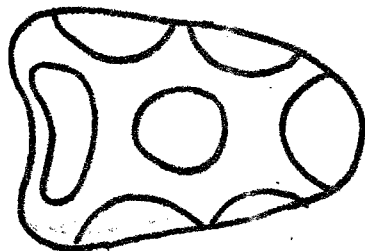
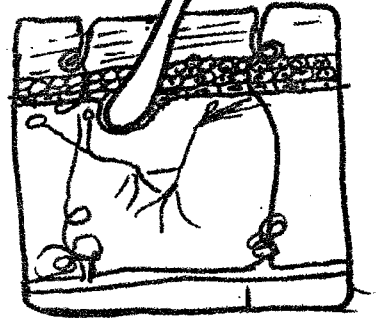
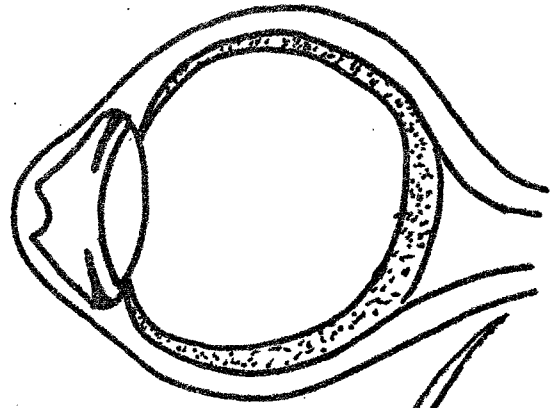
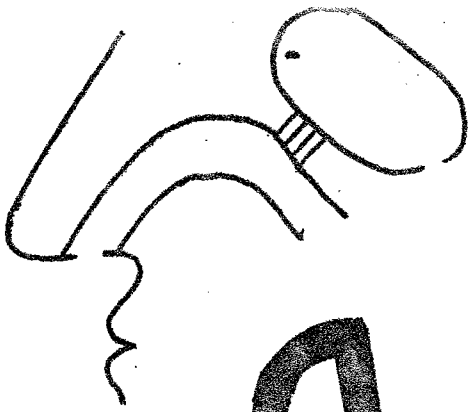


The Five Senses



G. GRAMBO
SEPTEMBER 1983

THE FIVE SENSES

GRADE 6

Through the use of these hands on experiments, students will learn about their senses, and how they work. The experiments use art activities, puzzles, dictionary work and reading assignments as well as manipulative projects that allow the children to learn at their own pace. A grading sheet and answer keys accompany this science unit.

Gregory Grambo
The Louis Armstrong Middle
School
September 1983

- A. Herman- Principal
- B. Alfant- Asst. Principal
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CONTENTS

CHAPTER ONE

Experiment 1-	What are senses?	6
Experiment 2-	What is your sense of smell?	7
Experiment 3-	How can you use your sense of smell to tell you about your environment?	8
Experiment 4-	What is your sense of touch?	9
Experiment 5-	What is texture? (Art Activity)	10
Experiment 6-	How can you use your sense of touch to tell you about your environment?	11
Experiment 7-	What is your sense of sight?	12
Experiment 8-	How can you use your sense of sight to tell you about your environment?	13
Experiment 9-	What is your sense of taste?	14
Experiment 10-	How can you use your sense of taste to tell you about your environment?	15
Experiment 11-	What is your sense of hearing?	16
Experiment 12-	How can you use your sense of hearing to tell you about your environment?	17

READING ASSIGNMENTS

Reading assignment about the nose	19
Reading assignment about the skin	20
Reading assignment about the eye	21
Reading assignment about the tongue	22
Reading assignment about the ear	23

GAMES

Cover for "The Five Senses" board game	25
Instructions for playing "the five senses" game	26
Game board	27
Sense cards (for board game)	29
Pad for game (board game)	31
Cover for Bingo game	32
Bingo playing cards	33
Draw cards for bingo game	36

APPENDIX

Quiz on experiments 1-6	38
Quiz on experiments 7-12	39
Materials list	40
How to make sense boxes	41
Answer key for sense boxes	42
Answer key for puzzles found in experiments	43
Answer key for question sheets	44
Grading sheet (How to use it)	50
Setting up the room for group work	51
What is a log book and how to set up a log book	52
Log book cover sheet	53

Chapter one

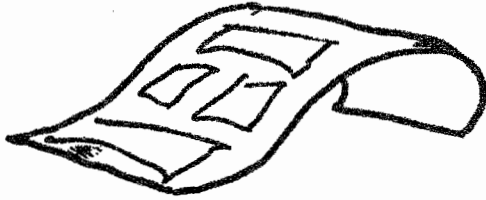
The Five Senses

Name _____

Class _____ Group No _____

What are senses? Experiment 1

1) Begin
With



This
sheet



Hi! I'm Chuck
Here to bring
you information
about your senses.

2) There is an accident in front of your home. How do you know it happened?



3) Why did you get up and run outside?

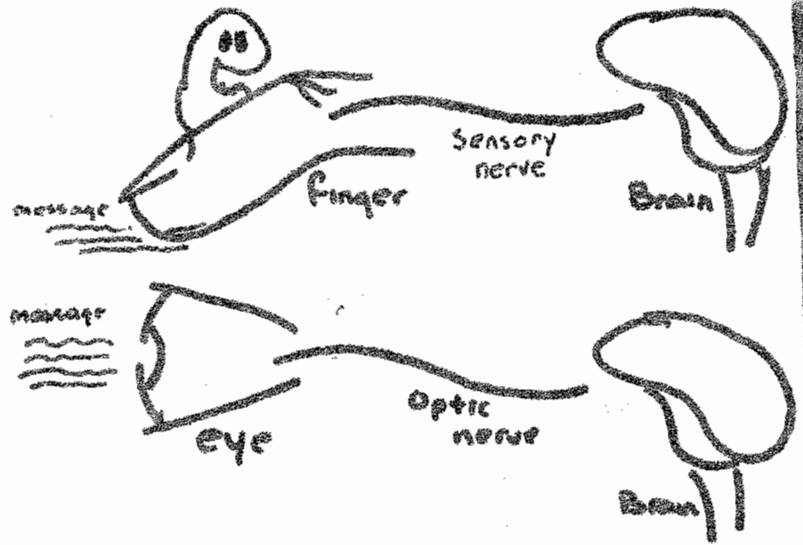
4) How can you tell if there is a fire in your neighborhood?



5) You reach into your pocket for change. How can you tell when you have a dime and not a quarter?

6) Why do you like certain foods?

2) There are parts of your body that receive messages from outside your body. These body parts are called sense organs. Sense organs pick up these messages and send them through wires, called nerves, to the brain.



3) Your body has many senses. There are five very important ones. Name them if you can.

- 1 _____
- 2 _____
- 3 _____
- 4 _____
- 5 _____

9) Special body parts or sense organs are used to give us the five senses. Name the organ associated with

- Smell _____
Taste _____
Touch _____
sight _____
sound _____

Homework -

- 1- The skin is sensitive to _____.
- 2- What are nerves used for?
- 3- What might happen if you loose one of your senses?
- 4- Do your senses work together? How can you tell?

The Five Senses

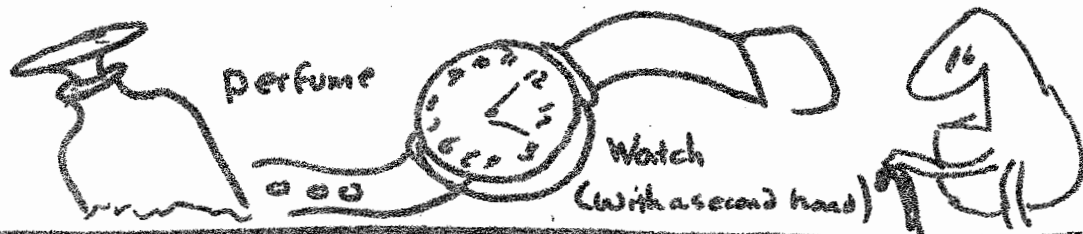
Name _____

Class _____ Group No. _____

What is your sense
of smell?

Experiment 2

1) Begin
With



2) You leave a pot of food on the stove and leave to go watch T.V. Suddenly you begin to smell something burning.

How is this smell helpful to you?

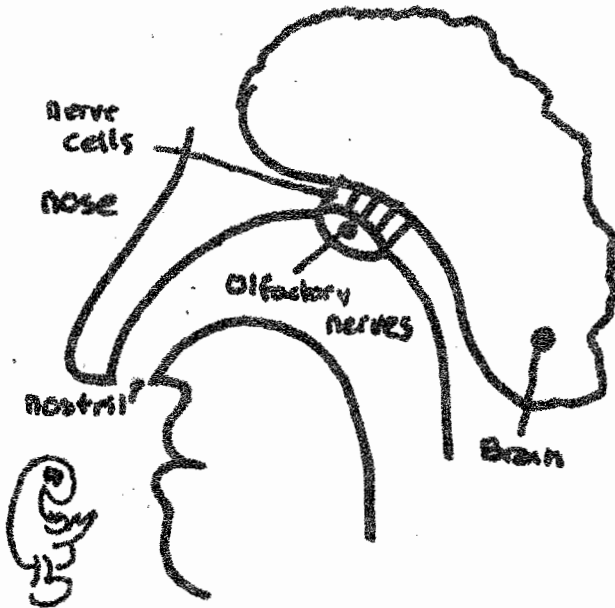
3) How did the smell get from the kitchen to where the T.V. is?

4) Have a partner open the perfume on the teachers desk. See how long it takes the smell to reach you.

_____ time

5) Certain things called molecules are in everything. These molecules break off and go into the air. Molecules carry the smell with them

6) The smell or odor travels through the air until it enters the nose, when you breathe. The picture below shows what happens then.



Smells travel through the nostril and to the olfactory nerves. The smell then passes through the olfactory nerves to the brain.

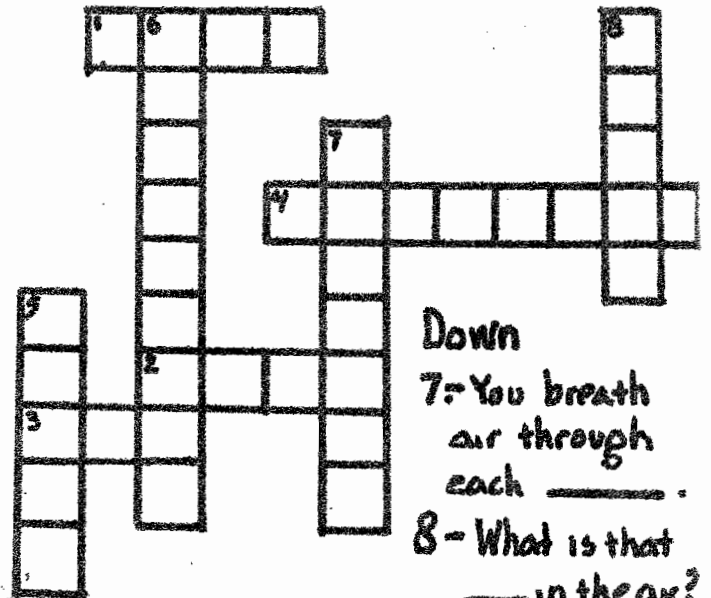
7) Lets see what you remember.

Across

- 1- Our sense organ for smell is _____.
- 2- Another word for smell is _____.
- 3- Smells travel through the _____.
- 4- Smells in the air are carried by _____.

Down

- 5- Messages travel to the _____.
- 6- Smells travel through the _____ nerves.



Down

- 7- You breathe air through each _____.
- 8- What is that _____ in the air?

8) You may wish to see what happens when you smell the same thing for a long time.

Put a smelly object under your nose for 3 or 4 minutes. What happened to the smell?

Homework-

Define - (look in a dictionary) Cells, Nerves, Nostril, Messages

The Five Senses

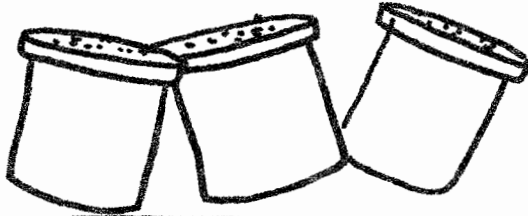
Name _____

Class _____ Group No _____

How can you use your sense of **smell** to tell you about your environment?

Experiment 3

1) Begin With



Jars
1-6



2) You are riding in a car how can you tell if you are near a garbage dump?

3) What would make you think you were near a garbage dump and not a flower shop?

4) How would you describe the smell of

a - a flower _____

b - garlic _____

c - garbage _____

d - candy _____

e - eggs _____

f - broiled steak _____

5) How can you tell smells apart without looking at the item?

6) In the front of the room are 6 jars. Take one of them. Smell the jar. DO NOT REMOVE THE COVER. When you are done, return the jar.

7) Describe the smell in each jar. Is it sweet, sour, spicy

1 _____
2 _____
3 _____

4 _____
5 _____
6 _____

8) What do you think is in each jar?

1 _____
2 _____
3 _____
4 _____
5 _____
6 _____

9) Why do you say this?

Homework-

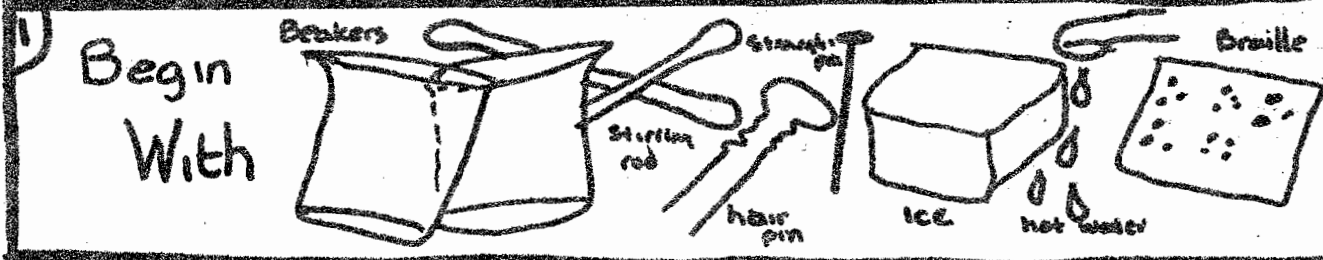
- 1- How were you able to tell what was in each jar?
- 2- How did your sense of smell help tell you about your environment?

The Five Senses

Name _____
Class _____ Group No _____

What is your sense of touch?

Experiment 4



2) Why wouldn't you put a sharp pin through your hand?



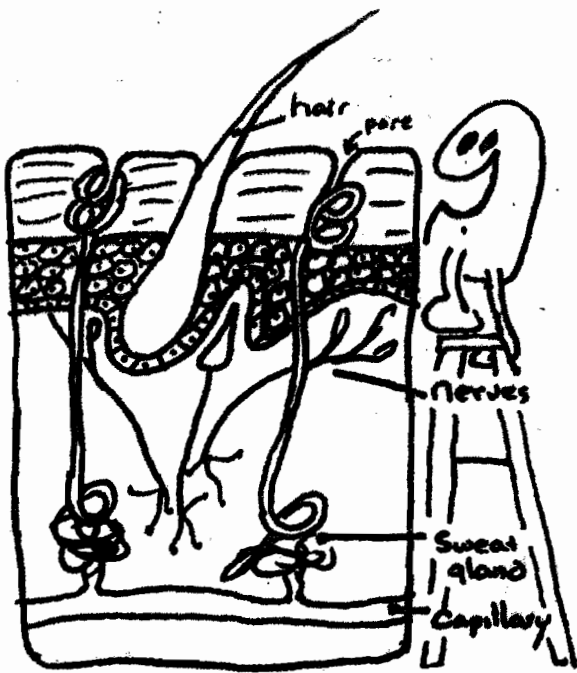
3) Why do you use a potholder to pick a pot up off a stove?

