Name _____ Date _____ Period _____

UNIT 2 CRIME SCENE INVESTIGATION AND EVIDENCE COLLECTION

1. FUNDAMENTALS/OBSERVATION & RECORDING

MA LEARNING STANDARD(S)/OBJECTIVES

- ✓ SIS1. Make observations, raise questions, and formulate hypotheses.
- ✓ SIS2. Design and conduct scientific investigations.
- ✓ SIS3. Analyze and interpret results of scientific investigations.
- ✓ SIS4. Communicate and apply the results of scientific investigations.

Student Objectives

- summarize Locard's exchange principle
- identify four examples of trace evidence and
- distinguish between direct and circumstantial evidence
- summarize the three steps of a crime scene investigation
- explain the importance of securing the crime scene
- identify the methods by which a crime scene is documented
- demonstrate proper technique in collecting and packaging trace evidence
- describe how evidence from a crime scene is analyzed

NOTEBOOK -TABLE OF CONTENTS

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1.			
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13.			
14.			
15.			

Vocabulary: summarize the definitions

Chain of custody	
Circumstantial evidence	
Class evidence	
Crime scene investigation	
Direct evidence	
First responder	
Individual evidence	
Paper bindle	
Primary crime scene	
Secondary crime scene	
Trace evidence	

Name: _____ Period: _____

Chapter 2 Crime Scene Investigation and Evidence Collection

A crime cannot be committed without a perpetrator leaving some sort of evidence behind at the scene, no matter how minute. The proper security of a crime scene, collection of evidence, and preservation of that evidence before, after, and during that crime are vital to finding and convicting the perpetrator of that crime.

LESSONS FROM THE JONBENET RAMSEY CASE

The 1996 homicide investigation of six-year-old JonBenet Ramsey provides valuable lessons in proper crime-scene investigation procedures. From this case, we learn how important it is to secure a crime scene. Key forensic evidence can be lost forever without a secure crime scene.

In the Ramsey case, the police in Boulder, Colorado, allowed extensive contamination of the crime scene. Police first thought JonBenet had been kidnapped because of a ransom note found by her mother. For this reason, the police did not search the house until seven hours after the family called 911. The first-responding police officer was investigating the report of the kidnapping. The officer did not think to open the basement door, and so did not discover the murdered body of the girl.

©AP Photo/Paul Sakuma

The Ramsey Home in Boulder, Colorado.

Believing the crime was a kidnapping, the police blocked off JonBenet's bedroom with yellow and black crime-scene tape to preserve evidence her kidnapper may have left behind. But they did not seal off the rest of the house, which was also part of the crime scene. Then the victim's father, John Ramsey, discovered his daughter's body in the basement of the home. He covered her body with a blanket and carried her to the living room. In doing so, he contaminated the crime scene and may have disturbed evidence. That evidence might have identified the killer.

Once the body was found, family, friends, and police officers remained close by. The Ramseys and visitors were allowed to move freely around the house. One friend even helped clean the kitchen, wiping down the counters with a spray cleaner—possibly wiping away evidence. Many hours passed before police blocked off the basement room. A pathologist did not examine the body until more than 18 hours after the crime took place.

Officers at this crime scene obviously made serious mistakes that may have resulted in the contamination or destruction of evidence. To this day, the crime remains unsolved. Go to the Gale Forensic Sciences eCollection for more information on this case.

What mistakes were made by the Boulder City police department in searching the crime scene?

What specific kind of evidence may have been compromised?

What could the police have done differently to secure the crime scene and the evidence?

Ask a family member about the case. What do they remember? Did they believe a family member was involved?

Physical Evidence Notes **Name** _____

1. The value of trace forensic evidence was first recognized by Edmund _____ in 1910. The Locard's Exchange Principle states that "with _____ between two items, there will be an _____."

2. Complete each section below as you discuss the notes in class.

Paint

What is an example of a "class" characteristic? _____

What is an example of an "individual" characteristic? _____

Glass

What are three characteristics of glass that could be used to match glass from a crime scene to a suspect?

