

WELCOME to the 4-H Embryology Project. 4-H is a fun organization for youth interested in learning something new by actually doing it. In this project, you will learn how life develops by observing eggs you set in your incubator. You will be responsible for the daily care of the incubator. Also, you will be asked to observe and record various scientific information. This record is designed to help you record this information and to write your observations, reactions, and thoughts about this experience.

LIFE IS A MARVELOUS THING

Life begins from a single cell. Under proper conditions this cell divides first into two, then into four, eight, sixteen, thirty-two until a new individual is born. For a fertile egg (remember not all eggs are fertile) to develop into a bird, the egg must be held at a certain temperature for a given number of days. This is called the incubation time. This time is different for different kinds of birds. For the chicken it is 21 days, for turkeys 28 days, and for grouse 25 days. In nature, the mother bird sits on a nest of eggs and the warmth from her body causes the eggs to develop into baby birds. For this project we will study this life development process using chicken eggs and an incubator.

HIGHLIGHTS IN LIFE OF CHICK EMBRYO

Once the fertile egg is placed in the incubator, cell division occurs very fast. After 24 hours has passed, the heart has begun to form and after 42 hours, the heart begins to beat. The formation of the tongue and beak occurs on the 4th, 5th, and 6th days. By the 9th day the embryo begins to look like a bird and by the 13th day the embryo has formed all its organs and parts with only growth and final development to occur. On the 19th day the embryo begins to absorb the yolk in the egg for nourishment after hatching. On the 21st day the chick hatches by breaking the shell. It will take the chick 15 to 20 hours to break its way out of the shell. You should not give the chick any help as you might injure the chick.

HATCHING EGGS WITH AN INCUBATOR

An incubator is a box that provides and maintains a favorable environment for hatching fertile eggs. Four factors are very important to insure the success of hatching fertile eggs in an incubator. These are (1) temperature, (2) humidity, (3) ventilation, and (4) turning the eggs regularly. Of these, temperature is the most important. Humidity is the measure of moisture in the air while ventilation is movement of fresh air through the incubator. Plans for building an incubator are available from the Extension Service Office.

OPERATING YOUR INCUBATOR

Location: The incubator should be placed where it is free from drafts and direct sunlight. This will help you to maintain a more uniform temperature and humidity. Make sure there is plenty of space around all sides of the incubator. This will allow the air to move freely through the ventilation holes.

Temperature: Temperature is the most important key in obtaining a good hatch. You should operate the incubator with water in it for several hours before you place the fertile eggs in the incubator. This will give you time to make the necessary temperature adjustments. The ideal temperature for hatching chicken eggs in a still air or gravity ventilated incubator is 99.5 - 101 degrees F. Short periods of time below 97 degrees F will usually not affect the number of eggs hatched but will slow up embryonic development. This will delay the hatch and could cause an increase in the number of deformed or weak chicks. The embryos, however, are more sensitive to temperatures over 103 degrees F. Operating at higher than ideal temperatures will increase mortality and number of crippled and deformed chicks.

Humidity: You should keep water in the bottom of the incubator at all times to maintain humidity in the incubator. Humidity is maintained by water evaporating from the water troughs. You adjust the level of humidity by opening or closing the ventilation holes. Some of the holes should be closed if water is not evaporating from the water troughs or opened if moisture is collecting on the glass. During the last three days you will want to raise the level of humidity in the incubator by closing most of the ventilation holes. (It is all right if moisture collects on the glass during the last three days.) Low humidity will cause the shell to stick to the hatching chick.

Ventilation: Ventilation is very important to the developing embryo. This embryo needs oxygen to live while the gases given off by the embryos need to be removed from the incubator. This is accomplished by air moving through the holes in the side of the incubator.

Placing the Eggs: Eggs should be placed horizontally in a single layer on the metal platform in the incubator. It is very important that the eggs are turned at least three times a day. This prevents the embryo from sticking to the shell membrane thus causing their death. Eggs should not be turned the first day or the last three days. During the last three days the eggs should not be moved or disturbed. The developing embryos have assumed the hatching position in the eggs. By not opening the incubator during the last few days will help you to maintain the needed high humidity. To help you know which eggs you have turned, place a light lead pencil mark on one side of the egg. This mark will either be facing up or down on the metal platform.