4) Why wouldn't you use your hand only?

5) How can you tell the difference between an ice cube and boiling water?

6) There is an organ that covers your whole body. It picks up heat, cold, pressure and pain. This organ is the skin.

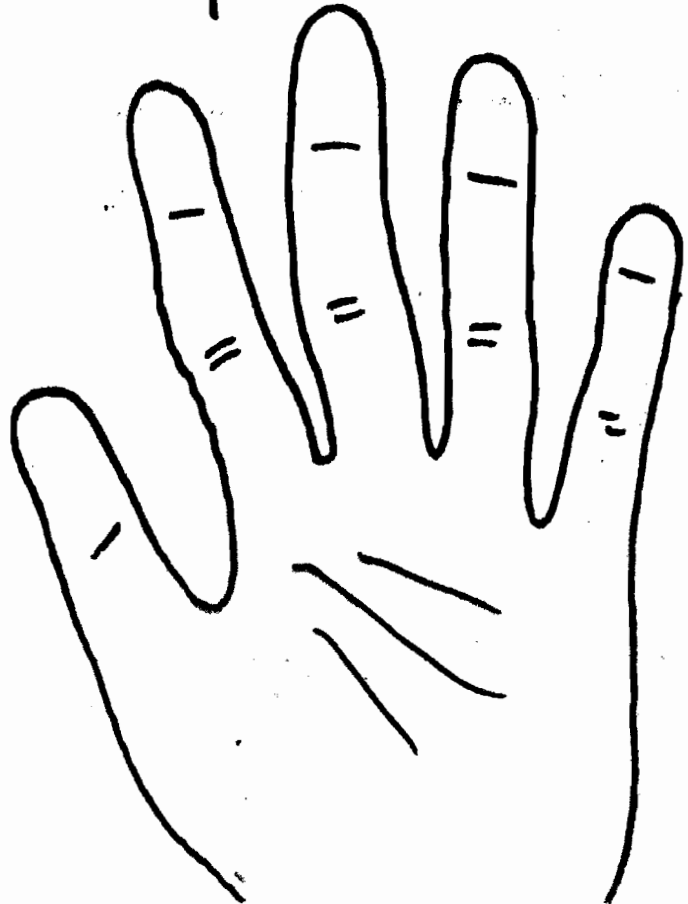
7) Surrounding each hair are many nerves. Special nerves pick up each sensation - hot-cold - pressure and pain



8

Some parts of the hand and body are more sensitive to one or more sensations. Here is a picture of a hand. We are going to make a map.

- 1- Place a stirring rod in ice touch it to the hand. Color red where you feel it.
- 2- Place a stirring rod in hot water. Color it blue where you feel it touch the hand.
- 3- Using a hair pin and regular pin apply pressure
 - heavy pressure - yellow
 - light pressure - green
 - pain - black



9 Try this experiment on your arm and stomach. Which part of the body is most sensitive to touch?

Why do you think this is so?

10 Look at the sample of braille writing. How can blind people read it?

Homework -

Define - (look in a dictionary)
nerve - neurons

What is texture? Experiment ↗

1) Begin With

penny paper crayons

2) How might this dead leaf feel?

Why?

All objects feel different. Some are rough because of bumps. Some are smooth because they have no bumps. The way an object feels is called its texture.

3) How would knowing what an object feels like help you understand what it looks like?

4) Place a penny under this sheet and rub over it with a pencil or crayon.

5) How might we show what an object feels like?

6) Why did this happen?

7) We call this a rubbing. Why do you think we call it a rubbing?

8) How do rubbings help show texture or how an object feels?

9) Using a crayon. Make a rubbing of four (4) Rough objects

1 _____
object

2 _____
object

3 _____
object

4 _____
object

10) Make a rubbing of 4 smooth objects

1 _____

2 _____

3 _____

4 _____

Homework —


Using a crayon make rubbings of five objects with different textures. On a different sheet of paper describe the object. We will use the rubbings and descriptions to play a matching game.

The Five Senses

Name _____
Class _____ Group No _____


How can you use your sense of touch to tell you about your environment? Experiment 6

1) Begin With



quarter nickel Touch boxes

2) If you were blind, how could you tell a light bulb was on near you?



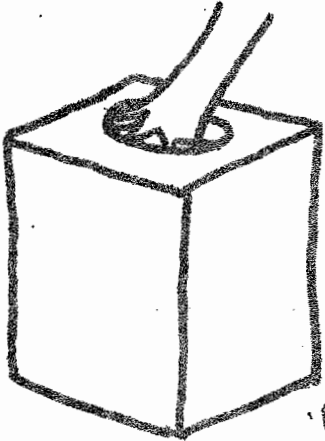
3) Close your eyes. Pick up a nickel and a quarter. Describe how they are different.

How can you tell them apart? (without looking at them)

4) How has your sense of touch helped you so far?

5) In the front of the room are 6 touch boxes. Take only 1 of them. Feel, DO NOT LOOK inside the box. Return the box after use.

6



Describe how big each item is.

- 1. _____ 4. _____
- 2. _____ 5. _____
- 3. _____ 6. _____

Remember take only 1 at a time!

7) Do they feel **COLD** or **HOT**?



8) Are they hard or soft?

- 1. _____ 4. _____
- 2. _____ 5. _____
- 3. _____ 6. _____

How can you tell?

9) Describe the shape and texture of each item.

10) What is in each box?

Homework —

- 1- How were you able to tell what was in each box?
- 2- How does your sense of touch help tell about your environment?

The Five Senses

Name _____

Class _____ Group No. _____

What is your sense of sight?

Experiment 7

1) Begin With

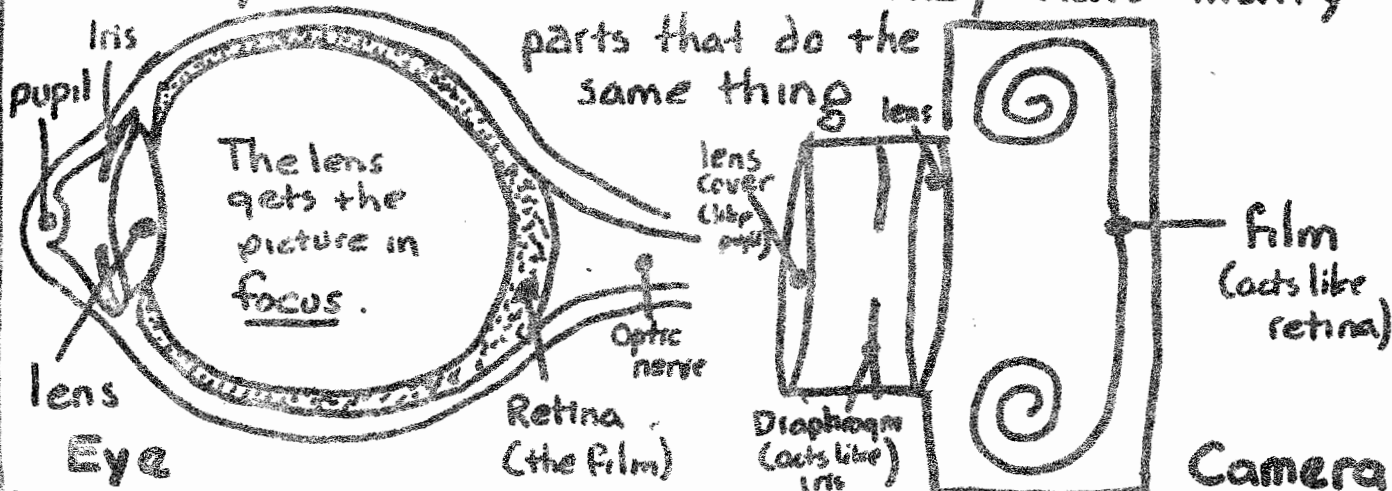


2) Right now your eyes are taking pictures of the words on this paper. The pictures are sent to the brain through a wire called the optic nerve.

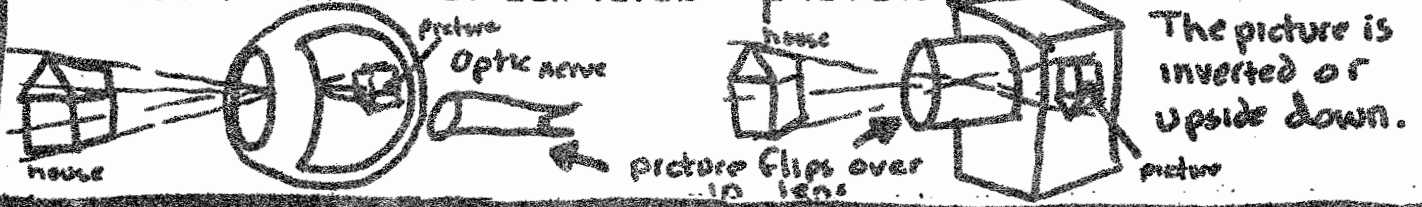
3) Why can't you see in a very dark room?

4) How does light help you see?

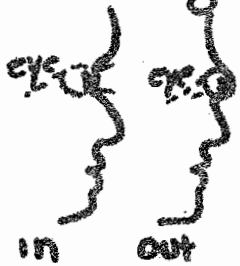
5) The eye is like a camera. They have many parts that do the same thing



6) Light enters the eye and the camera. Both take a picture. The picture in the eye is not permanent (lasts forever) like a camera's picture.



7) Why do you think eyes are inside your head and not sticking out?



8) Why do you have eyelids?



(think of what happens when you come out of a dark movie house)

9) Why do you have eyelashes?



10) Why do you think 2 eyes are better than 1?

12) Which is better? Why?

13) You have a retina. Look in a mirror. Describe the size of the dark hole in your eye.

Shine a light in your eye. What happens?

(not a bright light)

11) Take 2 pencils or pens. Try to touch the points with 1 eye closed. Try with both open.

Homework -



Why does the eye have so many safety devices? (eyelash, eyelid, iris,)

The Five Senses

Name _____
Class _____ Group No _____

How can you use your sense of sight to tell you about your environment?

Experiment 8

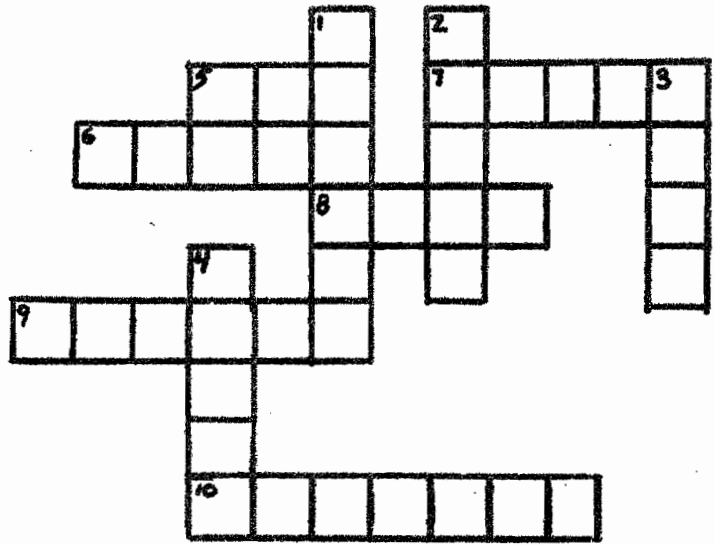
1) Begin With  Sight boxes 

2) Describe how the eye works?

4) What happens to the picture inside the eye or camera?

5) Describe your pen or pencil for me. Give as much detail as possible.

3) lets see what we remember.



Down

- 1- Pictures are printed on the _____.
- 2- Pictures go to the brain via the _____ nerve.
- 3- The _____ gets the picture in focus.
- 4- There is a _____ behind the eye that brings impulses to the brain.

Across

- 5- The sensory organ you use to see with, is the _____.
- 6- You need _____ in order to see.
- 7- The _____ lets light into the eye.
- 8- The _____ opens and closes to change light.
- 9- The eye is like a _____.
- 10- The _____ keeps dirt out of the eye.

6) In the front of the room are three sight boxes. Take only 1 to your seat. Look at it and describe it. Use as much detail as you can. Return it and take another one

8) Do they look hard or soft?

1-

2-

3-

How can you tell?

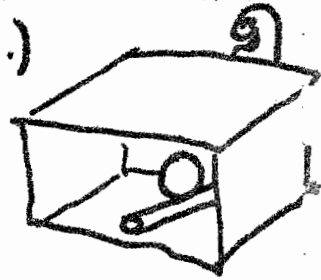
9) What are the items in the boxes?

7) Describe the size of the items in each box. (How big are they.)

1.

2.

3.



9) Describe the shape and texture of the items in the boxes.



m.s.p.

11) Do the items in the boxes belong together?

Why or Why not?

Homework—

- 1- How do your eyes tell you about your environment?
- 2- How is the information given to you by your eyes different from information given by the other senses?
- 3- How could you know what was around you if you couldn't see?

The Five Senses

Name _____
Class _____ Group No _____

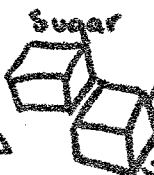
What is your sense of taste?

Experiment 9

1) Begin With



paper towel



Sugar



Crackers

2) What are your favorite foods? (list them)

3) Why do you like these foods?

4) Why wouldn't you want to eat something that is very burned?

5) Why do you think some foods taste different from other foods?

6) Why do you think we taste things at all?



7) On your tongue are nerve cells called Taste Buds.

Take the mirror and examine your tongue.

* Describe how it looks.

* How does it connect to the mouth?



Wash the mirror.

8) The little bumps you see are called papillae. These are the taste buds.

9) Take a piece of paper towel and dry off your tongue. Put a cracker or sugar on the tongue. (throw the towel out)

How does it taste?

10) Close your mouth so the Saliva gets your tongue wet. How does it taste now?

11) What has to happen to food before you can taste it?

12) How does saliva help you taste food?

Home work -

Define - (look in a dictionary)

Saliva, dissolve, flavor

1- What do taste buds do?

2- What are papillae?

The Five Senses

Name _____
Class _____ Group No _____

How can you use your sense of taste to tell you about your environment?

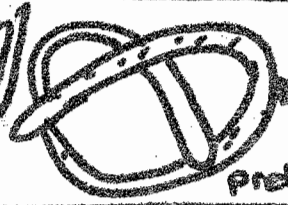
Experiment 10

Begin

With



lemon



pretzel (with salt)

candy

1) Why does food have to dissolve in your mouth?

2) The tongue can taste these 3 tastes. It also tastes bitter. (like the taste of coffee)

3) Lets make a map of your tongue.

4) How does candy taste?

How does a lemon taste?

How does a pretzel taste?