_____ _____ _____

Explosives

How do scientists match bombs and other explosive devices to suspects? _____

_____

Ballistics

What does the abbreviation GSR represent? _____ _____

What is rifling? _____

What does the acronym IBIS mean? _____

Dust & Dirt

How could dust or dirt be used in an investigation? _____

_____

Fingerprints

What are the 3 main types of fingerprints? _____

What does the acronym AFIS mean? _____

Impression Evidence

Give 3 examples of impression evidence. _____

Fractures Matches

What are fracture lines? _____

Give an example of a type of evidence that might be identified using a fracture match. _____

Wounds

What information can be learned from a wound? _____

_____

Documents

Besides handwriting, what else could an investigator use to match a ransom note to a suspect? _____

_____

Insects

What type of insects are helpful in a murder investigation? _____

What is PMI? _____

DNA

What types of tissues might be used for DNA testing? _____

What does the acronym CODIS mean? _____

Skeletal Remains

What 4 things can be determined from skeletal remains? _____ _____ _____ _____

What type of scientist studies skeletal remains? _____ _____

Body Fluids

What type of clues could investigators get from body fluid samples? Give two examples.

_____ _____

Hairs & Fibers

How can hairs and fibers be used in an investigation? _____

_____

What must be present in a hair sample to test for DNA? _____

Catching Killers: Trace Evidence

Answer the following questions while watching this episode of Catching Killers.

1. What was the first real piece of evidence left behind by the I-5 Killer?

2. List 4 example of Trace Evidence

   a. _____ c. _____

   b. _____ d. _____

3. Summarize what can be specifically told about hair when viewed microscopically.

4. Give a brief summary of the history of trace evidence

5. Describe the case that made Locard famous.

6. Why is it important to collect evidence quickly?

7. Who was the prime suspect in Locard's case? What evidence did he collect from him?

8. Fill-in the following table

	Description of Method
Picking	
Light Sources	
Lifting	

9. What type of method was used on Darcie's dress?_____

10. Describe the fibers found on Darcie's dress

11. How did police originally find Roger Kibbe?

12. Explain, in complete sentences, what made Kibbe's car fibers go from indistinguishable to being considered an individual match?

13. How could fingernail scrapings be used differently today than they were in 1912?

14. Would cosmetics be enough to identify a suspect today? Why or why not?

15. What made Kibbe's white cord different from all the other possible mass produced white cords?

16. Why was Kibbe originally only convicted of Darcie's murder? What allowed him to be convicted of the other murders?

Name _____ Date _____ Period ____

Background Information
Forensic Science Laboratory Activity – Locard's Principle
Read before the Lab!!

Edmond Locard (1877-1966) in 1920 persuaded the police department in Lyons, France, to give him two attic rooms and two assistants to start the world's first police laboratory.

During his first years of work, the only instruments available to Locard were a microscope and a rudimentary spectrometer. However, his enthusiasm quickly overcame the technical and monetary deficiencies he encountered. From these modest beginnings, Locard's research and accomplishments became known throughout the world b y forensic scientists and criminal investigators.

It was Locard's belief that when a criminal came in contact with an object or person, a cross-transfer of evidence occurred (Locard's Exchange Principle). Locard strongly believed that every criminal can be connected to a crime by dust particles carried from the crime scene. This concept was reinforced by a series of successful and well-publicized investigations. In one case, confronted with counterfeit coins and the names of three suspects, Locard urged the police to bring the suspects' clothing to his laboratory. Upon careful examination, he located small metallic particles in all the garments. Chemical analysis revealed that the particles and coins were composed of exactly the same metallic elements. Confronted with this evidence, the suspects were arrested and soon confessed to the crime.

Every time you make contact with a person or object there is an exchange of materials. This could mean the transfer of fibers, hairs, wood shavings, metal filings, tidbits of paper, or any small, lightweight item adherent to the donor object. This exchange enables forensic scientists to determine where someone has been based on trace evidence. It is even possible to track a person's daily movements by examining his or her clothing.

