   (a) The chemist has several ways to make a chemical _____ in a lab.
   (b) An eastern moving body is traveling in _____ when it travels westwardly.
   (c) In _____ when the nucleus is split into two parts, it releases a lot of energy.
   (d) H_2O_2 is a _____ compound.
   (e) Einstein developed the _____ of Relativity.
   (f) When we wish to speak of the moon as it was developing, we can call it the _____.
   (g) Because we live on the earth, we are called _____ beings.
   (h) Moonshine might be called _____ light.
   (i) A _____ studies conditions of the motion of the earth.
   (j) A piece of sugar _____ in a cup of tea.
   (k) _____ makes the sea very high or very low.
   (l) Having dirty rivers is an _____ problem.

VOCABULARY LIST II

capture - get and keep
trend - popular way of thinking
commonality - oneness
distinct - quite different
formation - making
condensation - thickening
objections - negative reactions and questions
obstacles - problems
passage - passing
selective - taking some, but not all
escape - go away
fragments - parts
encounters - meetings
accrete - add new material
assemblage - grouping

LANGUAGE

2. Circle the correct word for the definition.

(a) get and keep	(orbit - capture - nebula)
(b) quite different	(clear - distinct - overt)
(c) making	(formation - seizing - passing)
(d) add new material	(accrite - accrate - accrete)
(e) become thick	(consider - condense - densize)
(f) take some but not all	(fission - binary - selective)
(g) problems	(obstacles - tides - distincts)
(h) grouping	(fission - assemblage - ordering)
(i) parts	(pantaloons - figments - fragments)
(j) negative reactions	(objections - electrons - pions)
(k) oneness	(compatibility - commonality - compartiality)

3. Explain the following in any suitable way:
(a) so-called (b) is clear and straightforward (c) runs into
(d) to consider a common starting point (e) despite any new ideas

4. Give the adjectives of the following words:
(a) moon (b) commonality (c) chemistry (d) density (e) select

Give the nouns of the following words:
(a) environmental (b) solar (c) dynamic (d) assemble (e) tidal

5. "The second theory is having a difficult time despite any new ideas of commonality."
Another way to write this is to use "however" to connect two clauses. The phrase "despite any" is followed by a noun, so in the new clause we must put in a verb. (There are new ideas of commonality, however the second theory is having a difficult time.)

LANGUAGE (cont'd)

Change the sentences, using "however":

(a) We shall come despite the cold.
(b) He can read despite his blindness.
(c) The chemist breathed despite any gas in the air.
(d) The farmer worked outside despite the rain.
(e) They continued their projects despite any obstacles.

6. Give each word in List A its opposite from List B.

List A: wide; similarities; clear; terrestial; integration; common; younger; possibly; inner; distinct

List B: unclear; impossibly; uncommon; narrow; indistinct; differences; disintegration; older; extraterrestial; outer

7. Draw a picture in which you show how the moon began according to one of the given theories, or one of your own.

8. "in the 14,000-19,000 km. range."
One km or kilometer = 5/8 mile.

Change these distances in kilometers to distances in miles:
(a) 19,000 km; (b) 240 km; (c) 36,024 km (d) 2,000,000 km
(e) 5,280 km (f) 80,808 km (g) 14,000,000 km.

SOURCE: "Scientists Trace Earth-Moon Similarities," Aviation Week and Space Technology 100, May 13, 1974, pp. 38-41.

COMETS p.101

Add these paragraphs:

Kohoutek is our most famous contemporary comet. In January of 1975, the space probe, Mariner 10, then on its way to Venus and Mercury, was able to photograph the comet from outer space. From these photos, scientists have found evidence of certain compounds which may substantiate the belief that comets originate from giant planets such as Jupiter or Saturn.

Although Kohoutek was not a spectacular astronomical display, it did provide scientists with valuable new insights into the nature of comets.