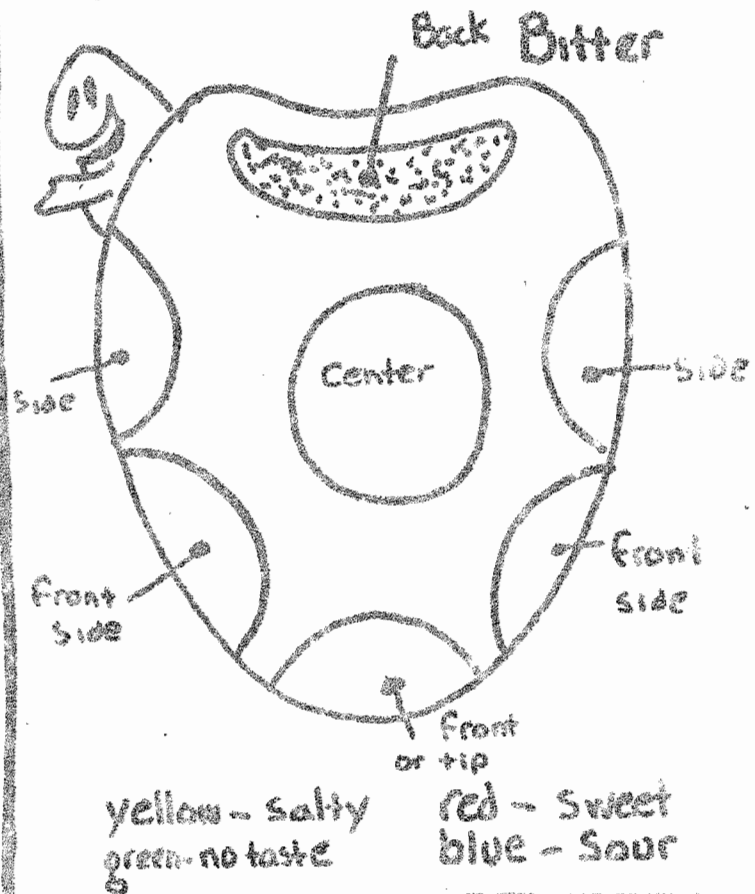
5) Parts of the tongue taste these 4 things. Messages go to the brain. The brain assembles, or puts together, the messages and you taste a certain food.

7) Pick up the sweet candy. Touch it to the front, side, back, and middle of the tongue. Color red where you taste it.

8) Do the same with the sour lemon. Color blue where you taste it.

9) Try salty now. Color yellow where you taste it. (Throw away all food now)

10) Bitter has been done for you. It is tasted in the back.



11) Color green where you can't taste anything

12) What happens when you try to taste something and you hold your nose?

13) How do these senses help each other?

Homework -

- 1- What is the sense organ for taste?
- 2- What are the four tastes?
- 3- Why can't you taste food when you have a bad cold?

The Five Senses

Name _____
Class _____ Group No _____

What is your sense
of hearing?

Experiment 11

1) Begin
With



Tuning fork



Rubber Block.

2) Place a tuning fork
on your
desk.



3) How can we make it, make
a noise?

hit against
rubber block.

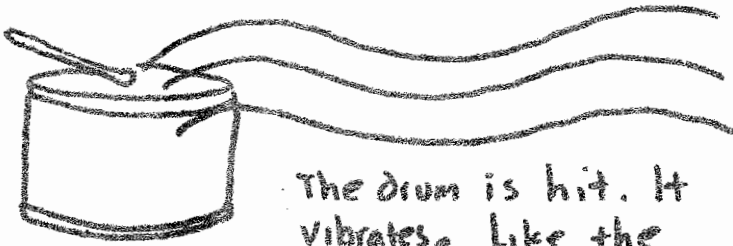
4) How can we make a drum
make noise?

5) What must happen to
an object in order
for it to make a noise?

6) Define - Vibrate -

7) There is a basin of water on the teachers desk.
Place the wood block in the basin and press down.
Watch what happens to the water. Describe it.

3)



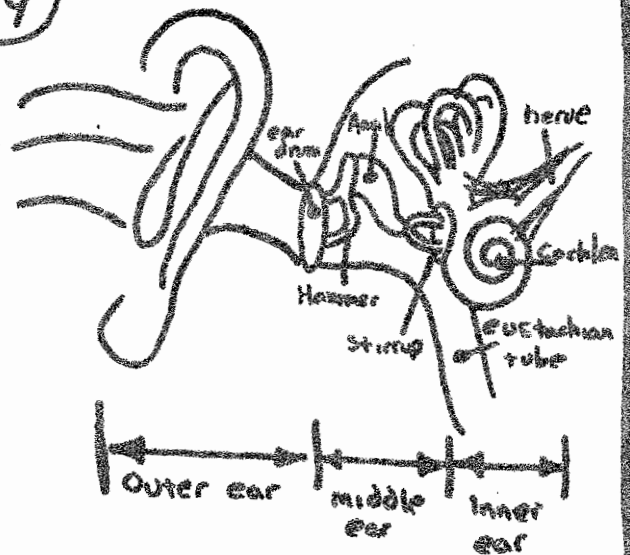
The drum is hit. It vibrates. Like the water making waves. the sound travels in waves.

10) Why do you think the outside of your ear has the shape that it does?

Roll a paper into a funnel and hold it over your ear. Have a friend talk. Can you hear better or worse? Why?

11) Different animals can hear different things. Try to see what the highest and lowest noise you can hear are? (dog whistle - piano note - friend screaming)

9)



Sound travels to the ear. It is caught by the ear and sent, or funneled, inside. The vibrating waves make the eardrum and bones. like the hammer, anvil, and stirrup vibrate. The bones vibrate a liquid in the snail shaped cochlea. Nerves in the cochlea send messages to the brain.

Homework

Define

Pitch, Tone, frequency
1- Describe how you hear (step by step)

The Five Senses

Name _____

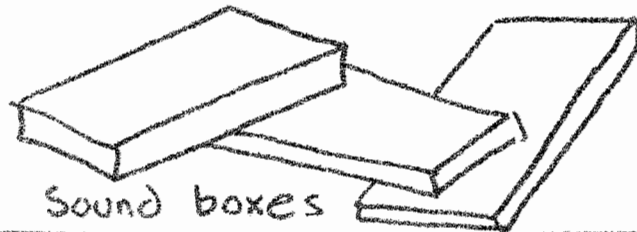
Class _____ Group No _____

How can you use your sense of hearing to tell you about your environment?

Experiment 12

Begin

With



Sound boxes

2) How can you tell where a sound is coming from?

3) How does sound travel?

5) Describe the sound of a.

1- Dish breaking

2- explosion (fireworks)

3- fan

4) Pitch is how high or low a sound is. Tone is the quality of a sound.

What is volume of a sound?

6) What has to happen to an object in order for it to make a noise?

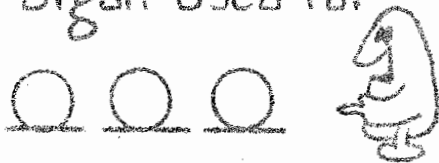
7) Unscramble these words.

Parts of the
ear

Jumble

_____o erven
o_____ mremah
_____ vanil
_____o_____ rirtusp
_____ claecho
_____ mrud

The sense organ used for
hearing



9) What do you think is in
each box?

10) Why do you say this?

8) On the teacher's desk
are sound boxes. Take only 1 box. Do
Not open it up. Try
to figure out what is
in the box. Return
each box before
taking another one

Describe the sounds in
each box. Is it loud
or soft? Does it roll or
slide?

1.

2.

3.

4.

5.

Home work-

1- How did your sense of hearing help tell you
about your environment?

Reading Assignments

NOSE

I AM THAT LITTLE hill that rises from the center of Joe's face—his nose. He worries about his eyes, ears and digestive tract but tends to think of me as a nuisance. I water on winter days, sneeze at the wrong time, clog with a cold, tend to get smashed in accidents. There are colorful and poetic allusions to other facial features—eyes, ears, lips. But not to me. I am kept to the grindstone, one pays through me, and nothing is plainer than the nose on a face.

But I am an important organ in Joe's body, and do numerous jobs that he is unaware of. Let him go to sleep on his left side, for example, and my left nostril will gradually become enlarged. In about two hours I send out a silent signal—I don't want to awaken him—which causes him to turn over. This is one of several trigger mechanisms that lead to movement, preventing his muscles from being cramped in the morning.

Automatically, I sniff Joe's victuals before he eats, to protect him from spoiled food that might poison him. Much of Joe's pleasure in eating comes through me. Let me smell a broiling steak and I crank up salivary glands that set his mouth to

35

Sensory Organs

watering and start his digestive juices flowing. As Joe has noticed, when my capabilities are blunted by sickness, as by a cold, his food is tasteless, and he loses appetite and weight. Without my stimulus Joe becomes a picky eater.

Another thing, Joe has a pleasing, deep voice. In part he has me to thank. I contribute some resonance. Let him pinch his nostrils when he speaks and possibly he'll hear the difference I make.

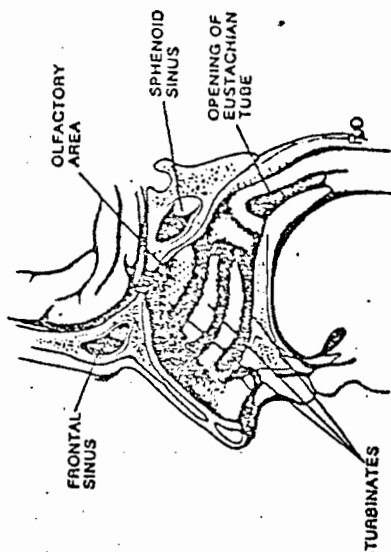
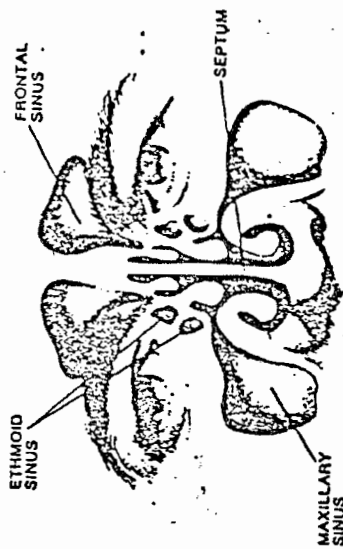
Architecturally, I am nothing to boast about. I am sandwiched in between the roof of Joe's mouth and his brain. In reality, I am two noses, since a septum, or partition, divides me in two. Above Joe's mouth I have a rather cavernous interior, my workroom. I also have small hollows in the bones on each side—in the cheeks, in the frontal bone over the eyes, in the wall between me and the eyes, and at the back of my main cavity. These hollow spaces make up my eight sinuses. They contribute some of the moisture I need to humidify air, make a slight contribution to voice quality and lighten Joe's skull, but mostly they cause trouble. Bacteria slip in to cause infection and blockage of the narrow channels that empty into my main passages. Then Joe is in for painful, headachy misery.

One of my major tasks is cleaning and conditioning the air for Joe's lungs. Each day I must process about 500 cubic feet of air—a small roomful. Joe may be skiing on a frigid, dry day, but his lungs aren't interested in dry, zero air. They want about what one would find on a humid summer day—75 to 80 percent saturated, temperature in the 90s. They demand air almost totally free of bacteria, and cleansed of grit, smoke and other irritants. The air conditioner for a medium-sized room is as large as a small trunk. My air-conditioning system is compressed into a tiny area only a few inches long.

For the humidifying job I secrete about a quart of moisture a day. Mostly this is sticky mucus, produced by the spongy, red membrane that lines my passages. While the rough cleaning job is done by hairs in Joe's nostrils, it's the mucus that does the major work, acting as a kind of flypaper to trap bacteria and particles that get past the hairs. Naturally, I can't permit this film of mucus to stagnate. In a few hours there would be total

36

NOSE



37

Sensory Organs

pollution. So every 20 minutes I produce a clean new mucous blanket.

To remove the old mucus, I have an army of microscopic brooms—cilia. These minute hairs rapidly whip the film back to the throat for swallowing and then slowly settle back to their original positions. Strong stomach acid destroys most swallowed bacteria. My tireless little cilia make about ten sweeping strokes a second. Joe, of course, is unaware of this activity, which goes on day and night. But on a cold day he becomes aware of it, since cold partially paralyzes my cilia and causes an overproduction of mucus. Then, instead of being swept back to the throat, the moisture dribbles out the front. Joe gets a runny nose.

Besides mechanical trapping I have another protection against bacteria—a microbe slayer called lysozyme, the same stuff that protects Joe's eyes from infection. It makes me one of the cleanest of all organs—so clean, in fact, that much nose surgery can be performed without elaborate efforts at antiseptics.

Warming the air that Joe breathes is also quite a task. I accomplish most of this with my turbinates. Three of these little chips of bone, the biggest about an inch long, protrude from the side walls of each of my nostrils. In reality, they are small radiators. They are covered with erectile tissue with a relatively enormous blood supply—the steam for my radiators. Blood usually flows from tiny arteries, through a capillary bed, and into veins. In my turbinates the capillaries are associated with the tiny cisterns of my erectile tissue. As more blood is forced in, the tiny caverns swell. This happens when Joe breathes in cold air—I swell and provide greater warming surface.

My other big job, of course, is detection of odors. Joe, like most people, can recognize 4000 different scents. The really sensitive nose can go up to about 10,000. Since life rarely depends on me, my great skills are subdued, unused. Had Joe been born deaf and blind he would have appreciated my enormous potential. As a key tool of identification I would have been able to recognize people, houses and rooms by scent alone.

How do I detect odors? On the roof of each of my nasal cavities I have a patch of yellow-brown tissue smaller than a postage stamp. In each patch I have roughly ten million receptor

NOSE

cells, and six to eight tiny sensory hairs that project from each cell. All this apparatus is connected to Joe's brain, an inch away.

That, then, is the setup. But it doesn't tell how Joe identifies the smell of a broiling steak. We have only theories. It's known that anything smellable throws off molecules. Hot onion soup throws them off in plenty, cold steel hardly any at all. One theory holds that my receptor sites can distinguish the sizes and shapes of different molecules. The difference is somehow registered, and a wisp of electricity is generated and dispatched to the brain. The electrical signal is familiar to Joe's brain. The brain arrives at a verdict: vinegar, it says, or marigold or burning rubber.

Actually, it isn't all that simple. It is possible that there are primary odors, just as there are three primary colors. With the brain as a palette, odors are blended into a familiar scent.

If I am overwhelmed by a particular odor, after a short time I can no longer detect it. After the first few whiffs, Joe's wife hardly notices the perfume she is wearing. If Joe gets a job in a tannery, glucoworks or stockyard, he is oppressed by the odors at first. Soon, however, he is so worn out with those particular harsh smells that he hardly notices them. Yet his sensitivity to other odors remains. Even in the stench of a tannery a rose smells as sweet as ever.

As one of the body's most exposed organs, it's little wonder that I am the target for a wide spectrum of ailments. Certain microbes—notably those of syphilis and tuberculosis—can attack my cartilage and destroy my shape. Polyps sprout on my mucous membrane—little "mushrooms" that vary from pea to grape size. They can block air passages or sinus channels to cause a variety of grief.

Allergens, tobacco smoke and dust irritate my mucous membranes, causing them to swell and to produce excess fluid which drips into the throat. This is postnasal drip. Or air passages may be inflamed and shut by a cold. Joe often tries to blast them open with a mighty blow. This is dangerous business. It can force infection into my sinuses, or into the middle ear via the eustachian tubes. Or he may resort to nose drops—tissue shrinkers of various kinds. He'd best be cautious here, too. Drops cause the "rebound" phenomenon—temporary shrinkage is followed by greater swelling than was originally present.

Sensory Organs

Experts warn against nose drops because they end by complicating rather than solving the problem.

Joe is 47 now and my accuracy is declining. Coffee doesn't stir quite as good as it once did, and other odors aren't quite so noxious. All this is perfectly normal. It might have been handicap at one point in man's development, but no longer. Until I warm and cleanse Joe's last breath I will continue to do my jobs for him. And in defense of my lowly status I might add that in Joe's old age I will do my jobs far better than his eyes and ears will do theirs.