Forensic Science Laboratory Activity – Locard's Principle

Objectives:

1. Demonstrate how transfer of evidence occurs
2. Identify a possible crime scene location based on trace evidence examination

Materials (per group):

For Part 1

Outer garment (sweater, wrap, pants) that has been worn at least once since being washed
Translucent tape
Hand lens
Spatula
Tweezers
Flashlight
Labels – masking tape
30 cm ruler

For Part 2

3 fabric squares in separate sealed evidence bags
1 white sock in sealed evidence bags tweezers
Hand lenses
1 role of clear tape or masking tape
white Paper
scissors
gloves

Safety Precautions:

Wash your hands before starting work
Refrain from touching hair, skin, or clothing when collecting evidence
Wear gloves while collecting evidence

General Procedure

Three methods are used in this experiment to separate traces of materials adhering to garments.

1) ***Lifting***: Press lengths of translucent tape onto the surface of the garment, taking care not to allow materials stuck to the tape to fall off by overloading the tape. Place the tape lifts in a transparent container such as a Petri dish, where they can be studied with a hand lens.

2) ***Picking***: Use clean forceps or tweezers to lift traces of materials from the garment onto a clean sheet of paper (to avoid loss of sample). Transfer the traces of materials to a transparent container such as a Petri dish, where they can be studied with a hand lens.

3) ***Scraping***: Use a clean spatula or similar tool to dislodge the traces of materials adhering to the garment's surface directly onto a clean sheet of paper. Transfer the traces of materials to a transparent container such as a Petri dish, where they can be studied with a hand lens. (This technique is particularly useful for dried splatters of liquids.)

Label all traces of materials removed from garments with the identity of the garment's owner.

Part 2 Scenario:

A dead body has been found. The crime scene investigators determined that the body has been moved after the killing. Trace evidence was found on the victim's sock. It was determined that the crime could have occurred in three possible locations. Can you match the trace evidence found on the victim's sock with trace evidence collected from three different locations and determine which location was the crime scene?

Procedure:

1. Open a fabric square evidence bag from location 1 by cutting along an edge other than the signed, sealed one.
2. Using forceps/tweezers and a hand lens, examine and identify items found in the sample.
3. Record your finding on the data table provided.
4. Press a piece of adhesive tape onto the surface of the fabric to remove any additional evidence that the forceps/tweezers cannot pick up. Tape the evidence on white paper and examine it. Add any items to your data table.
5. Repeat steps 1 though 4 with your other two fabric squares.
6. Open the white sock sealed envelope in the same manner as you opened your fabric square bags.
7. Use the same procedure as you did for the fabric squares to examine the white sock.
8. You must determine which of the three original location matches the crime scene location.

Data Table:

Fabric Square from Location #1	**Fabric Square from Location #2**	**Fabric Square from Location #3**	**White Sock**

Procedure

You will need a partner for this experiment.

Part 1: Examining clothes

1. Observe the surface of the garment and identify any traces of materials adhering to the surface. If necessary, use a flashlight to illuminate the surface of the garment (traces of materials can be shown in greater detail if light is shone on the surface obliquely).
2. Remove traces of materials from the garment using the techniques described above, starting with lifting. *H* materials are found that cannot be removed in this way, move to picking: If the material adheres more strongly to the garment, use scraping.
3. Using a hand lens, identify the fragments of material found as far as is possible. For example, you should be able to identify hairs, threads of fabric, leaves, and seeds.
4. Identify the garment and its owner in data table A on the next page. Record the technique(s) used to remove the fragments of material and the part of the garment from which it was removed. If the traces of materials were in the form of stains (e.g., milk), use the ruler to measure the approximate area of the stain.

DATA TABLE A		
Type of garment		
Owner of garment		
Date		
Evidence found		
Identification of fragment (hair/thread/leaf/seed)	Method of collection (lifting/picking/scraping)	Number of traces of this type found (for fragments) Area covered (if splashes or stains)

Name _____ Date _____ Period _____

Questions:

1. Based on your examination of the trace evidence, which of the three sites was probably the crime scene? Justify your answer!!