VOCABULARY LIST

* solar
* major
  minor - small
  comets - bright objects in the sky having tails
  planets - the nine major objects in the sky which are not burning
  faint - not bright
  unaided - alone; not being helped
  so far - until now
* recall
  casual - careless
  glance - short look
  disappear - hide
  plot - follow on paper
* observations
  adapted - fit to a change
  trace - follow with the eyes
* series
* elongated
* orbit
* perihelion
  aphelion - greatest distance from the sun
* average
  interval - period
  influence - effect
* angle
  evidence - information
  substantiate - help to prove
  spectacular - wonderful
  astronomical - of the universe
  display - show

LANGUAGE

1. Write the word for each definition.

(a) follow on paper _____
(b) not bright _____
(c) effect _____
(d) careless _____
(e) hide _____
(f) period _____
(g) small _____
(h) fit to a change _____
(i) help to prove _____
(j) show _____

2. Write the correct answer on the line at the right.

(a) Comets are (planets; stars; meteors; none of these) a. _____
(b) The part of the comet that is not very bright is the tail; nucleus; perihelion; orbit) b. _____
(c) A comet's tail points (towards; away from; on; around) the sun. c. _____
(d) When a comet is closest to the sun, this is its (aphelion; major; perihelion; faint) d. _____
(e) Halley's Comet is at least (1,910; 65; 77; 2,100) years old. e. _____
(f) The time of a comet's orbit changes because of the (number; influence; aphelions; brightness) of the planets. f. _____
(g) Halley's Comet was first recorded by (The Hindus; cavemen; Halley; the Chinese) g. _____
(h) Kohoutek gave us information about how comets are probably made from (gases; hydrogen; stars; planets) h. _____
(i) The last planet that has been seen is (Kohoutek; Halley's; Chin-su; none of these) i. _____

SOURCE: McClure, Michael. "Comet Kohoutek," Chemistry 48, February, 1975, pp. 23-24.

OIL AT BABA GURGUR, IRAQ p.105

VOCABULARY LIST

consist - be made of
limestone - a soft white rock
* precaution
* drill
casing - tube
rush - quick movement
tools - devices
hiss - a sound
boilers - something used to heat
* pound
* reservoir
unaware - unconscious
piercing - sharp
drowned - covered
* release
* extinguish
* generator
gushed - almost exploded
* vapour
task - job
range - distance
roar - loud noise
ankle - back of foot
standstill - stop
approaching - coming near
misted - rained lightly
* windscreen
steelwork - derrick
drifted - moved slowly

LANGUAGE

1. Write the number of the definition before its word.

(a)	_____	distance	1. coming near
(b)	_____	unaware	2. a soft white rock
(c)	_____	approaching	3. made of
(d)	_____	limestone	4. misted
(e)	_____	tools	5. a sound
(f)	_____	lightly rained	6. devices
(g)	_____	consist	7. range
(h)	_____	drifted	8. unconscious
			9. moved slowly

LANGUAGE (cont'd)

2. Write the correct answers on the lines at the right.

(a) Oil had been found in the (mud; limestone; boiler) _____
(b) The main method of drilling had been (rotary; precaution; percussion) _____
(c) They kept (diamonds; steel; mud) to keep the oil from gushing up. _____
(d) The oil gushed up because it had been under (mud; pressure; steam). _____
(e) (Gas and oil vapour; gas vapour and limestone; limestone and oil vapour) were coming out of the well. _____
(f) The (rotary drill; bit; casing) cracked the limestone. _____
(g) Messages had gone by (letter; radio; telegram). _____

ARRIVING FROM OUTER SPACE p.110

VOCABULARY LIST

detect - find; notice
trace - small part
* orbit
sputnik - a kind of rocket
* vacuum
finest - best
* pumps
* polar
* conduct
ionosphere - layer that contains ions
reflect - send back
ions - negative-charged atoms
wireless - radio
* meteors
intensely - very
* vaporize
plunge - dive
density - thickness
creatures - living beings
* stratosphere
* meteorologists
relatively - quite; rather
* equator
fog - thick air
hail - falling ice
absorption (absorb) - take in
alternating - changing
twilight - evening
intense - very strong

LANGUAGE

1. Draw a line from the definition to its word.

(a)	small part	1.	wireless
(b)	quite	2.	stratosphere
(c)	layer of charged atoms	3.	relatively
(d)	radio	4.	hail
(e)	thickness	5.	alternating
(f)	changing	6.	trace
(g)	kind of rocket	7.	density
(h)	falling ice	8.	ionosphere
		9.	sputnik

LANGUAGE (cont'd)

2. Fill in the blanks with the correct words from the passage.

(a) The _____ can be detected above the polar regions.
(b) The _____ layer of the ionosphere conducts electricity and _____ radio waves.
(c) The Kennelly-Heaviside, or _____ layer, contains _____.
(d) In the troposphere we find clouds, rain, _____, snow, and _____.
(e) The _____ is closest to the earth.
(f) As we go high in the atmosphere, the air becomes _____.
(g) The air does not _____ the sun's heat.