1. How does the nose protect us?
2. True or False. If the sense of smell is lost, food loses its taste.
3. What is the function of the 8 sinuses?
4. The substance which traps bacteria and particles is called _____?
5. What is the function of the cilia?
6. True or False. The nose is one of the cleanest organs.
7. True or False. Loss of a sense organ would improve the sense of smell.
8. What are polyps?
9. Allergies produce excess fluid which drips into the throat and is known as _____?
10. How is temperature regulated inside the nose?

Sensory Organs

the middle *dermis*, the bottom *subcutaneous* tissue. In most places around Joe's body my outer layer is paper-thin. He can see for himself next time he burns a blister: my epidermis is the transparent tissue on the top of the blister. Joe can shave off a callus without a bloodletting because there is no blood supply in my epidermis. Its cells are nourished by diffusion from below.

While a snake sheds its skin in dramatic fashion, the shedding of my epidermis is a slow, steady process. Each day many millions of baby epidermal cells are formed in the innermost part of my epidermis and begin pushing their way outward, changing as they go—from jellylike cellular material to hard, horny *keratin*. My keratin layer consists of flattened, singly cells—all dead. (Fragile living cells couldn't survive exposed to the hostile outside.) Each day millions are washed away when Joe showers, or are rubbed away by clothing. Thus Joe gets a new outer skin every 27 days—the birth-to-death span of these cells.

Functionally, there isn't a great deal to be said for my fatty subcutaneous portion. It acts as a shock absorber to protect internal organs, serves as an insulator to conserve body heat and is responsible for pleasing body contours—more important to women than to men. Some experts don't consider this layer part of me at all—subcutaneous actually means "*beneath*" the skin."

Look now at my tough "hide," or *dermis*. It is the strong but elastic envelope that holds everything together—that keeps vessels, fat, etc., from bulging or falling out. The *dermis* contains an intricate collection of nerves, blood vessels and glands. The mix varies at different places in Joe's body. But under an average square centimeter of surface—an area the size of Joe's little fingernail and about 1/8 inch thick—there will be some 100 sweat glands, 12 feet of nerves, hundreds of nerve endings, 10 hair follicles, 15 sebaceous glands and 3 feet of blood vessels!

My intricate network of blood vessels is particularly interesting. Let Joe exercise on a hot day and these blood vessels dilate; he becomes flushed. I am trying to radiate heat to the outside to get rid of it. On a cold day the reverse takes place. My vessels shut down, detouring blood to the interior of Joe's body; he goes pale. My blood vessels are also under the command of

42

SKIN

JOE THINKS OF ME, his skin, as a not too interesting sausage wrapper, an inert parchment demanding much—shaving, bathing, scratching, anointing—and giving little. How wrong he is. I am an absolute essential.

I do jobs he never dreamed of. He doesn't think of me as a manufacturer of intricate chemicals, but I am. I produce at least one important vitamin—vitamin D—and activate the sex hormone, testosterone, produced by Joe's testes. I help regulate blood pressure. I keep water in (Joe would quickly die if I didn't); I also keep water out (Joe can swim for hours without becoming waterlogged). My complex nervous system detects pain, touch, heat, cold, and instantly passes findings along to Joe's brain. I have been called the "frontier" of Joe's body. But maybe "rampart" would be better, for I protect against a mighty horde of potentially deadly invaders—bacteria—that live or land on my surface.

I come in many forms—Joe's fingernails and toenails, the hair on his head, the callus on his sole, the wart he once had on a finger. And I am made up of three layers: the outer *epidermis*,

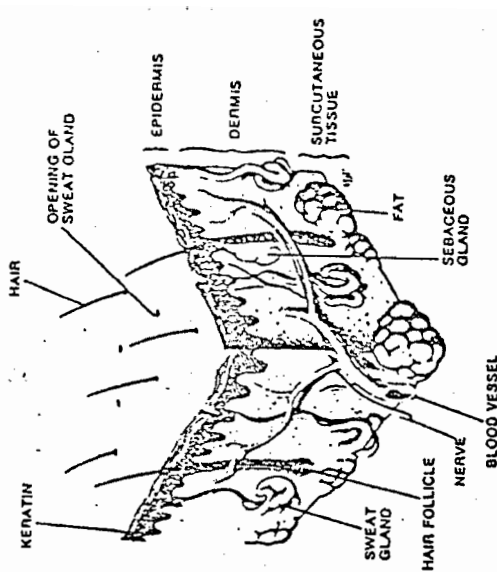
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SKI

emotions. When angry, Joe flushes—I've opened up the blood vessels of his face. Fear shuts them down—Joe gets cold feet.

It's no news, of course, that evaporation of sweat cools the body. But that hardly tells the full story of my complex air-conditioning system. Let body temperature vary more than a few degrees from a normal 98.6°F., and Joe is a goner. To avoid this, I have a staggering number of sweat glands—two million spread around Joe's 18 square feet of body surface. Each is a tightly coiled little tube buried deep in my *dermis*, with a 50-inch-long duct rising to the surface. Tiny as they are, I have a total of six miles of these ducts.

Extracting water, salt and some wastes from the blood, my sweat glands function almost continuously. On a day of comfortable temperature, when Joe isn't even aware that he is sweating, my glands will produce half a pint of water. But if Joe,



43

Skin

1. The skin produces vitamin ?
2. What liquids does the skin keep from leaving or entering and WHY?
3. The tissue layer on top of a blister is called the ?
4. True or False. Only snakes shed their skin.
5. What is the function of the subcutaneous tissue?
6. Heat can be controlled by the ? tissue.
7. How is normal body temperature kept at about 98.6 F?
8. True or False. The skin also removes waste products.
9. The skin manufactures ?
10. Why are sunburns dangerous?

Sensory Organs

are a professional football lineman, playing on a hot day, he might lose seven quarts—that's about 14 pounds of water.

My sweat glands also respond to emotional stimuli. In periods of anxiety Joe breaks out into what he calls a "cold sweat"—it's cold because there are quantities of it subject to rapid evaporation. With fear, his palms get damp—again, excessive evaporation.

Of the sebaceous glands are my sebaceous or fat glands—there are a few hundred thousand of them, producers of a semiliquid oil. Obviously they are attached to hair follicles, and lubricate both the hair and surrounding skin. For Joe's primitive hair-covered nesters, these glands probably served a useful purpose: keeping hair waterproof, and enhancing its heat-retaining capability. Today they mainly cause trouble. My hair follicles become clogged, cellular debris collects and blackheads and pimples result—or that special misery of the young, acne.

Now to my manufacture of hair. I have about ten hair follicles per square centimeter, each consisting of a bulbous root deep down, and a shaft extending up and above the surface. Joe's wife, Jane, has about the same number of follicles. But in the main they produce hair so fine and so light-colored that it is almost invisible. My follicles produce hair continuously, extruding dead cells above the surface.

I also have millions of cells called melanocytes, which produce the pigment melanin. This is the stuff that determines the color of Joe's hair, eyes and skin. (If it were lacking in Joe, he would be an albino.) Melanin is mainly a protective substance; it screens out dangerous ultraviolet from the sun's rays. A day or so after Joe has been out in the sun, my pigment granules start rising from the lower part of my epidermis to the surface, giving him a protective tan. Freckles are simply concentrations of melanin.

My network of nerves is really awesome. On his fingertips, Joe has thousands of sensory nerve endings per square inch. Let him stub a toe, burn a finger, nick himself with a razor and I sound the alarm. If he is chilled, my cold receptors inform his brain. Joe's muscles go to work and he shivers to stimulate circulation, and gooseflesh forms—tiny muscles in my hair follicles cause this pebbling of skin. Its original purpose was to

SKIN

make hairs stand erect—providing greater protection when fighting greater warmth when cold. Today this still works for Joe's dog, but not for Joe.

Typically, with age I become thinner, more transparent (veins in the hands of the aged become prominent). My undercoat of fat diminishes and, as it does, wrinkles form. Elastic skin fibers lose snap; bags begin to form under eyes, jowls begin to sag.

The biggest danger I face is cancer. Mostly this traces to overexposure to the sun (which also ages skin). Forehead, nose and ears are favorite spots. Fortunately, my cancers are highly curable. But they can be killers, so Joe would do well to take heed of any growths on his skin—especially if they bleed and don't heal.

Can Joe do anything for me? Avoiding overexposure to the sun is perhaps the most important thing—down to wearing a hat when he plays golf. Unless skin is unduly oily, excessive tub soaking is bad in wintry weather since it dries me out.

No matter how good the care Joe gives me, I will still cause him a certain amount of trouble. Since I am the bulwark between inside and outside, totally exposed and subject to trouble from both within and without, it isn't surprising that I am prey to an array of diseases—upward of 2000. Psoriasis is a major one. Its red, scaly patches are caused by epidermis cells being formed and discarded too rapidly—perhaps in five days rather than a normal 27. Cause? No one knows. Shingles is another of my banes. This one is caused by the chickenpox virus. First comes pain, often a great deal. Then blisters form—usually, but not always, in the trunk area. The pain may persist, especially in older people, for some time after the blisters heal. In cases of these and other diseases, Joe will just have to get his doctor's advice, and be thankful that I do as well as I do.

Readers Digest

I AM JOE'S EYE

Though I wasn't really designed for today's heavy close-up work, I'm a marvel of endurance and reliability.

By J. D. RATCLIFF

FOR concentrated complexities on for continuous close-up work. Look at my anatomy and you'll understand why I am having difficulty adjusting to today's demands. First, my front window—my clear, dime-size cornea. It starts the seeing process by bending light rays into orderly patterns. Next, my pupil—an adjustable gateway for light. In bright sun it is nearly closed; on a dark night it is wide open. Up to this point there is nothing about seeing camera ever made. I am relying that a cheap camera couldn't handle.

My wonders really begin with my lens—a little envelope of fluid the size and shape of an oval vitamin pill. My lens is surrounded by a ring of tiny, superbly strong, unbelievably hard-working muscles. When they tense, my lens fattens for near vision; when they relax, it flattens for distant vision. This was a fine arrangement for Joe's cave-man an-

52, 47, is a typical American man. Many other organs have told their stories in issues of The Reader's Digest.

I AM JOE'S EYE

cestors. Since they were mainly interested in things 20 or more feet away, the muscles were relaxed most of the time. But Joe now lives in a close-up world—lots of reading, desk work and such. This keeps my ciliary muscles tensed a lot of the time. They grow tired.

In front of and behind my lens I have two fluid-filled chambers. In front the fluid is like water; in back it is about the consistency of egg white. The watery fluid keeps me firmly inflated. Both fluids must be absolutely clear to permit passage of light. Those "specks" Joe sees when he looks at a bright light are cellular remnants left over from his earlier construction. They will float aimlessly in his eye fluid as long as he lives.

When Joe looks at some object, the light passes through my lens, which brings it into correct focus on my retina, a kind of onion-skin wall-paper which covers the rear two thirds of my interior. Except in Joe's brain, I don't think that anywhere else in his body is so much packed into so small a space. Covering less than a square inch, my retina contains 137 million light-sensitive receptor cells: 130 million shaped like rods for black-and-white vision, seven million shaped like cones for color vision.

This article was prepared in consultation with members of the Department of Ophthalmology of the Harvard Medical School at the Massachusetts Eye and Ear Infirmary.

The rods are scattered all over my retina. Let a firefly pass at night and a complex chemistry gets under way. The faint light bleaches rhodopsin, a purplish-red pigment in my rods. The bleaching process generates a tiny wisp of electricity—a few millionths of a volt, far too little to tickle a mosquito. This feeds into my straw-size optic nerve and is transmitted to Joe's brain at about 300 miles per hour. The brain interprets the signals flooding in and hands down its verdict: a firefly. All of this intricate electrochemical activity has been completed in about .002 second!

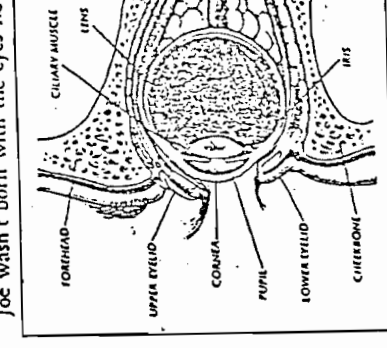
If my rods seem complex, my cones are far more so. They are concentrated in the fovea, a pinhead-size, yellowish depression at the rear of my chamber. This is the center for acute vision—reading, any close work—and for color. A leading theory is that these cones, too, have bleachable pigments, one each for red, green and blue. Like an artist mixing paints on a palette, Joe's brain blends these colors to make scores of other hues. If anything should go wrong with this intricate electrochemical process, Joe would be color-blind—as one in eight men is to some degree. In dim light, activity of my cones diminishes, color or scene vanishes and everything becomes gray, as my rods take over.

While Joe sees with me, he sees in his brain. A crushing blow at the back of his head, severe enough to destroy the optical center of his

THE READERS DIGEST

brain, would produce permanent blindness. A lesser blow and he sees "stars"—a chaotic electrical disturbance. Joe gets clinching evidence of the brain's role when he dreams. He "sees" pictures, even with my lids closed in total darkness. Had he been born blind, he would dream in terms of other sensory stimuli: touch, sound, even smell.

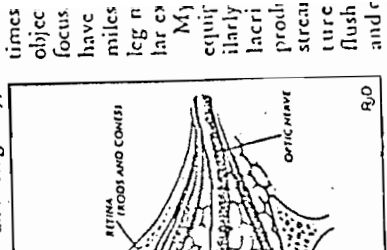
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1. The eye is best compared to a ? CAMARA

2. True or False. Light rays are bent by the cornea.

3. The aperture on a microscope regulates the amount of light. Why is the pupil similar?

4. How can a person's eye focus?

5. True or False. The cone cells are scattered throughout the retina.

6. Black-and-white vision is accomplished by the ? Reception cells.

7. Give an example of how the eye must work with other organs to function.

8. True or False. People are born with excellent vision.

9. What is the function of blinking? To keep the cornea moist and clean

10. The condition where both the cornea and lens cloud over is known as ? CATARACT

I AM JOE'S EYE

Nature gave me superb protection, placing me in a bony cavern with protruding cheekbones and forehead to act as shock absorbers for direct blows. She also gave me supersensitive nerves to sound the alarm if there should be a potentially damaging intruder such as a cinder. Still, I do have my troubles. My focusing apparatus often fails to work perfectly. Eyeglasses can correct 95 percent of this trouble. Disease is a more serious problem. One potential disorder is really a plumbing problem—either too much fluid entering me or too little draining away. Pressure builds up, reducing the blood supply to my optic nerve. This is glaucoma.

In severe instances, glaucoma can cause permanent blindness in a few days. More often it is a leisurely performer, producing symptoms so mild they are apt to go unnoticed. These symptoms: colored halos around bright lights, loss of side vision, difficulty in adjusting to the dark, a blurring of vision. At his age, Joe has one chance in 40 of glaucoma damaging his sight, or blinding him completely. His doctor can check for glaucoma simply by pressing a little gadget called a tonometer against my eyeball. Joe should have this test every year. The treatment for glaucoma? Drugs in drop form, or surgery.

Astigmatism is another of my common ailments. In this one, my cornea is not a spherical surface and distorts vision like a bubble flaw in a piece of glass. Eyeglasses correct this condition. A detached retina is more serious. It occurs when my retinal wallpaper blisters or peels, and usually announces itself with flashing lights, image distortion, blurring spots. A surgeon can "tack" my wallpaper back in place with 80-percent chance of success.

Both my cornea and my lens—normally totally transparent tissue—can cloud and lead to blindness. If it's the cornea, Joe can regain sight with a corneal transplant. If it's the lens, he will need a cataract operation, and either thick eyeglasses or contact lenses afterward.