2. How might the adhesive tape interfere with your evidence collection?

3. Why were gloves necessary in the collection and handling of trace evidence?

4. What other instruments could be used to improve on your ability to identify evidence?

5. A suspect's shoes and clothing are confiscated and examined for trace evidence. What kind of evidence might be found on the clothes or shoes? List at least **five examples** of trace evidence from the shoes or clothing that might be useful in linking a suspect to a crime scene.

6. A home burglary has occurred. It appears the perpetrator entered after breaking a window. A metal safe had been opened by drilling through its tumblers. A suspect was seen running through the garden. Three suspects were interrogated and their clothing examined. List as least **three examples** of trace evidence that might be found on the suspect.

7. Some examples of trace evidence are listed below. For each item, suggest a possible location where the trace evidence might have originated. For example, broken glass fragments – headlight from a hit-and-run accident.

Trace Evidence	Possible Source
Example: glass fragment	Headlight from car accident
Sand	
Sawdust	
Pollen	
Makeup	
Hair	
Fibers	
Powders or residues	
Metal filings	
Oil or grease	
Gravel	
Insects	

Study Guide Questions:

Chapter 2: Work on these questions using your notes. They will be **due the day of the test.**

1. Write out Locard's Exchange Principle.

2. What three factors determine the extent of the transfer of forensic evidence?

3. Give three examples of direct evidence:

4. What is circumstantial evidence? Describe each of the three categories of circumstantial evidence:

5. Define and give an example of class evidence:

6. Define and give an example of individual evidence:

7. What should be included in crime scene photos?

8. What must be included on a crime scene sketch?

9. List and sketch the four methods to search a crime scene:

10. Describe the various containers used to collect evidence and what kind of evidence each can hold:
11. What information is included on an evidence log?
12. What information is included in the chain of custody?
13. Why are evidence logs and chain of custody so important for evidence collection?
14. Where should forensic detectives get control samples from? What are control samples used for?
15. What are some signs that a crime scene was staged?
16. Which Amendment affects crime scene investigation? Explain how it affects an investigation.
17. When can a crime scene be searched without a warrant?

MURDER BY A MILITARY MAN

Name:_____

Date: _____ Period: _____

In November 1940, five hours after a fifteen-year-old girl had gone out to get the evening paper; her body was found close to some railway tracks near her home. She had been sexually assaulted and strangled to death. A forensic expert called to the scene found a small piece of fabric near the girl's body. The piece of fabric appeared to be a finger bandage that had mud and blood upon it. No blood from the victim was found on or near the body as the victim had been strangled to death. Therefore, it was speculated that the suspect had lost the fabric finger bandage during the murder.

When the bandage was analyzed, traces of a disinfectant, used commonly by the military, were found within it. This led forensic investigators to suspect that the culprit was a member of the military. Upon further investigation it was discovered that a local man named Samuel Morgan had recently deserted the military and was a suspect in an attack upon another local woman.

When Samuel Morgan was brought in for questioning he had a deep cut upon his right thumb. Investigators found out that Morgan had been living with his brother and sister- in-law. When his brother was questioned he said that on the night of the murder Samuel had told him he had to leave town and had begged him for money. The suspect's sister- in-law admitted that she had earlier dressed his finger wound and had applied disinfectant from Morgan's military kit.

Microscopic analysis of the fibers of the bandage found at the crime scene matched fibers of the bandages from Morgan's sister-in-law. Also, trace elements found in the dirt at the crime scene matched the trace elements found in dirt found upon the finger bandage and Morgan's clothing. Testimony from relatives, as well as the fiber and trace element evidence, led to the conviction and eventual hanging of Samuel Morgan.

Related Questions:

1. What led investigators to conclude that the bandage found at the crime scene had been left behind by the suspect?

2. How did testimony provided by Samuel Morgan's family members lead to his arrest and conviction?

3. Describe the fiber evidence that helped support the case against Samuel Morgan.

4. A piece of the bandage is waiting for you, the evidence collector, to properly collect, document and package. Go to pages 26-28 in your text book and make notes on the proper steps to follow to properly package, seal, and label the evidence in a paper bindle and evidence bag. Be thorough because you will have to complete this task (using these notes) as part of your quiz grade for this unit.