Determining Fertile Eggs and Live Embryos: Remember not all eggs are fertile. Fertile eggs are obtained only when roosters are kept with the laying hens. Eggs you buy in the grocery store are usually infertile eggs since these eggs are laid by hens on farms with not roosters (males). Sources of fertile eggs are available at the Extension Office. To determine if all eggs are fertile and non of the embryos have died, all eggs should be candled on the third, sixth, ninth, 12th, 15th, 17th and 19th days of incubation. Place the eggs in front of the candler and observe if the embryo mass is increasing in size. If it is not the embryo has died. If the egg is clear, showing no blood vessels or a dark mass the egg is infertile.

How to make a candler: Take a piece of cardboard or plywood and cut a circle one inch in diameter. Hold a 60 watt light bulb behind the board. In a dark room place the egg in the hold and observe if embryonic development is taking place.

Care of Chicken after Hatching: Once the chicks have hatched and dried off, they may be placed in a cardboard box. Cedar shavings or shredded newspaper may be used as litter. Litter should be one to two inches thick in the bottom of the box. Newly hatched chicks should receive feed (chicken starter available at local feed store) and water within 48 hours. Shallow pans or coffee can lids may be used as feeders or waterers. A goose neck lamp with a 75 watt light bulb will provide sufficient heat. Remember baby chicks need heat, feed and water in order to survive. They are dependent on you for these.

THINGS TO DO

During the course of this activity you should do the following:

1. Record the temperature of the incubator each time the eggs are turned.
2. Record the number of infertile eggs, embryos that died, and number of eggs broken open for observation.
3. Remove infertile eggs and dead embryos as soon as they are observed. This may be done with a candling light in a dark room. Dead embryos give off poisonous gases that could affect the other developing embryos.
4. Try to break open fertile eggs on the 3rd, 6th, 9th, 12th, 13th, 15th, 17th and 19th or 20th days of incubation to observe embryonic development. These embryos may be preserved for future use in a 10% formaldehyde solution.
5. Make notes and or drawings on your observations each time you break open an egg to observe embryonic development.
6. At the end of the project write a story of your experiences with the 4-H embryology project.
7. Turn in your completed 4-H embryology project members record to your teacher.

NOTE: Please help us prevent the spread of disease in poultry. Use only eggs provided by Cooperative Extension or secured from a commercial hatchery. Eggs used from other sources (i.e. students, homes) could have several different diseases present if hatched, could spread to our commercial poultry industry and cause serious economic losses.

Answers to this worksheet can be found by reading the 3 pages before this worksheet.

QUESTIONS TO HELP YOU REMEMBER

1. All eggs are fertile and will develop into a bird when placed in an incubator.
True or False _____

2. What is an incubator? _____

3. What are the four factors very important to hatching fertile eggs successfully in an incubator?

1. _____ 2. _____

3. _____ 4. _____

4. What is the ideal temperature for hatching chicken eggs? _____

5. How many times should the eggs be turned each day? _____

6. What do we mean by the term ventilation? _____

7. Chicken eggs should not be turned during the last three days of incubation.
True or False _____

8. How should eggs be placed in the incubator? _____

9. Why should eggs containing dead embryos be removed as soon as they are observed? _____

10. What do the four H's stand for in 4-H?

1. _____

2. _____

3. _____

4. _____

Answer Key

Answers to this worksheet can be obtained by reading the 3 pages of information prior to this worksheet.

QUESTIONS TO HELP YOU REMEMBER

1. All eggs are fertile and will develop into a bird when placed in an incubator.
True or False False - only eggs where a rooster was present will be fertile.
2. What is an incubator? A box that keeps eggs at the right temperature and humidity to hatch.
3. What are the four factors very important to hatching fertile eggs successfully in an incubator?
 1. temperature
 2. humidity
 3. ventilation
 4. turning the eggs
4. What is the ideal temperature for hatching chicken eggs? 99.5° - 101°
5. How many times should the eggs be turned each day? 3
6. What do we mean by the term ventilation? movement of fresh air
7. Chicken eggs should not be turned during the last three days of incubation.
True or False True
8. How should eggs be placed in the incubator? horizontally
9. Why should eggs containing dead embryos be removed as soon as they are observed? They give off poisonous gases that could affect the other developing embryos.
10. What do the four H's stand for in 4-H?
 1. Head
 2. Heart
 3. Hands
 4. Health

OBSERVATIONS

Take notes on the various things you saw and learned as a result of this project.

Here is the space where your students write what they see. You could do this when you candle the eggs and once they hatch. You do not need them to write a story here.

PROJECT STORY

Write an interesting story of your experiences with the 4-H embryology project.

Once your chicks have hatched
have your students write a story
about their project. They can even
draw pictures. Ideas on what to

write are:

What did you like?