Fortunately, Joe has so far escaped all these things. Just the same, I am growing old—like Joe's other organs. The transparency of my lens is lower, accommodation muscles are weaker, hardened arteries are diminishing blood supply to my retina. These processes will continue, but Joe shouldn't worry unduly. The odds are heavily in favor of my providing him with serviceable vision as long as he lives.

Reprints of this article are available. Prices, postpaid to one address: 12—\$1.00; 50—\$2.50; 100—\$4; 500—\$15.00; 1000—\$25. Address: Reprint Editor, Reader's Digest, Pleasantville, N.Y. 10570

Sensory Organs

and yellow blend into a thousand hues, so too do the basic tastes blend into thousands of taste sensations.) But the researchers were wrong.

Taste buds are by no means confined to me, but are scattered around Joe's oral cavity. The primary tasters of sour and bitter are near the junction of the soft and hard palates in the roof of the mouth, if Joe ever wears dentures that cover his palate, the buds will be covered up and things won't taste so good. Lemon pie will lose some of its sour tang, and tea and coffee may become less flavorful without their predominant bitterness. Most of the buds for salt and sweetness are on the tongue—although a few are elsewhere, particularly in the upper throat.

Food must be liquefied before any real taste emerges. This is true even of ice cream, which, until it melts in the mouth, is quite tasteless. But once liquefied, it binds to the sweet-taste receptors of the buds; a minute electrochemical current is generated and passed by cranial nerves to the gustatory terminals in the brain. (Other impulses are transmitted for foods that taste sour, bitter or salty.) Like colors mixed on a palette, the messages are blended, and the brain hands down its verdict: the ice cream is delicious.

For a long time, it was assumed that all foods tasted alike to all people. (It's a strange notion when you think about it—everyone knows that hearing and sight are subject to great variations.) Now it becomes clearer all the time that there are vast differences in taste sensitivity. To one person, spinach may be honestly delicious; to another, bitter and horrid. It's the same with scores of other foods. Several pure chemicals point up variations in human taste response. Sodium benzoate, for example, is sweet to some, and to others sour, bitter, salty or tasteless. So there's no point in arguing if someone doesn't like the Roquefort cheese that you find delectable.

Indications are that taste follows regular inheritance patterns. Just the same, tongues do have a certain amount of adaptability, and Joe has learned to accept foods that he once found intolerable. Few babies like buttermilk; many adults do. It took time for me to learn to accept such things as curry, chili and strong cheese. And once I've learned I don't forget: unlike most other organs of the body, I hold up well with age. Joe's sight and hearing will diminish, but not his taste—bean soup has

48

TONGUE

of all sorts. I even express emotions: Joe's children stick out their tongues to indicate aversion or disgust.

One of my most important—and complex—tasks is to assist in swallowing. For this, my front part presses against the hard palate in the roof of the mouth. Then my rear portion humps up, catapulting food into the passage which leads to the esophagus. Though it sounds quite simple, it is actually a symphony of activity, conducted by nerves and executed by intricate muscles. Joe knew how to swallow before he emerged from the womb—an indication of how critical the swallowing reflex is to life.

Speech is another matter. I had to be trained for this extraordinary neuromuscular feat. As a baby, Joe experimented with sounds for more than two years before he was able to form simple sentences. Today, I am a tireless gymnast, able to flex myself into a great variety of shapes for more complex expression. Joe can get some idea of my acrobatics by uttering a single sentence. As he speaks, let him concentrate on my motions. He will be amazed at the activity.

Or, he can give thought to another matter. I live in constant proximity to a very real enemy—the teeth. They are capable of doing me real injury. But I am an extremely artful dodger; I keep out of their way and am rarely bitten.

Essentially, I am a slab of mucous membrane enclosing a complex array of muscles and nerves. My upper surface is studded with papillae—little nipples, some of which contain taste buds. Located in my taste buds are taste cells, which actually receive the sensation of taste. On my underside is a tiny cord, the frenulum. Let this cord be too short, restraining normal motion, and I am tongue-tied. Victims once went through life with garbled speech. Today, this defect can be corrected by surgery.

My taste buds look something like microscopic rosebuds. Their tasting action is a chemical process, like smell. Curiously enough, they are on my under as well as my upper side. Until recently, scientists thought that they had my taste buds completely mapped: I tasted salt with my tip, sweet in the middle, bitter in the rear and sour along my sides. (These are four of the basic tastes. And just as the primary colors red, blue

47

TONGUE

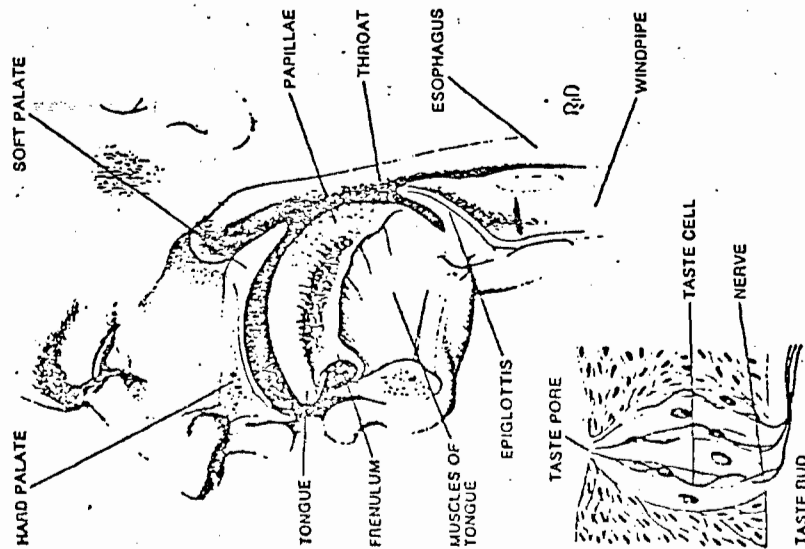
FROM TIME TO TIME, Joe sticks me out and examines me in the mirror. He is not exactly sure what he is looking for. If he finds anything unusual, he is almost certain to misinterpret it. That is about the end of his interest in me. After all, I'm only four inches long and weigh but two ounces, and I usually stay out of sight. I am Joe's tongue.

Compared with the eyes and ears, I have had a bad press: my faculty of taste has been called the "poor cousin of the five senses." Unfair, I say! Let Joe try to get along without me! Let him extend me from his mouth, for instance, and clamp me lightly between his teeth, and then try to speak. What comes out is hardly recognizable.

True, I don't have the virtuosity of some animal tongues. I can't flick out to catch insects the way a frog's tongue does, or "feel" the way through a dark cavern as a serpent's tongue can. Just the same, I have a large assortment of jobs: I assist in mastication, rolling food around in the mouth so that it is evenly ground and made acceptable to the stomach. I am quite a serviceable toothpick—I like to keep my domain clean of debris

46

TONGUE



49

Sensory Organs

about the same flavor for someone at 90 as when he was ten. As I mentioned earlier, Joe examines me from time to time. He thinks that when I am "coated" it's a sign of a digestive upset or constipation. Not necessarily. Many of the chronically constipated have clear tongues, and the tongues of many unconstipated people have greenish-white coats. My "coat" is simply tiny particles of food and old cells on my surface that have been trapped between my papillae and attacked by microbes (all of which can be scrubbed away). Those who breathe through their mouths are particularly prone to this.

Nevertheless, the tongue has been called the "mirror of disease" and often gives evidence of trouble elsewhere. With pernicious anemia, I am often red, beefy, smooth; jaundice makes me yellowish; with pellagra, I'm fiery red. Certain fungi can turn me black.

One of my more unpleasant ailments is dysgeusia. Taste is distorted; sugar can be repugnant, meat may taste dreadful. A candy bar may taste salty or a mackerel sweet. This common and now widely recognized disorder seems to be due mainly to the shortage of zinc in the body. The zinc is either lacking in the diet, is poorly absorbed or is lost in large amounts following flu or other diseases. Increase the supply and taste comes back.

Another of my ills is hypogeusia, which decreases the flavor I get from food and drink. Most foods are simply tasteless—roast beef is like soft rubber, an orange like unflavored gelatin. In order for me to taste sweetness, Joe must heap extra amounts of sugar in his morning cereal and coffee. The causes of this ailment include several factors that change the appearance and function of my taste buds. In extreme cases, taste perception disappears completely. Naturally, victims are depressed. They finally realize something the rest of you might note: taste is one of the most pleasurable of the senses.

It is really surprising that an organ that gives people so much service should be held in such low esteem. Under normal circumstances, Joe gives me less attention than his hair or fingernails, which aren't at all essential to his well-being. I suppose there is little I can do about it—except go right along tirelessly doing my jobs, tasting and talking my way through life.

50

Tongue

1. True or False. Without the tongue, you could not talk.
2. Name a function of the tongue.
3. True or False. Swallowing is a reflex.
4. What do papillae contain?
5. True or False. Food tastes the same on all parts of the tongue.
6. Food tastes delicious due to the tongue sending a message to the _____?
7. True or False. All foods taste the same to all people.
8. Why is the tongue called the "mirror of disease"?
9. What is hypogeusia?
10. True or False. Taste change as a person grows older.

By J. D. RATCLIFF

I AM JOE'S EAR

My mechanism is a triumph of miniaturization, but it is constantly endangered by today's loud, shrill noises

Joe is impressed by the computer his company bought not long ago. It will perform seeming miracles, but to me it is as crude as a concrete mixer. Perhaps I am prejudiced, for I am a triumph of miniaturization. Nowhere in his body is so much crammed into so small a space as in me. I have enough electrical circuits to provide phone service for a good-sized city. I am a kind of automatic pilot, keeping Joe from toppling over.

I am Joe's right ear, and I do all in a space not much larger than a hazel nut. Joe considers his eyes his most important sensory organs. Yet, without my partner and I, he would be doomed to solitary confinement—far more emotionally disabling than blindness.

Joe, 47, is a typical American man. Many of our other organs have told their stories in past issues of *The Reader's Digest*.

THE READERS DIGEST

vibrations from a whisper can push it inward—but ever so little, perhaps only a billionth of a centimeter. This minute displacement is then changed—in an awe-inspiring chain of events not yet entirely understood—into meaningful sound for Joe.

To see how, step through my drumhead to Joe's bean-size middle ear. Here are hinged together three tiny bones called the anvil, hammer and stirrup (also known as the stapes) because they vaguely resemble those things. It is their job to step up the tiny movements of my drum, amplifying them 22 times and passing them on to my inner ear via an oval window attached to the stirrup.

My inner ear—the real organ of hearing—resides in a fortress-like cavern hollowed out of the body's hardest bone and filled with watery fluid. Its major hearing component is the snail-shaped cochlea, whose twisting interior is studded with thousands of microscopic hair-like nerve cells—each one tuned to a particular vibration. When the middle ear's stirrup "knocks" on the oval window leading to the inner ear, this fluid is set vibrating. If middle ear C has been sounded, say, then the cochlea's middle C's hair cell vibrates, waving in the lymph fluid like seaweed in a tidal current.

The waving produces a wisp of electricity that feeds into my audi-

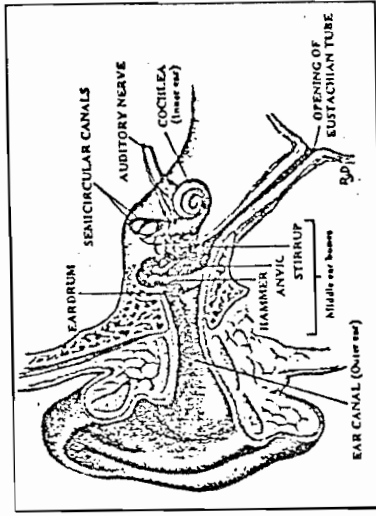
This article is based largely on interviews with Dr. Howard P. House, president of the Los Angeles Foundation of Otolaryngology and professor of otolaryngology at the University of Southern California.

I AM JOE'S EAR

the brain was getting more messages than it could handle, and Joe lost all muscular control. Let disorderly displacement of fluid continue too long, as in a tossing boat, and I begin to involve other organs. Joe breaks into a sweat, and motion sickness is apt to follow.

Joe's hearing started declining almost the moment he was born. It is

most the moment he was born. It is



now going down each year as my tissues lose elasticity, hair cells degenerate and calcium deposits invade critical spots. When Joe was a baby, he had a hearing range of 16 to 30,000 cycles per second (vibrations). (If it had gone much below 16 he could have heard the vibrations of his own body. As a matter of fact, Joe can hear his body vibrations. Let him stopper his ears with his fingers: the low rumble he hears comes from tensed finger and arm muscles.) By the time he reached his teens, the upper limit of his hear-

ing had dropped to 20,000. Now he hears nothing above and, if he reaches the age of 40, will be down to about 4,000. Then hear conversation reasonably well in a quiet place, but try difficulty in a noisy area. hear low tones better than tones. He also has a decibel loss in sound intensity. any participant in a conversation. a quiet ranks at decibels, it about 60 band 120 shout in 14 this does that a rock only twice as normal variation. A jump of twenty on the tricky decibel scale hundredfold increase of intensity. Right now Joe has a 40-decibel hearing is quite service. I he is beginning to ask people great words. With any structure as cor mine, a great deal can go Drum punctures are frequent untunately, most such punctures themselves or can be repaired operation. Tinnitus, or ringing the ears, is another source of trouble. This can be caused by abn-

1. What is the function of wax glands?
2. Why is the ear compared to a drum?
3. The three bones in the ear are called the _____, _____, and the _____?
4. We can hear different tones due to the functioning of the _____?
5. Why does your own voice sound different on a tape recorder?
6. The ear is not only a sensory organ, it also is an organ of _____?
7. True or False. Hearing improves as a person matures.
8. The throat and ear are considered to be connected by the _____?
9. What problems could arise if loud music were listened to constantly?
10. True or False. The bones must be allowed to vibrate for us to hear.

THE READER'S DIGEST

wearing hearing aids a few years hence. But he thinks *he* can adjust to today's shrill racket. He can't. When excessively loud, low-pitched sounds strike my drum, I have muscles to tighten it; otherwise, I take what comes. This was fine for Joe's ancestors. Thunder or the roar of a lion were the loudest sounds around, and these were low-pitched. It's the new high-pitched sounds—the whine of jets, rat-a-tat-tat of riveting machines, etc.—that wreck me.

Sustained loud noise can wreck internal organs of a mouse and eventually kill it. If such an experiment were ever tried on Joe, I can guess the result. What can Joe do about it? He could speak out against senseless noise, seek quiet in home and office and cover his ears when he goes hunting—the repeated burst of a shotgun can really wreck me. He could stop smoking, or at least cut down. Nicotine (coffee, too) constricts arteries in my all-important inner ear, reducing the nourishment my inner ear needs.

Joe has his eyes examined regularly, and I would like the same attention. If Joe only knew how limited and lonely the world of silence is, he would take all possible steps to preserve my partner and me.

Reprints of this article are available. Prices, postpaid to one address: 12—\$1.00; 50—\$2.50; 100—\$4; 500—\$15.00; 1000—\$25. Address Reprint Editor, Reader's Digest, Pleasantville, N.Y. 10570

things: drugs (some antibiotics, alcohol), fever, circulation changes, tumors on my acoustic nerve. Once the causative factor is tracked down and eliminated, I sometimes cease my racket.

Middle-ear infections are another source of trouble—and, before antibiotics, often culminated in hearing loss. The eustachian tube, leading from the middle ear to Joe's throat, is the culprit. The throat is, microbially speaking, a very dirty place, and the eustachian tube offers microbes easy access to the middle ear. When he has a cold, Joe would be wise not to blow his nose too hard—it forces throat pollution into me.