NOTES and DIAGRAMS:

Come up front to complete you collection of the bloody bandage. It has been dried out for you.

- ❑ I properly handled and packaged all materials considered evidence into a bindle.
- ❑ I properly bundled and packaged all materials considered evidence into a bag or plastic bag and completed the Evidence Inventory Sheet for each evidence bag.
- ❑ I properly sealed and labeled all evidence containers.
- ❑ I wrote my signature across the seals on all evidence I collected.
- ❑ I completed the chain-of-custody information for each evidence bag.

Date_____Signed_____

UNIT 2: Quiz Review

Crime scene Review worksheet

1. _____ a location other than where the crime took place, but is in some way related to the crime and where evidence is found
2. _____ a material that can be related to a single source
3. _____ a written record of all people who have had possession of an item of evidence
4. _____ any place where evidence maybe located to help explain events
5. _____ evidence that (if true) proves an alleged fact, such as an eyewitness account of a crime
6. _____ indirect evidence; evidence used to imply a fact but not prove it directly
7. _____ material that comes from a proven or known source
8. _____ material that connects an individual or thing to a group that share similar characteristics
9. _____ small but measurable amounts of physical or biological material found at a crime scene
10. _____ the elected or appointed official who represents the government in the prosecution of a crime
11. _____ the first police officer to arrive at a crime scene
12. _____ the location where the crime took place
13. _____ there is always a cross transfer of evidence between a suspect and victim or locale
14. _____ when witness or suspects create story of what happened at a crime

A. chain of custody
B. circumstantial evidence
C. class evidence
D. collusion
E. control sample
F. crime scene
G. direct evidence
H. district attorney
I. first responder
J. individual evidence
K. Locard exchange principle
L. primary crime scene
M. secondary crime scene
N. trace evidence

Fill-In and Short Answer Questions

15. Most wrongful convictions seem to be the result of _____.

16. A pair of latex gloves was found at a crime scene. A box of the same brand of latex gloves was found at a suspect's home.
    - Are the gloves individual or class evidence?
    - Can the gloves be individualized to the box?

17. In a class of 25 students, 8 were wearing a pink shirt. In the same class, 17 students had on blue jeans. Eyewitnesses all stated that the suspect was in the class, and wearing both a pink shirt and blue jeans. According to the laws of probability, what percent of the class could be the suspect? **Show your work.**

Types of Evidence Mark all boxes that correctly describe the evidence item.

Evidence Item	Direct?	Circumstantial?	Physical?	Biological?	Trace?	Class?	Individual?
18. Gun							
19. Shoe print							
20. Pollen							
21. Written confession							

In order, list the seven S's of crime scene investigation. Give a description of each.

Seven S's of crime scene investigation	Description
22.	
23.	
24.	
25.	
26.	
27.	
28.	