STRANGE LOCOMOTIVES p.115

VOCABULARY LIST

* locomotive
* design
  iron (Fe) - a very hard metal
  frames - shapes
  diameter - a line through the middle of a circle
* pistons
* stroke
  rods - long straight objects
* cylinder
  horizontal - from side to side
  spikes - big nails
  rear - back end
  sledge - like a large ski
  similar - same
* springs
  distribution - placing
  lever - handle
  enclosed - not shown outside
  platform - a place to stand
  passengers - people who ride
  goods - things made and sold
  coaches - vans to sit in
  fate - fortune
* manufacture
* typical
* steering
* pressure

LANGUAGE

1. Circle the correct word for the given definition.

   (a) big nails (sledges; spikes; springs)
   (b) a place to stand (piston; passenger; platform)
   (c) from side to side (horizontal; vertical; diameter)
   (d) like a large ski (sledge; coach; frame)
   (e) long straight objects (goods; design; rods)
   (f) handle (rod; lever; iron)
   (g) fortune (fate; fame; frame)

2. Fill in the blanks with correct words from the passage.

   (a) Most locomotives have a railway _____.
   (b) The frames of N. Grew's locomotives were made of _____.
   (c) _____ could have been fixed on wheels.
   (d) The locomotives had _____ instead of tires.
   (e) The first locomotives were steered by _____, the next by _____.
   (f) The locomotives in Russia were used for _____ and _____ and also ran a _____ service.
   (g) Locomotives in Canada were used to pull _____.

TIME AND THE STARS p.119

VOCABULARY LIST

* infinite
* velocity
enormous - great; large
appears - seems
* circumference
visible - seen
observer - one who watches
occupies - takes
* internal
perceive - see
fraction - less than one
bodies - objects
* satellite
* planet
distinctly - clearly
* instant
* vision
* unconscious
events - happenings
dawn - time before sunrise
anxiety - nervousness
* decade
fixed - having a definite position

LANGUAGE

1. Write the number of the definition on the line before its word.

(a) _____	perceive	1. happening
(b) _____	dawn	2. seen
(c) _____	occupies	3. one who watches
(d) _____	visible	4. see
(e) _____	fraction	5. nervousness
(f) _____	event	6. less than one
(g) _____	anxiety	7. large
(h) _____	observer	8. time before sunrise
		9. takes

2. On the given line, write the time it takes light to reach the earth from each of these heavenly bodies.

3; 80; 8; 160; 5; 320; 4; 14; 40

(a) The sun; about _____ minutes
(b) Neptune; about _____ hours
(c) The nearest fixed star; about _____ years
(d) Uranus; about _____ minutes
(e) The moon; about _____ seconds
(f) Saturn; about _____ minutes
(g) Jupiter; about _____ minutes

DRILLING FOR OIL p.123

VOCABULARY LIST

progress - going ahead
* drill
century - 100 years
primitive - not developed or advanced
brine - salty water
jerked - pulled
spring-board - piece of wood that goes up and down
* principle
* oilfields
* suspended
* fragments
lined - covered on the inside
sufficient - enough
disadvantage - bad quality
* penetrate
oil-bearing - oil-carrying
* tube
spouts - shoots out
* equipment
waste - not being used
banging - hitting hard
* rotate
toothed - having teeth
* ball-bearing
diamonds - the hardest stones
crush - push into very small pieces
revolutions - turns
sunk - put into the ground

LANGUAGE

1. Write the correct word on the line after its definition.

a. covered the inside _____
b. having teeth _____
c. turns _____
d. 100 years _____
e. sufficient _____
f. push into very small pieces _____
g. not being used _____
h. salty water _____

2. Fill in the blanks with correct words from the passage.

a. The Chinese used sharp _____ that hung from ropes, and they used _____ for weight.
b. In oil wells weight was added by attaching the bit to a piece of _____.