Sometimes an overgrowth of bone is apt to freeze motion of the bones in my middle ear. Once motion stops, hearing is impaired. This is conduction deafness. Joe has the beginnings of it, but chances of its progressing to really serious deafness are only about one in ten. If this happens, Joe has two options: a hearing aid or surgery. The operation (which has an 80-percent chance of success) replaces my stirrup bone with a tiny filament of stainless steel. Motion of the bones resumes, and Joe can hear again.

Perhaps the biggest thing Joe should be worrying about right now is noise pollution. Joe knows that workers in noisy trades may develop hearing difficulty, and that today's rock musicians will probably be

games

BOARD

GAME

The FIND Senses

for 2-6
players

FIVE SENSES

NOSE

part of the nose is the ———.

Molecules carry — to the nose.

You breathe air through your — (your mouth).

Smells travel through the —.

Take a Sense Card

Skp & Lw'n

What is Texture?

Move back 1 space

Name 5 parts of the Eye

What does the nose tell you?

Skip the Skin

What is the job of the Iris?

The colored part of your eye is the —.

How is the eye like a camera?

Move 1 space

EAR

Objects that vibrate will make a noise.

The first in line is found in the —.

Take a Sense Card

Nerves make messages to the —.

Move back 2 spaces

Skip to the nose

Objects that vibrate will make a noise.

How does sound travel?

The largest sense organ in the body is the —.

Skin

Part of the ear is called the —.

How does sound travel?

What can you taste on the tip of your tongue?

You can taste salty and —.

Take a Sense Card

Name 1 of the Shifts

Name 2 of the Shifts

Take a Sense Card

The front of the tongue can —.

Why does the tongue have to be wet?

You hear a car in spaces of the ear or —.

How many parts are there?

TONGUE

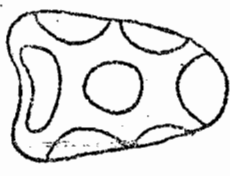
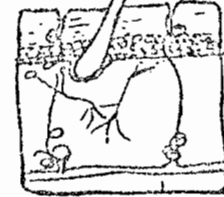
THE FIVE SENSES

board game

G. GRADY
SEPTEMBER 1983



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ear



The Retina is found in the _____
Or move back 2 spaces

Objects that vibrate will make/ not make noise

Take a Sense Card

Nerves send messages to the _____

Move 2 back spaces

The anvil, hammer and stirrup are bones in the _____

How does Sound travel?

The largest sense organ in the body is the _____

Skin

Move ahead 1 space



Name 2 parts of the Ear or go back 4 spaces

You hear a car. Run ahead 2 spaces

YOU CAN HEAR

Skip to the nose



Why does the tongue have to be wet?

sweet is tasted on part _____ of the tongue

What can you taste on part _____ of the tongue?

You can taste sour, sweet, salty and _____

The front of the tongue can taste _____

Take a sense card

Name part 1 of the skin

Name part 2 of the skin

You must try something taste in order to taste

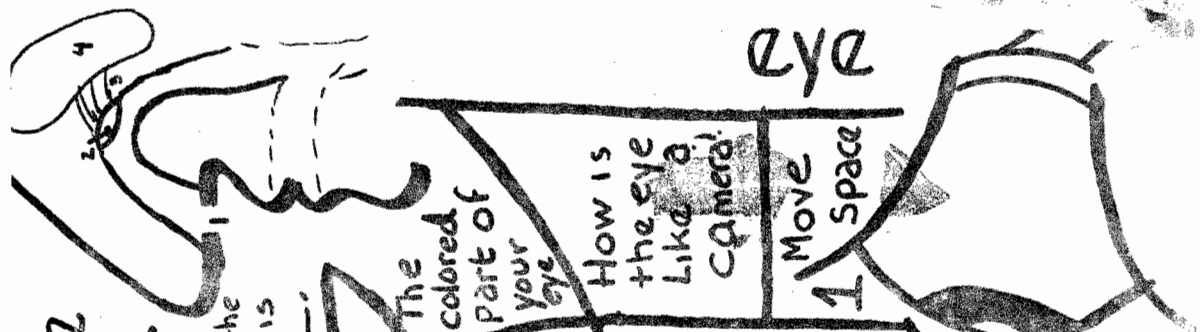
Part 1 of the ear is called the _____

Take a sense card

Sk to

The n sens part the bc

lo t go



nose

eye

part 4 of the nose is the ---

Molecules carry to the nose

You breath air through your (not mouth)

Smells travel through the ---

Skip a turn

Take a sense card

What is Texture?

most five of days---

What does the nose tell us?

Name all 5 senses

What are olfactory nerves?

The colored part of your eye

How is the eye like a camera?

1 Move Space

Skip to the Skin

Take a sense card

What is the job of the iris?

What do Senses tell us?

What is the optic nerve?

What do Senses tell us?

so your tearing back one.

© Grambo 1987

senses cards

the five senses
the five senses

The Five Senses

To Begin

Each player is given one playing piece and a sheet from the senses pad.

To Play

Place your playing piece on one of the five senses. Each player takes a turn and rolls the die. Highest roll goes first. Other players go clockwise around the table.

Players move the number of spaces shown on the die. Players are to do or answer any question that the space requests. If a player answers a question wrong he/she goes back two (2) spaces.

If a player lands on a space marked "Take a sense card", he/she is to do what the card says. If he/she cannot do this he/she will go back five (5) spaces and will lose a turn.

To Win

The object of the game is to be the first player to land on all five senses.

Grambo 1983

The Five Senses

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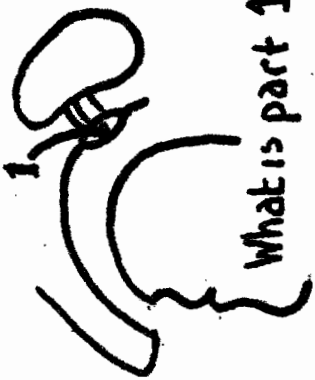
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Grambo 1983

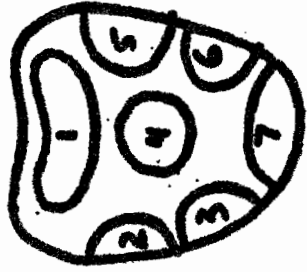
cards



What is part 1?



What is part 1?



Where would you taste bitter?



What is part 2?



What is part 2?

How do smells travel?



where is the inner ear?

Show a skin pore on the pad diagram.

How does sound travel?

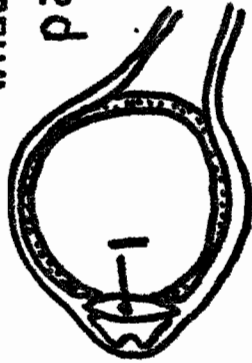
Define
Pitch

Show nerves in the pad diagram of the skin.

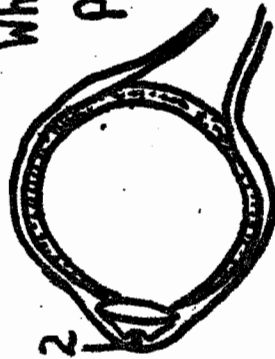
cards

Show the optic nerve in the pad diagram of the eye.

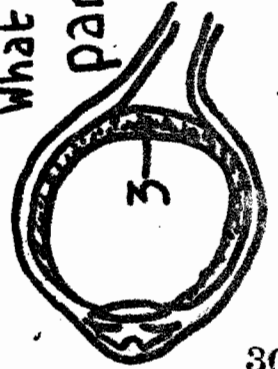
What is part 1?



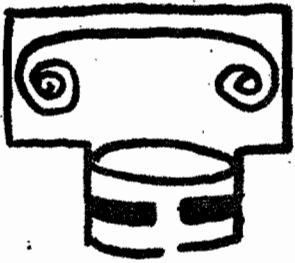
What is part 2?



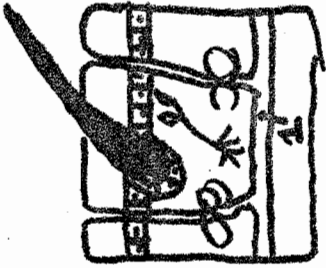
What is part 3 for?



How is this camera like the eye?



What is part 1?



What does a rubbing show us?

Describe the smell of a flower.

What are the 5 senses?

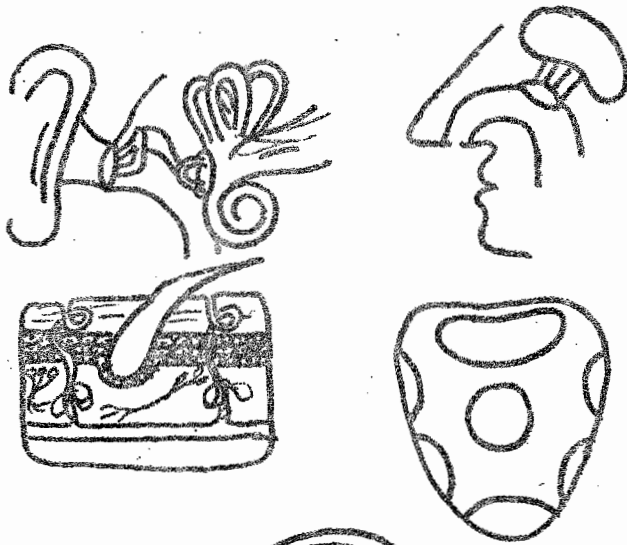
Show the hammer on the pad diagram of the ear.

What is the job of the ear drum?

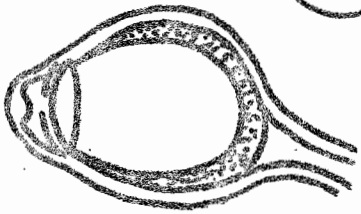
Why is it difficult to taste food if you have a cold?

The Five Senses

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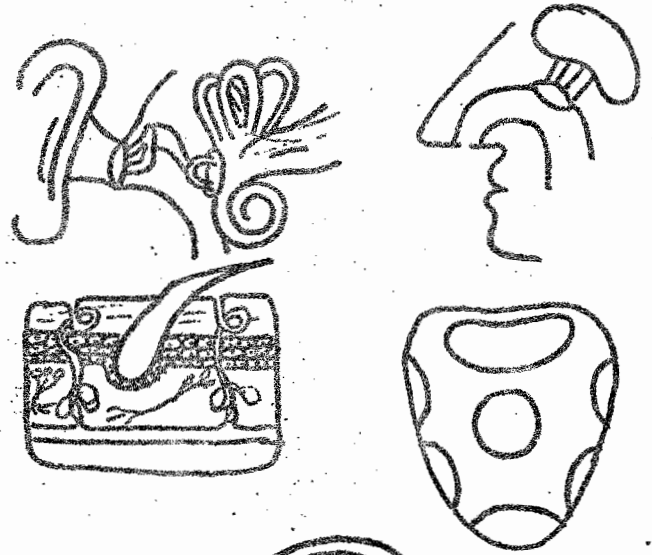


- Skin
- Nose
- Eye
- Ear
- Tongue

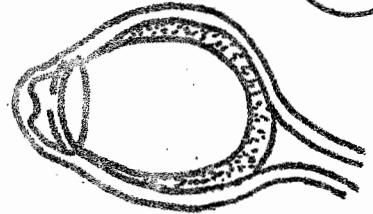


Name _____
 Class _____ Group No _____

The Five Senses



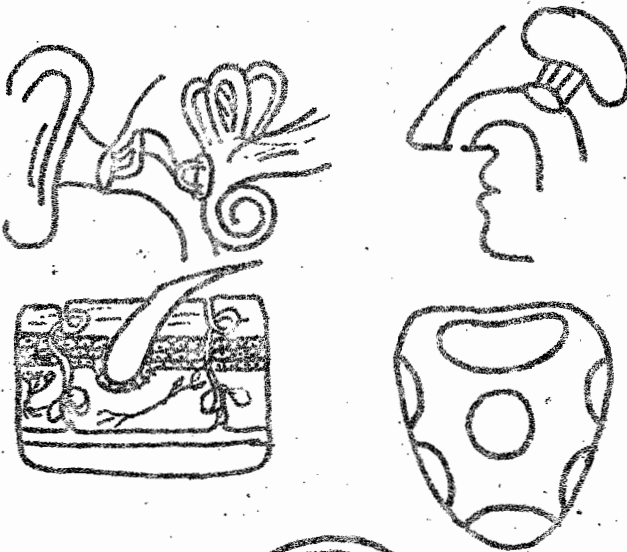
- Skin
- Nose
- Eye
- Ear
- Tongue



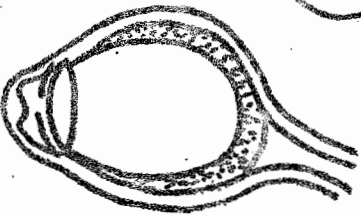
Name _____
 Class _____ Group No _____

The Five Senses

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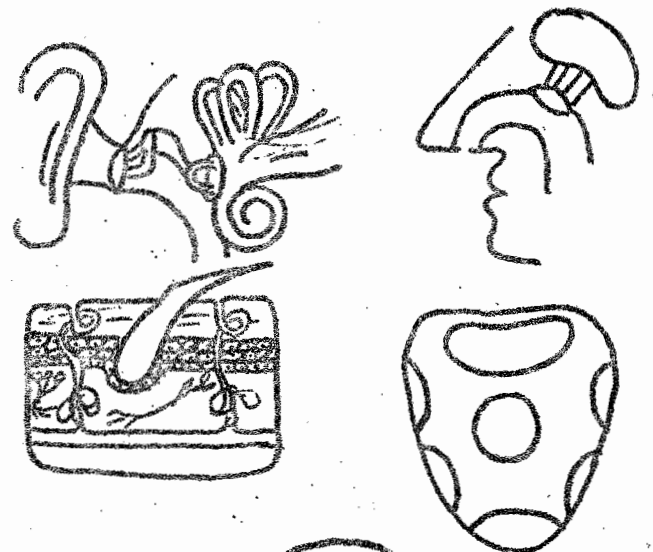