What did you not like?

What was your favorite part?

What did you learn?

Eggsploring the parts

Match the name with the egg part and write it on diagram.

air cell

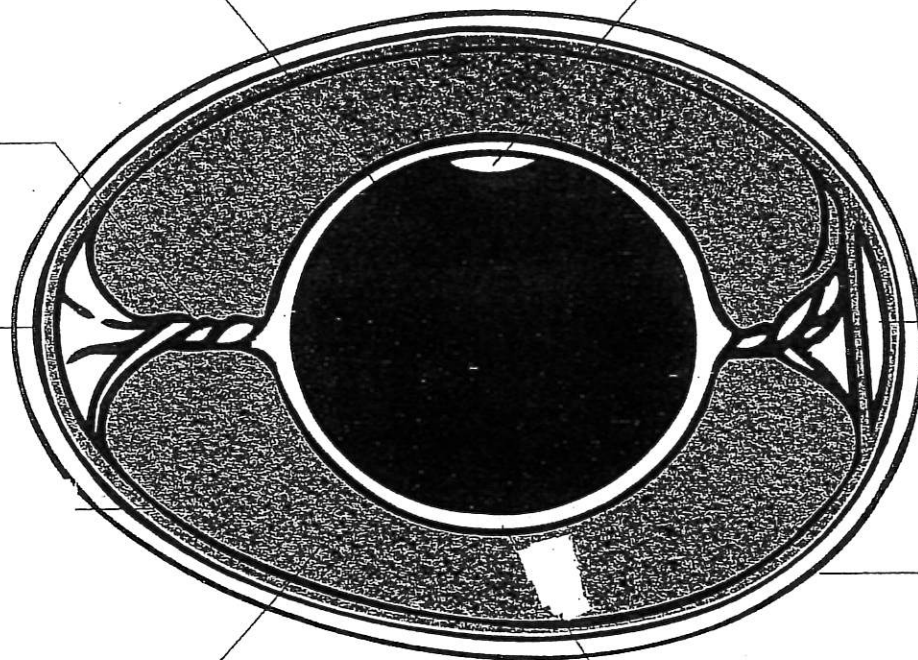
germinal disc

shell

yolk

chalaza

white



Eggsploring the parts

Match the name with the egg part and write it on diagram.