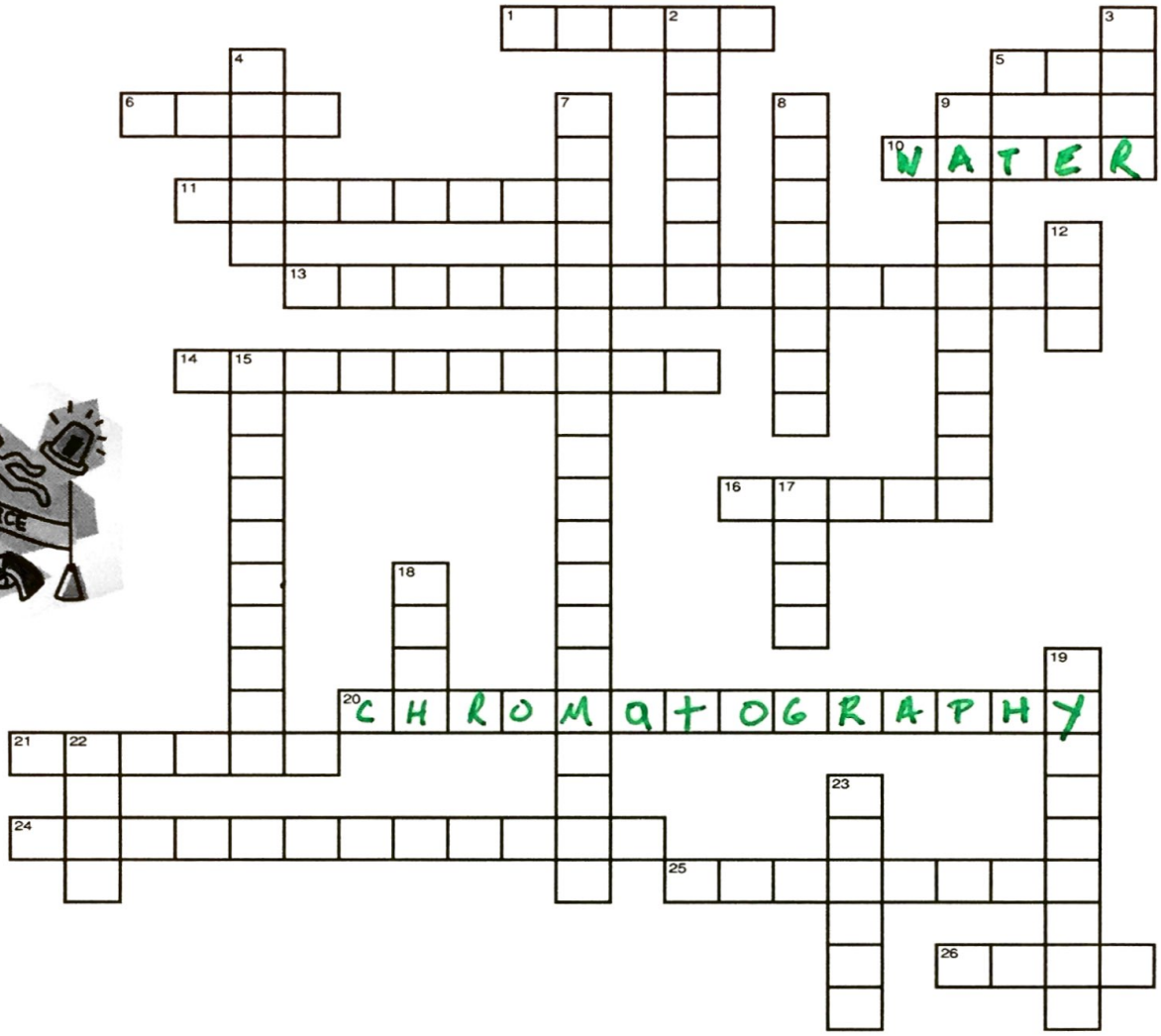
29. Besides a drawing of the crime scene, what else should be included in the crime scene sketch?

30. What kinds of factors determine which type of packaging should be used for crime scene evidence? Give an example.

Unit 2

Power of Evidence Unit Review

Name _____



Across

1. Can be matched to a weapon and analyzed to determine a weapon's size, shape, or length as well as clues about the victim or suspect
5. Genetic material that can be extracted from body tissues and used to create a profile to identify a victim or suspect
6. Bottom portion of hair in which nuclear DNA can be found
10. The universal solvent
11. Points on a fingerprint where the ridge structure changes, such as forks, bridges, and deltas
13. Can be analyzed to determine the sex, stature, age, and race of a victim
14. Instrument used to examine hairs & fibers in detail
16. Can be analyzed to determine its properties, such as color, tint, thickness, density, chemical composition, and refractive index (RI).
20. Process of separating a mixture into its individual components, such as determining the compounds in gasoline
21. Type of print left on a surface at a crime scene, such as a tool handle, glass, door, etc.
24. Can be classified as loops, whorls, and arches
25. Forms when an object is torn or broken; edges can be examined to see if they match
26. Database used to find matches to bullets or firearms found at a crime scene