- Skin
- Nose
- Eye
- Ear
- Tongue

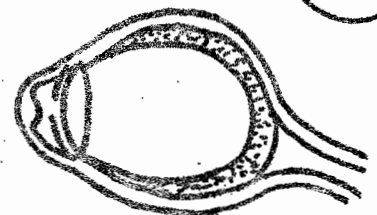


Name _____
 Class _____ Group No _____

The Five Senses



- Skin
- Nose
- Eye
- Ear
- Tongue



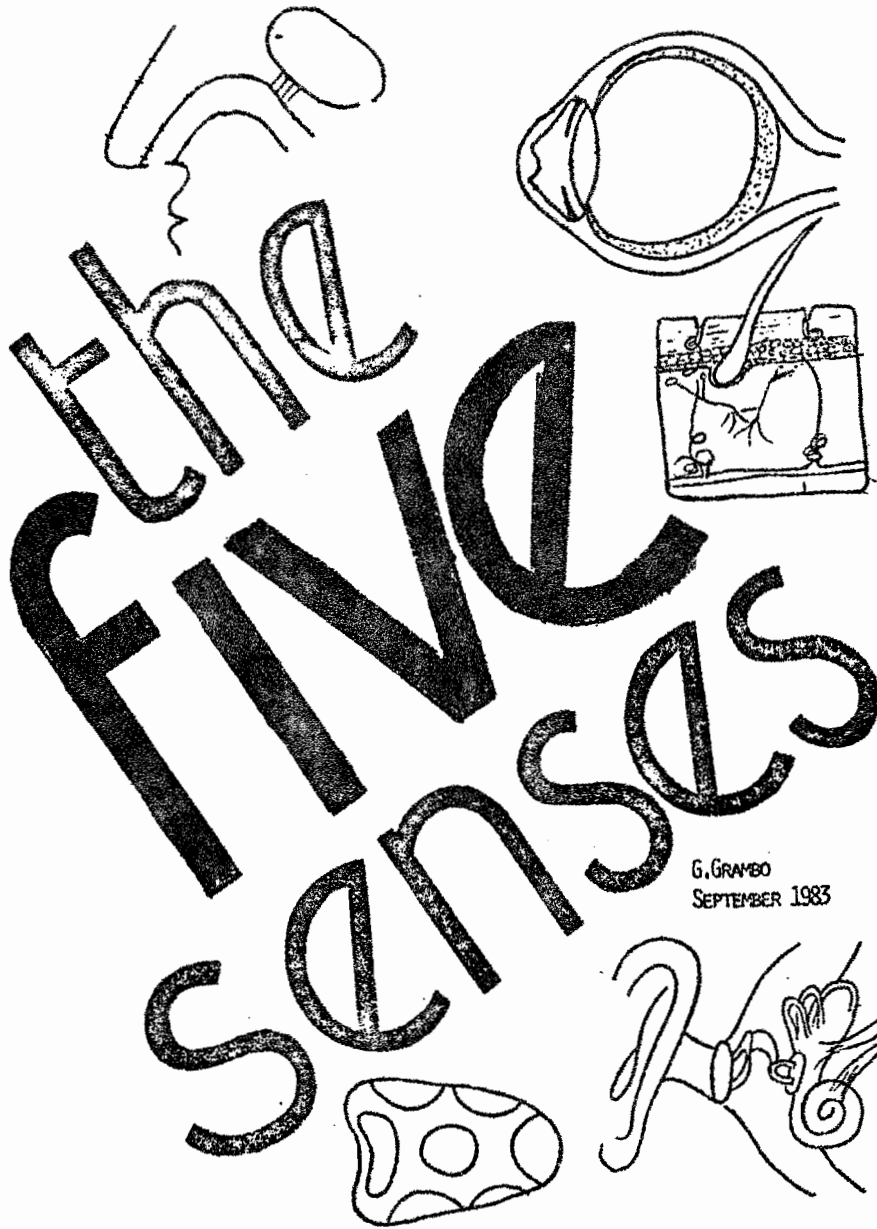
Name _____
 Class _____ Group No _____

THE FIVE SENSES

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THE FIVE SENSES

B I N G O



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SEPTEMBER 1983

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THE FIVE SENSES

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THE FIVE SENSES

the FIVE SENSES

G. Grawco
SEPTEMBER 1983

the five senses
BINGO 7

skin	nose	eye	nose	odor	skin	texture	eye
			taste buds	olfactory nerve	rubbing	lens	
			center	ear	pore	inner ear	
			middle	molecules	retina	camera	

the five senses
BINGO 6

rubbing	skin	nose		
	pore	inner ear		
lens	ear	taste buds		
center	light			
brain				

the five senses
BINGO 8

odor	center	rubbing	skin	nose
eye	texture	brain	lens	neuron
taste buds	tongue	vibrates	ear	middle ear

WINNER

BINGO

the five senses

1

BINGO

tongue	ear	texture	camera	optic nerve
light	retina	nose	Skin	olfactory nerve
hammer	eye	vibrates	middle ear	inner ear
brain	lens	taste buds	neuron	molecules
message	pore	center	odor	rubbing

the five senses

2

BINGO

camera	tongue	ear	optic nerve	texture
olfactory nerve	lens	retina	nose	Skin
inner ear	vibrates	eye	middle ear	neuron
light	rubbing	center	brain	molecules
odor	taste buds	hammer	pore	message

the five senses

3

BINGO

ear	optic nerve	tongue	texture	vibrates
retina	rubbing	center	pore	nose
skin	hammer	message	eye	brain
neuron	camera	olfactory nerve	molecules	inner ear
odor	middle ear	light	lens	taste buds

the five senses

4

BINGO

texture	rubbing	vibrates	tongue	ear
pore	light	olfactory nerve	taste buds	nose
retina	skin	message	brain	eye
center	molecules	optic nerve	camera	inner ear
middle ear	lens	neuron	hammer	odor

the five senses ⁵
BINGO

Skin	nose	eye	rubbing	olfactory nerve
hammer	lens	texture	neuron	tongue
ear	brain	light	middle ear	center
message	inner ear	molecules	optic nerve	retina
odor	taste buds	camera	pore	vibrates

the five senses ⁶
BINGO

rubbing	Skin	nose	eye	olfactory nerve
lens	pore	inner ear	texture	tongue
center	ear	taste buds	middle ear	odor
brain	light	molecules	neuron	optic nerve
camera	vibrates	message	retina	hammer

the five senses ⁷
BINGO

nose	odor	Skin	texture	eye
brain	taste buds	olfactory nerve	rubbing	lens
tongue	center	ear	pore	inner ear
neuron	middle ear	molecules	retina	camera
optic nerve	hammer	vibrates	light	message

the five senses ⁸
BINGO

odor	center	rubbing	Skin	nose
eye	texture	brain	lens	neuron
taste buds	tongue	vibrates	ear	middle ear
pore	olfactory nerve	retina	camera	hammer
light	optic nerve	molecules	inner ear	message

the five senses

9

BINGO

inner ear	vibrates	olfactory nerve	nose	Skin
tongue	ear	eye	optic nerve	rubbing
odor	pore	molecules	hammer	message
retina	camera	light	taste buds	texture
neuron	lens	brain	middle ear	center

the five senses

10

BINGO

olfactory nerve	odor	molecules	message	tongue
Skin	eye	ear	rubbing	inner ear
vibrates	pore	nose	center	neuron
optic nerve	light	texture	taste buds	hammer
retina	lens	brain	camera	middle ear

the five senses

//

BINGO

odor	camera	middle ear	pore	brain
nose	Skin	tongue	ear	eye
taste buds	center	molecules	retina	olfactory nerve
message	vibrates	neuron	inner ear	light
texture	rubbing	optic nerve	lens	hammer

the five senses

12

BINGO

middle ear	pore	brain	camera	odor
light	nose	Skin	tongue	ear
eye	inner ear	center	retina	neuron
vibrates	lens	molecules	rubbing	olfactory nerve
hammer	texture	taste buds	optic nerve	message

1- Largest organ in the body

2- Sense of touch

Skin

1- How things feel

2- rough, smooth describes an objects

Texture

1- film for the eye

2- image shown here inside the eye

Retina

1- means shakes

2- an object has to do this in order to make noise

Vibrates

1- Smell

2- picked up by the nose

Odor

1- You have 2 of these on your face. (fami)

2- Use for sense of sight

Eye

1- Has film inside.

2- Works like the eye

Camera

1- It will focus light.

2- focus the picture for the eye

Lens

1- picks up tastes on the tongue

2- nerves on the tongue

Taste buds

1- used to put in a nail

2- Bone inside the ear (not anvil or stirrup)

Hammer

1- Sense organ shaped like a cup

2- Makes use of vibrating waves

Ear

1- nerve behind the eye

2- nerve from the eye to the brain

Optic Nerve

1- section of the ear containing the hammer and anvil.

Middle ear

1- smallest piece of something.

2- smells carried on this.

Molecules

1- a note left on a pad

2- Impulse to the brain

Message

1- Sense organ used to smell a flower

2- Sense organ has olfactory nerves

Nose

1- nerve to the brain from the nose.

2- nerve that picks up smells

Olfactory Nerve

1- section of the ear containing the cochlea.

2- last part of the ear.

Inner ear

1- needed in order to see something

2- given off by bulbs or the sun.

Light

1- another name for nerves

2- Optic Nerve, Olfactory nerve, etc are all.

Neuron

1- Has taste buds

2- Sense organ inside your mouth

Tongue

1- Tiny holes in your skin

2- Where sweat gland meets the skin

Pore

1- middle of something

2- has no taste buds

Center

1- Inside the skull

2- Controls all the senses

Brain

1- picture that shows texture

2- put a penny under a paper and rub over it

Rubbing

appendix

The Five Senses



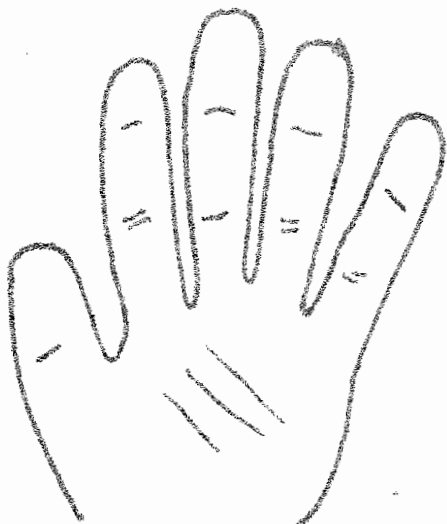
Name _____

Class _____ Group No _____

Quiz on Experiments 1-6

- 1) What do senses tell you?
- 2) What are they used for?
- 3) How do odors move through the air?
- 4) What are olfactory nerves?
- 5) What is texture?
- 6) How can your sense of touch help you?

7)



Where on the hand are you sensitive to

Cold - put an X

heat - put a ⊙

The Five Senses

Name _____

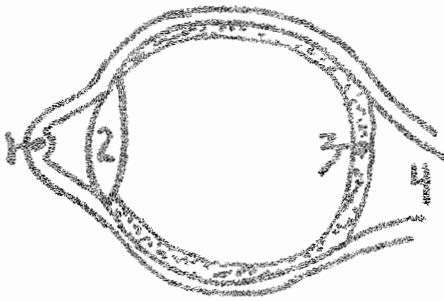
Class _____ Group No _____



Quiz on Experiments 7-12

1) How is the eye like a camera?

2) Label the parts of the eye



- 1 _____
- 2 _____
- 3 _____
- 4 _____

3) Why is light necessary in order to see something?

4) What are taste buds?

5) Why can't a dry tongue taste food?

6) In order for something to make noise what must happen to it?

The Five Senses

materials list

You are responsible for all materials in your box. Keep everything neat and clean. Report all missing materials to your teacher.

materials in your box

paper towel
tuning fork
rubber block
mirror
flashlight
2 sticks (like pencils)
2 beakers / cups
stirring rod
braille (sample)
straight pin (in a box)
hair pin (in a box)
Crayons

materials for the class to share

Sound boxes
sight boxes
touch/feel boxes
Smell boxes
hear boxes
Sugar cubes
crackers
pretzels
lemons
Candy
perfume

} Sense boxes

} Food samples

how to make sense boxes

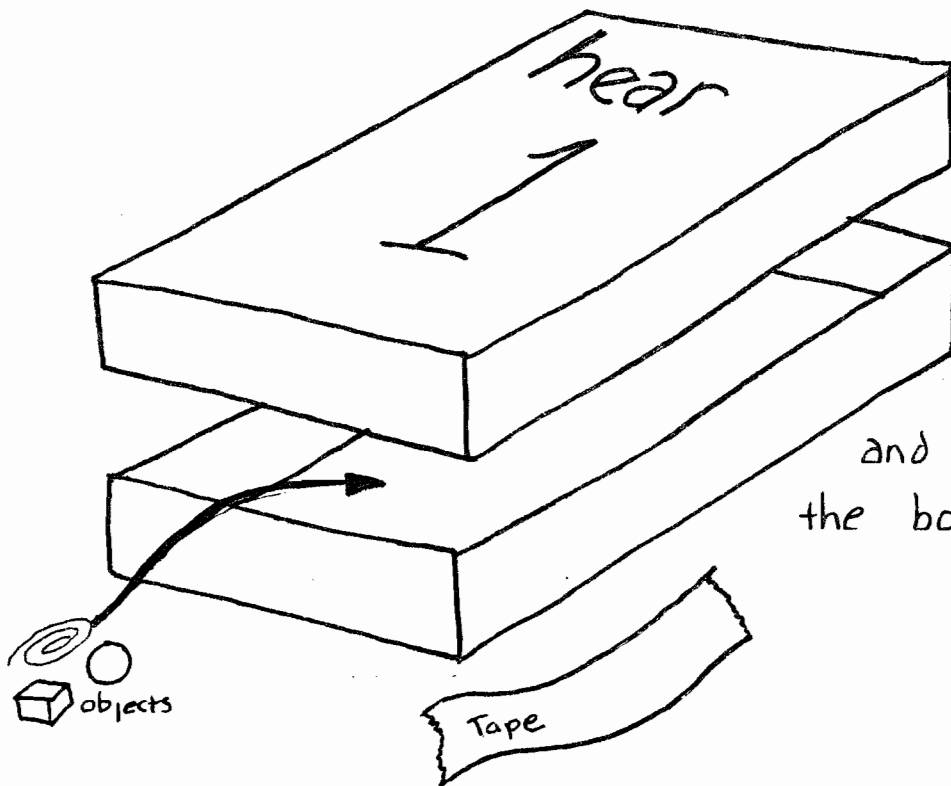
smell boxes



make sure they are dark colored

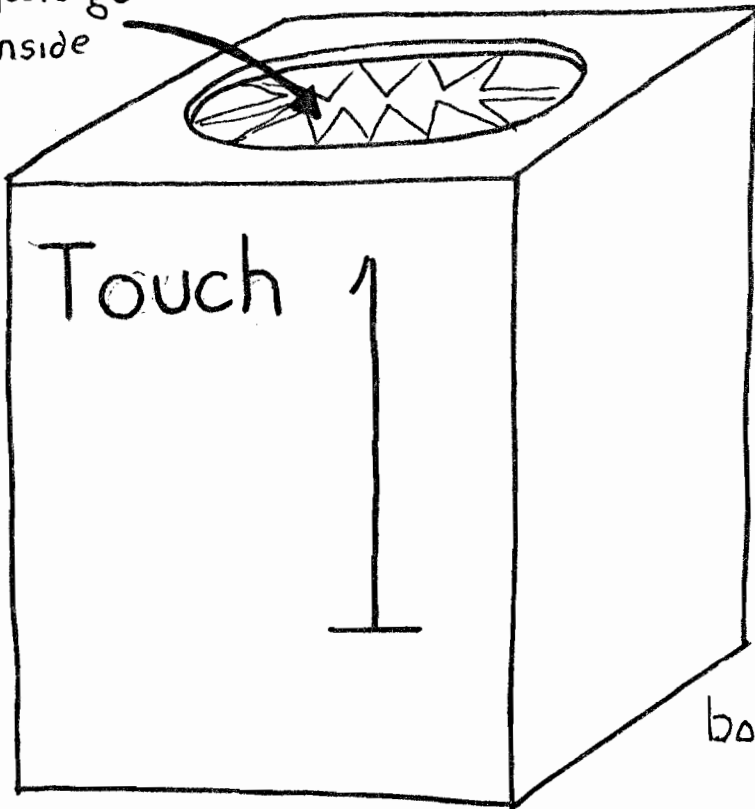
Use small containers such as film canisters from 35mm Kodak® film. Punch holes in the top with a hot pin. Label the containers. Have 2 sets on hand.

hear boxes

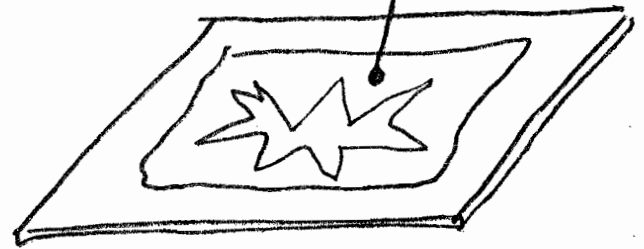


Use small boxes such as jewelry boxes. Place objects inside the boxes and seal them with tape. Label the boxes.