LANGUAGE (cont'd)

c. Two disadvantages to the pounding method are that it is _____ and has the danger of _____.
d. For hard rock, two rotary cutters are used which have _____ so they can rotate freely.
e. The deeper the hole, the _____ the tube, and the _____ the bit.
f. The newer method of drilling is called _____ drilling.

THE VALUE OF TRANSISTORS p.128

VOCABULARY LIST

conclude - finish
* efficient
amplification - making large
* portable
aid - help
* spectacles
* valves
* estimated
assume - believe without having proof
* test
industry - the making of products
commerce - trade between people or nations
inhabited - lived in
circuits - systems
suitable - useful and correct
* amateurs
conducts - carries
* insulator
substance - material
* element
germanium - Ge; the purest element
silicon - Si; a semiconductor
purity - cleanliness
investigated - questioned
* crystal

LANGUAGE

1. Draw a line from the definition to its word.

(a)	cleanlinesss	1.	conclude
(b)	carries	2.	commerce
(c)	help	3.	suitable
(d)	finish	4.	circuits
(e)	trade	5.	conducts
(f)	useful	6.	purity
(g)	systems	7.	aid

2. Write the correct answer on the given line.

(a) Transistors are useful wherever _____ is needed.
(commerce; amplification; germanium)

(b) Transistors are doing people's jobs in _____.
(industry; amateurs; valves)

(c) Transistor _____ need only a little power.
(purity; conductivity; circuits)

(d) If we want to see how well a semiconductor will conduct electrically, we must test its _____.
(purity; amplification; oxides)

LANGUAGE (cont'd)

(e) An example of a semiconducting compound is a _____.
(silicon; sulfide; spectacle)

(f) An example of an insulator is _____.
(an oxide; germanium; glass)

(g) An example of a conductor is _____.
(silicon; wood; H_2O)

3. Match these chemical terms, from this and previous stories, to their formulas and symbols.

(a) radium	1. Ge
(b) silicon	2. Co
(c) methane	3. $CHCl_3$
(d) mercury	4. S
(e) cobalt	5. O_3
(f) ozone	6. $(C_2H_5)_2O$
(g) sulfur	7. Ra
(h) chloroform	8. Si
(i) germanium	9. NH_3
(j) hydrogen	10. Hg
(k) nickel	11. H
(l) ammonia	12. Ni
(m) dioxide	13. CH_4
(n) ether	14. Su
	15. O_2

VOCABULARY LIST

gamma rays - rays from radium
* ionosphere
* x-rays
* ultra-violet
* infra-red
sunburnt - red skin from the sun's heat
sunbathing - sitting in the sun
Newfoundland - a State in eastern Canada
* obvious
* curvature
prevent - stop
* predictions
weakened - not strong
* atom
electrons - negative part of an atom
remainder - what stays
ion - a charged atom (+ or -)
streams - like little rivers
* negative
* tube
screen - where the TV picture is
upper - high

LANGUAGE

1. Underline the correct word for the given definition.

(a) negative part of an atom (electron; proton; neutron)
(b) stop (obvious; remainder; prevent)
(c) not strong (sunburnt; weakened; curvature)
(d) what stays (remainder; system; tube)
(e) charged atom (nucleus; ion; atom)
(f) rays from radium (ultra-violet; infra-red; gamma)
(g) where the TV picture is (screen; tube; set)

2. Fill in the blanks with correct words from the passage. Write the words on the lines at the right.

(a) The electromagnetic radiations that reach us most are _____ and _____. a._____
(b) Nuclear power uses _____. b._____
(c) The _____-layer of the ionosphere appears at night. c._____
(d) When an atom is charged it is called a _____. d._____
(e) The central body of an atom is the _____. e._____
(f) The particles of the _____ in the atmosphere are ionized. f._____
(g) Electric currents in wires are like moving lines of _____. g._____
(h) If the number of electrons and protons in an atom equal, then the atom isn't _____. h._____