air cell

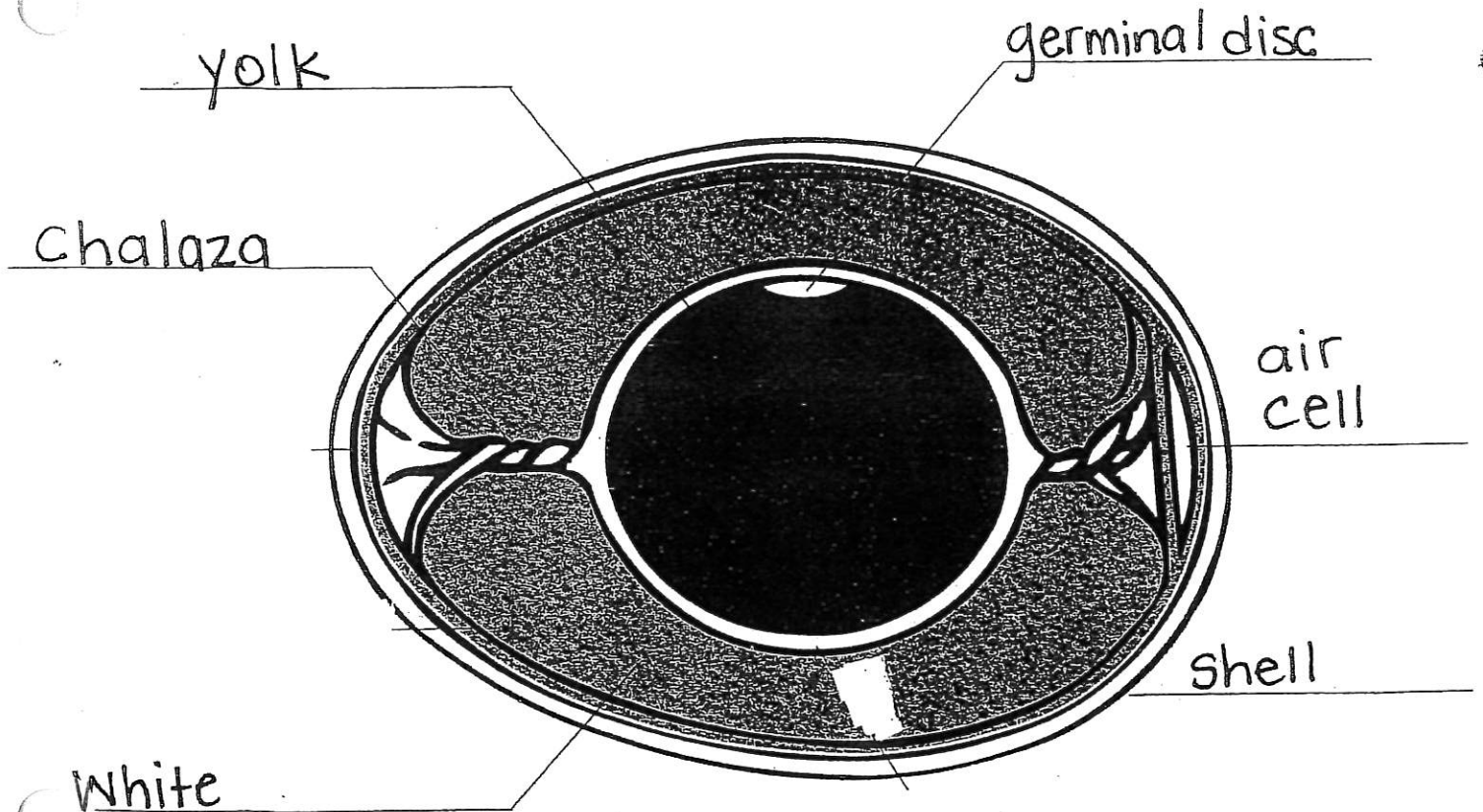
germinal disc

shell

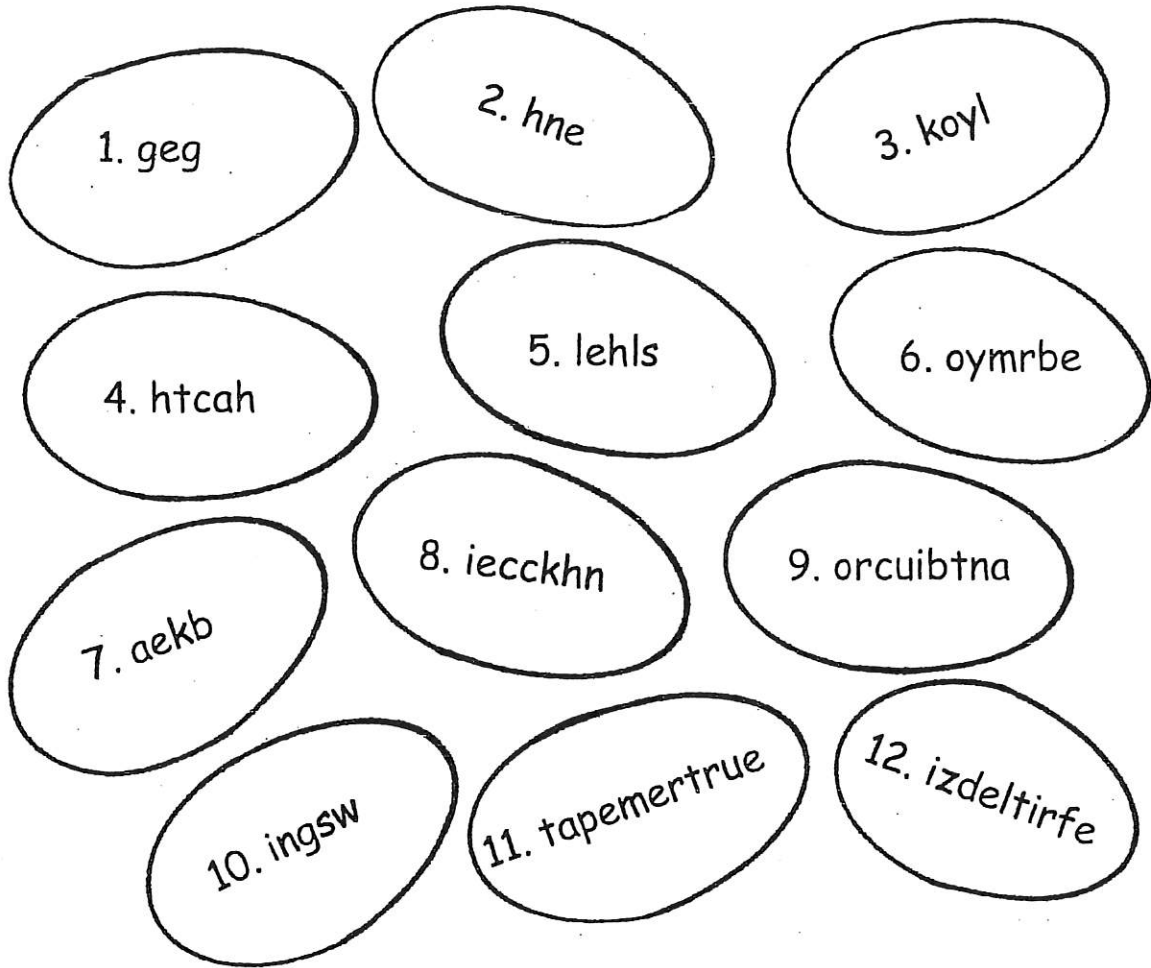
yolk

chalaza

white



Unscramble the Scrambled Eggs



1. _____

7. _____

2. _____

8. _____

3. _____

9. _____

4. _____

10. _____

5. _____

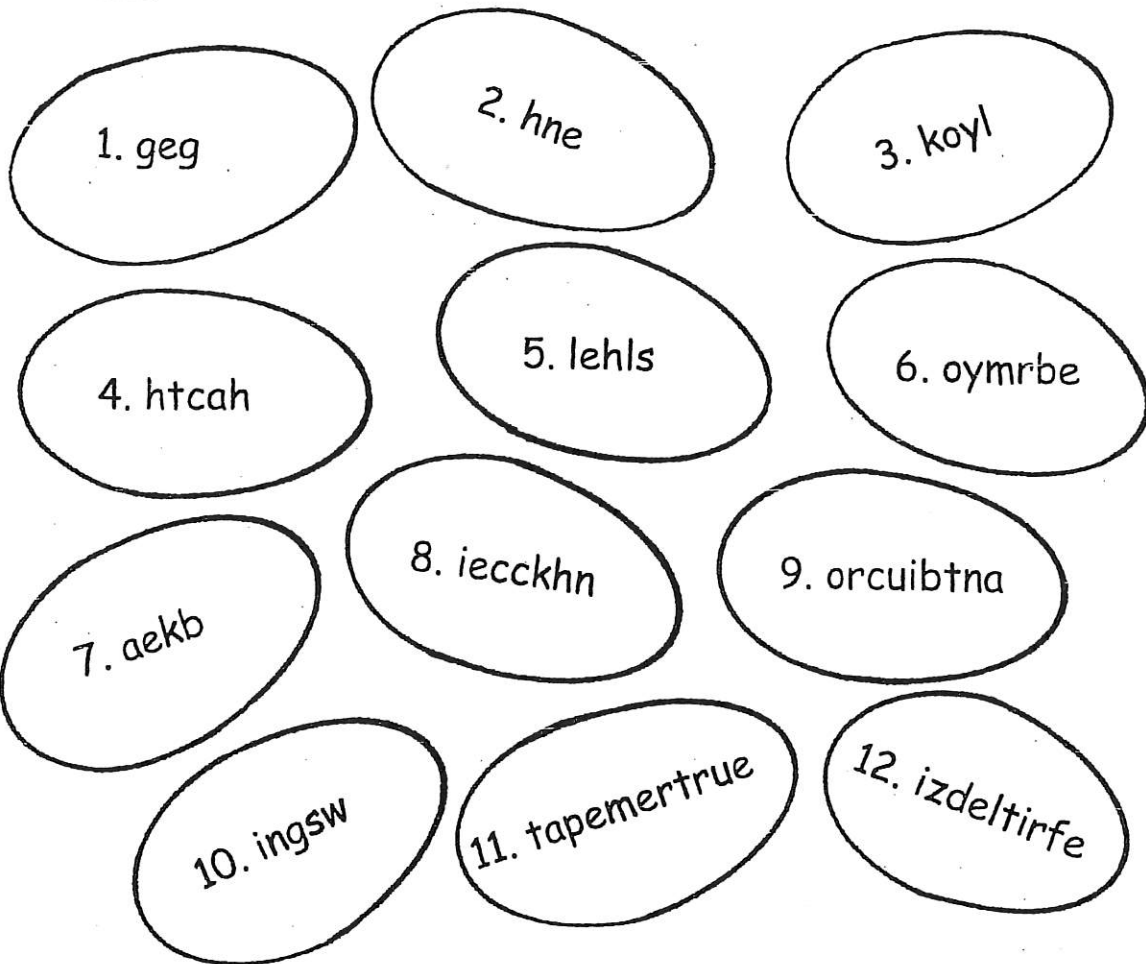
11. _____

6. _____

12. _____

Unscramble the Scrambled Eggs

KEY



1. egg

2. hen

3. yolk

4. hatch

5. shell

6. embryo

7. beak

8. chicken

9. incubator

10. wings

11. temperature

12. fertilized

Science Vocabulary

Put these words in alphabetical order.