Objects go
inside



Felt (inside hole)



Touch Boxes.

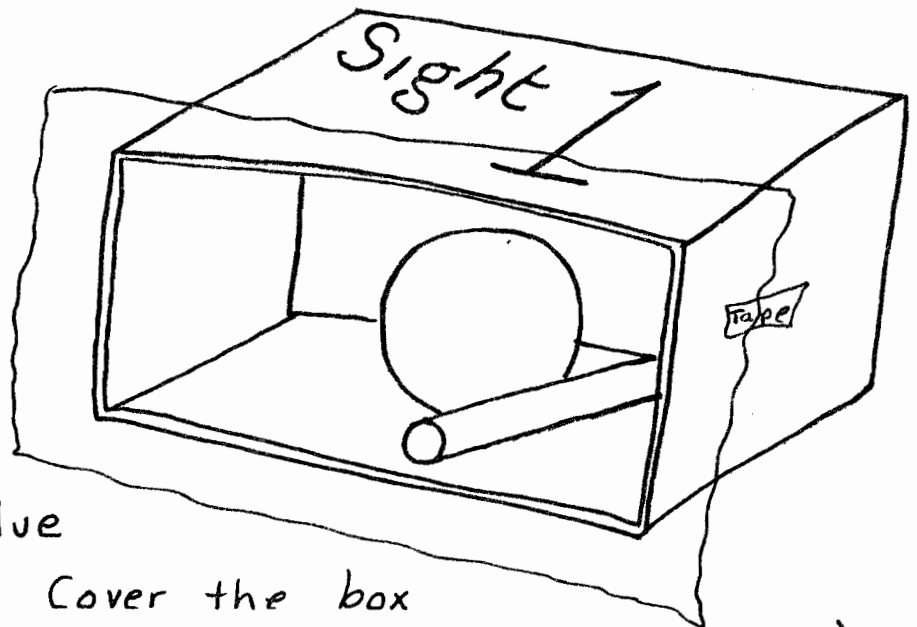
Use tall thin boxes. Cut a 5 inch or 6 inch circle in the top. Glue felt inside circle and slice felt. This is so children can't see inside the box. Tape boxes closed and label them.

Sight Boxes.

Use small boxes, about the size of a cigar box. You can glue wall paper or construction paper inside it. Place or glue

objects in the box. Cover the box

with clear plastic so children can see, but can't touch the objects. Label the boxes.



answer key

sense boxes

what is
inside?

smell

touch

sight

taste

hear

1 _____

1 _____

1 _____

1 _____

1 _____

2 _____

2 _____

2 _____

2 _____

2 _____

3 _____

3 _____

3 _____

3 _____

4 _____

4 _____

4 _____

4 _____

5 _____

5 _____

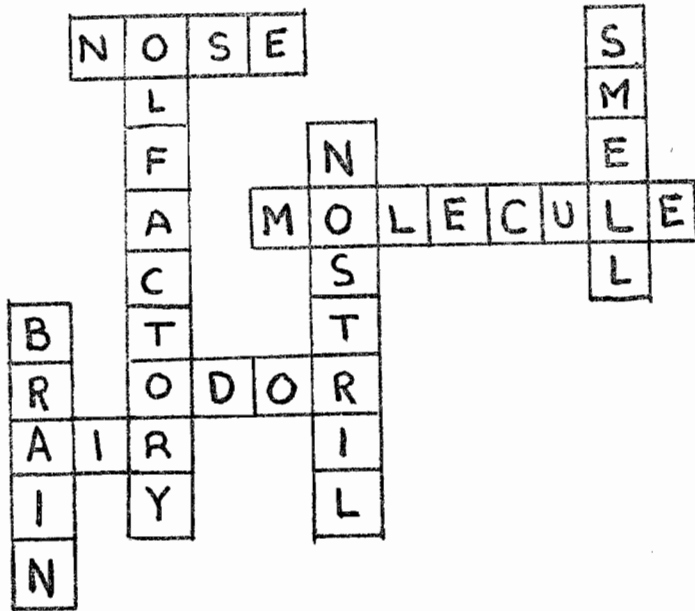
6 _____

Date _____

Class _____

answer key

Experiment 2



Puzzle Answers
for experiment
sheets

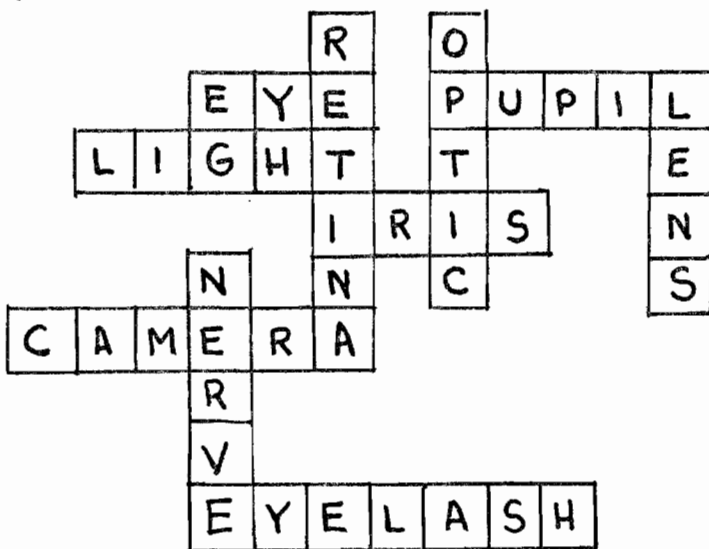
Experiment 12

Jumble

nerve
hammer
anvil
stirrup
cochlea
drum

Q @ R

Experiment 8



answer key

For Question sheets

Experiment 1 page 6

- 1- None
- 2- You may have heard a noise like a crash. You may have smelled a fire or you may have seen the crash.
- 3- You wanted to see what had happened
- 4- You can hear a fire crackling, you can see and smell smoke. You can see flames
- 5- The quarter is larger and thicker than the dime.
- 6- You like the taste.
- 7- None
- 8- Smell touch taste hearing seeing
- 9- \updownarrow \updownarrow \updownarrow \updownarrow \updownarrow
nose skin tongue ear eye

Homework (exp.1)

- 1- touch, pain, heat, cold
- 2- they act as wires sending messages to and from the brain
- 3- You rely on the other senses more.
- 4- Yes. You can't taste what you can't smell. You see hear and ...

Experiment 2 page 7

- 1- None
- 2- You can tell if something is burning before a big fire starts.
- 3- The smell traveled with the air.
- 4- Varies (Particles travel through the room)
- 5- None
- 6- None
- 7- See answer key page 43
- 8- The smell seems to disappear

Homework (exp 2)

Cells - the basic unit of living matter, or tissue, usually very small

Nerves - any of the fibers or bundles of fibers that connect the muscles, glands, organs, etc. with the brain and spinal cord. Nerves carry signals to and from the brain

Nostril - either of the two openings in the nose for breathing and smelling.

Messages - a piece of news, an important idea.

Experiment 3

page B

1- None

2- You can smell the sulfur in the garbage. It smells like rotten eggs (which contain sulfur)

3- Flowers have a sweet smell. garbage does not

4- a- sweet smelling - smells like perfume

b- spicy smelling - strong smell

c- strong smell of sulfur like rotten eggs

d- sweet smell

e- sulfur smell - like garbage

f- sweet smell

} Varies

5- The brain can distinguish between smells.

6- None.

7- Varies - Check answer key - page 42

8- Varies - " " " - " "

9- Varies - " " " - " "

Homework - (exp 3)

1- Your nose and brain can tell smells apart

2- It helps locate smells in the environment. It lets you know what things are in your environment by the smells they have.

Experiment 4 page 9

1- None

2- You would feel pain. It would hurt a lot.

3- It is probably hot. You use a potholder so you don't burn your hands.

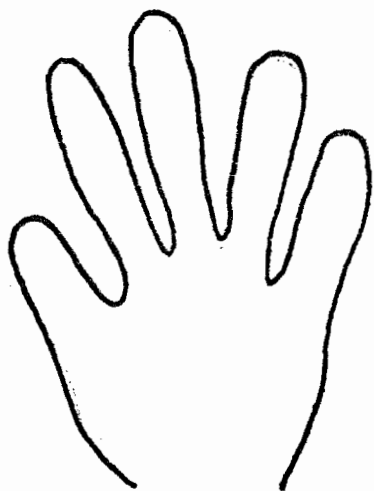
4- You would burn yourself.

5- You can tell one is cold and one is hot.

6- None

7- None

8-



- △ pressure (heavy)
- pressure (light)
- pain.

9- Your fingers are most sensitive to touch.
Hands used most often to touch things.

10- The bumps stand for words. Blind people read the bumps

Homework - (exp 4)

Nerve - (see homework exp 2)

Neuron - nerve cells.

Experiment 5 page 10

1- None

2- Because it is dead it may feel dry and rough.

3- You can imagine how an object looks by knowing its shape. This is one of the ways that helps us know what dinosaurs looked like. We put together their bones, learn their shape, and imagine what they looked like.

4- Draw pictures that look rough or smooth.

5 - 6- The high spots on the penny were picked up by the pencil.



7- Since you rubbed over the penny, we call it a rubbing.

8- They show how rough or smooth an object looks

9- Varies

10- Varies.

Homework (exo 5)

1- Varies

Matching game

see if children can match the rubbings to the descriptions of the items.

Experiment 6 page 11

1- None

2- You may feel the heat given off by the bulb.

3- Quarters are larger than nickels. Quarters have ridges on the edges. Nickles do not.



4- You can use your sense of touch to tell things apart

5- None

6- Varies - See page 42

7- Varies - " " "

8- Varies - " " "

9- Varies - " " "

10- Varies - " " "

Homework (exp 6)

1- Your sense of touch can tell things apart.

2- You can tell if your environment has rough or smooth things in it.

Experiment 7

page 12

- 1- None
- 2- None
- 3- You need light to see. It's too dark to see.
- 4- light reflects off objects allowing you to see them.
- 5- None
- 6- None
- 7- The bones of the skull and eye socket help protect the soft eye.
- 8- The eyelids help keep alot of light from hurting your eyes. The eyelids work like a cover, shielding the eyes from the sun.
- 9- Eyelashes help keep dirt out of the eyes. They catch dust and dirt.
- 10- 2 eyes are needed for depth perseption. You can't judge distance with one eye.
- 11- None
- 12- 2 eyes open is better because you can judge distance.
- 13- The hole or dark spot gets smaller. It cuts or reduces light into the eye.

Homework (exp 7)

- 1- The eye is so soft and delicate that without safety devices it would be destroyed.

Experiment 8

page 13

- 1- None
- 2- light enters the eye. the lens of the eye focuses the light and casts a picture on the retina. Nerves in the retina send this cast picture to the brain.
- 3- See answer key on page 43
- 4- The picture is cast on the retina or film.
- 5- The pencil is about 6 inches long, and $\frac{1}{4}$ inch thick. It is yellow with ribs, etc.
- 6- None
- 7- Varies - See answer key pg. 42
- 8- Varies - " " " " "
- 9- Varies - " " " " "
- 10- Varies - " " " " "
- 11- Varies - " " " " "

Homework

- 1- They let you see your environment and help you know where things are
- 2- Sometimes 2 things can sound or smell the same. The eyes give you a more reliable idea of what is in front of you.
- 3- Your other senses will tell you what is there.

Experiment 9

page 14

- 1- None
- 2- Ice cream, Cake, Steak, etc. are my favorite food
Vanes.
- 3- I like these foods because they taste good.
- 4- Burned food does not taste too good.
- 5- Some foods are sweet, some are sour, etc.
- 6- When food touches your tongue you can taste it.
If you didn't like food or if it had no taste
you might not eat it and then you would die.
- 7- The tongue is connected in the back of the mouth. It
has small bumps on it and it is wet.
- 8- None
- 9- You shouldn't be able to taste it. (Food has to dissolve
on the tongue in order for you to taste it.)
- 10- It should now have taste.
 - 1- It must get wet and begin to dissolve. or you wouldn't
taste it
- 12- It dissolves the food.

Homework (Exp 9)

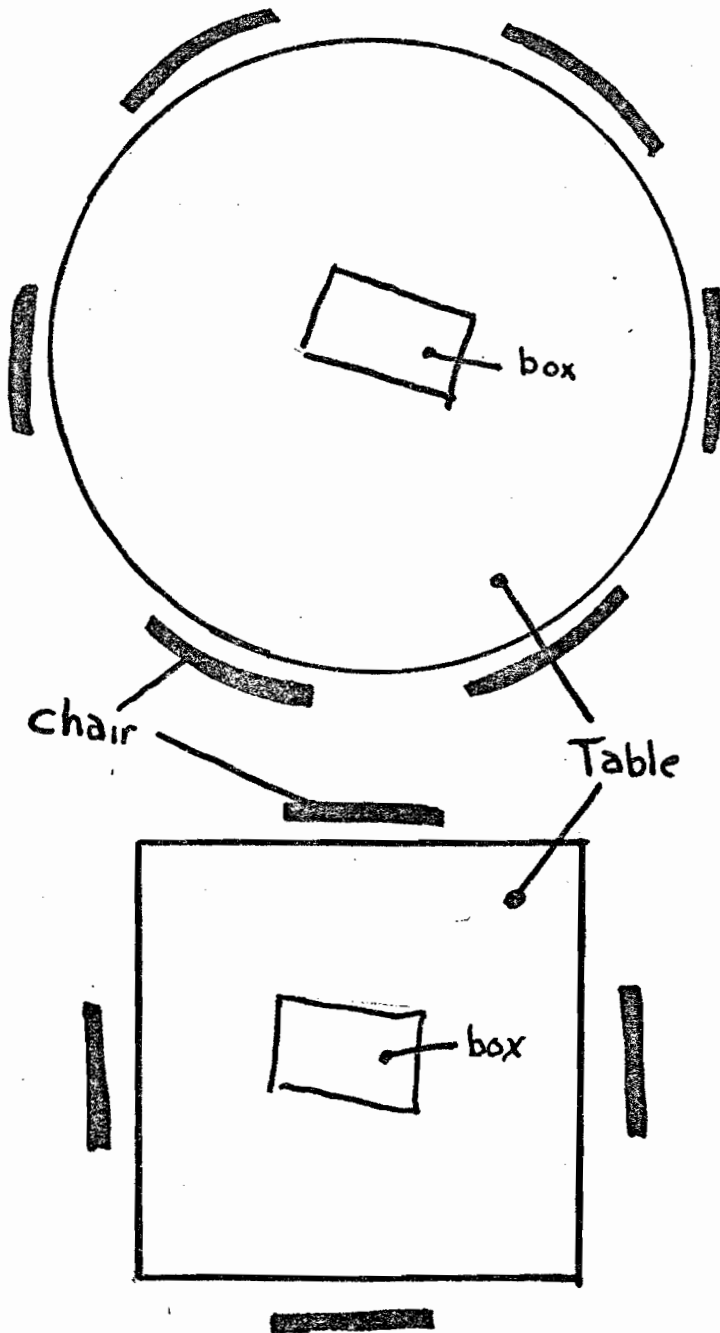
- 1- Taste buds are nerves in the tongue that send messages to the brain
- 2- Papillae are the taste buds

Saliva — the watery liquid in the mouth that is produced by certain glands. It helps digest food.

dissolve — to make
or become a liquid.

Flavor — the special quality of something that is a mixing of smells and tastes.

Setting up the room for group work



Place the box of materials in the center of the table. Allow students to sit around the table so they can talk and interact with each other. In this manner, children can question each other, and the work they are doing becomes more important than the front of the room or the blackboard.

If the children can face each other, they will be able to help each other.