Down

2. Type of fiber made from plants or animals
3. Substance made of keratin and is composed of the cuticle, cortex, and medulla
4. Database that is used to find matches for DNA evidence gathered from a crime scene or victim
7. Examiners may analyze a this type of evidence to determine the type of paper used, printing method, handwriting style, or type of ink to find a match to a suspect
8. Substances that give color to objects, such as paint, hair, and fibers
9. Study of firearms and ammunition
12. Abbreviation for gunshot residue
15. Evidence that is formed as an object leaves a "mark" on another one, such as tire tracks, toolmarks, & bitemarks
17. Most common type of fingerprint pattern
18. Least common type of fingerprint pattern
19. Type of fiber that is man-made
22. Database that can be used to find matches for fingerprints found at a crime scene
23. Principle that states "with contact between two items, there will be an exchange."

Power of Evidence Challenge

Name _____

Unscramble each term, write it in the blanks, and then find it in the puzzle.

HINT: All the words can be found on the Power of Evidence note worksheet!

P _ _ _ _
PTIAN

S _ _ _ _ _
SVAIAL

G _ _ _ _
GSASL

S _ _ _
SLOI

L _ _ _ _ _
LDOARC

W _ _ _ _
WUNOD

T _ _ _ T _ _ _ _ _
TREI TRKACS

F _ _ _ _ _ _ _
FURCARET

M _ _ _ _ _ _ _ _ _
MCRIEPOCSO

T _ _ _ _ E_ _ _ _ _ _ _
TARCE ENVCEDEI

O	J	T	M	L	H	Q	Q	E	W	W	W	Q	V	F	U	F	X	J	F
J	H	O	R	Q	X	Z	M	R	X	M	D	D	K	U	V	W	H	V	H
Z	V	O	L	M	W	T	I	C	P	P	M	D	N	U	O	W	V	Q	T
F	Z	L	C	A	V	A	U	L	F	U	L	B	N	P	M	T	T	N	B
R	R	M	F	S	H	B	Y	L	N	Y	L	O	V	U	C	E	N	H	Z
H	T	A	M	S	O	I	L	L	O	O	C	T	S	L	S	S	I	U	F
H	X	R	C	M	F	P	F	B	O	X	S	A	V	I	Y	J	A	Z	U
T	G	K	L	T	Q	K	C	D	S	Y	P	K	E	H	V	Z	P	F	J
I	W	S	N	W	U	M	U	B	G	H	J	C	R	C	W	E	H	W	U
R	H	P	M	S	E	R	A	N	D	S	O	Z	B	A	L	G	S	I	L
E	W	T	F	N	R	Z	E	D	C	S	I	E	X	K	M	V	Q	N	G
T	W	F	L	V	E	V	I	I	G	Y	R	C	P	B	A	E	V	B	F
R	G	K	Y	A	R	X	T	M	J	Q	M	E	D	R	L	H	T	K	C
A	L	F	A	H	W	S	A	X	Y	V	D	V	B	W	I	G	L	I	S
C	A	B	D	E	I	C	O	P	M	X	W	A	W	I	F	N	T	O	B
K	S	B	H	L	D	W	T	L	P	M	Y	K	C	T	F	L	T	T	Z
S	S	F	L	T	L	O	C	A	R	D	I	P	Z	F	H	N	O	S	G
M	J	A	V	F	Z	D	V	X	G	N	I	T	I	R	W	D	N	A	H
P	B	Q	E	P	O	C	S	O	R	C	I	M	F	S	A	L	I	V	A
K	R	R	S	G	T	R	A	C	E	E	V	I	D	E	N	C	E	U	Y

H _ _ _
HARI

B _ _ _ _
BLDOO

B _ _ _ _ _ _ _ _ _ _
BETI MSKRA

T _ _ _ _ _ _ _ _ _
TOLOMRAKS

B _ _ _ _ _ _ _ _ _ _
BLILTSIASC

F _ _ _ _ _
FSEBRI

E _ _ _ _ _ _ _ _ _
EIEXSLVSPO

S _ _ _ _ _ _ _ _ _
SHSORTIPNE

G _ _
GRS

H _ _ _ _ _ _ _ _ _ _
HITNGWDANRI