hatch
peeps
heart
egg
beak
yolk
white
shell

chicken
egg tooth
rooster
hen
chick
embryo
sac
wings

temperature
membrane.
blood vessels
incubator
fertilized
development
thermometer
feathers

- | | |
|-----------|-----------|
| 1. _____ | 13. _____ |
| 2. _____ | 14. _____ |
| 3. _____ | 15. _____ |
| 4. _____ | 16. _____ |
| 5. _____ | 17. _____ |
| 6. _____ | 18. _____ |
| 7. _____ | 19. _____ |
| 8. _____ | 20. _____ |
| 9. _____ | 21. _____ |
| 10. _____ | 22. _____ |
| 11. _____ | 23. _____ |
| 12. _____ | 24. _____ |

Choose 12 vocabulary words. Use each word in a complete sentence.

KEY**Science Vocabulary**

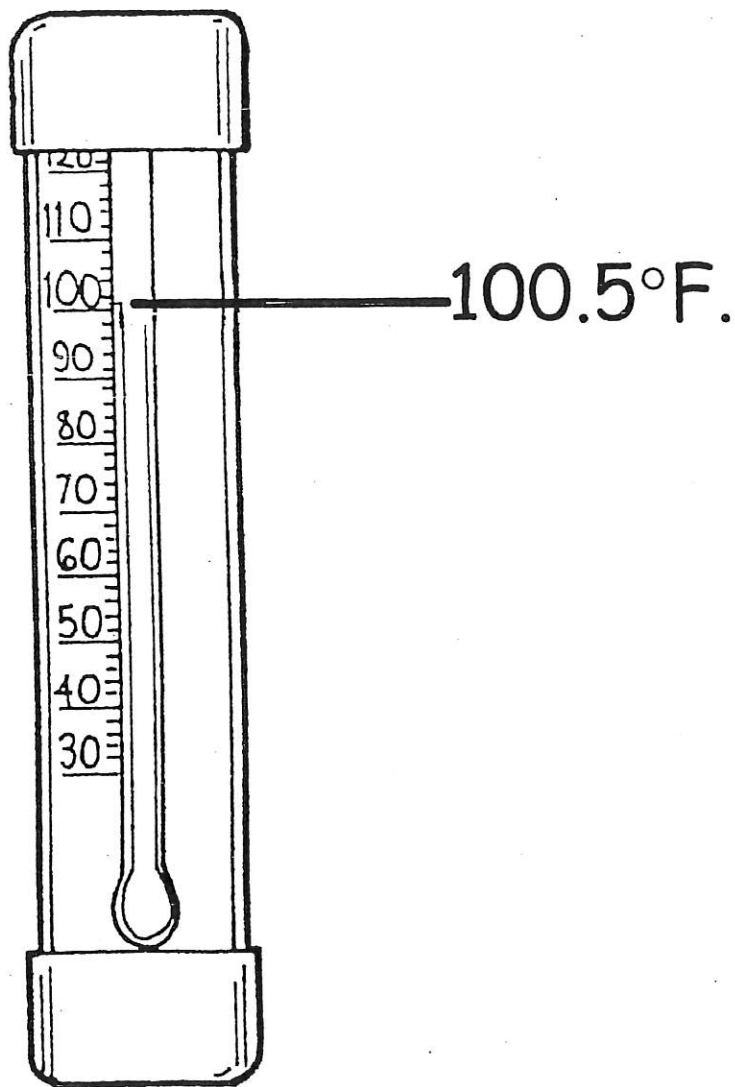
Put these words in alphabetical order.

hatch	chicken	temperature
peeps	egg tooth	membrane
heart	rooster	blood vessels
egg	hen	incubator
beak	chick	fertilized
yolk	embryo	development
white	sac	thermometer
shell	wings	feathers

- | | |
|-------------------------|------------------------|
| 1. <u>beak</u> | 13. <u>hen</u> |
| 2. <u>blood vessels</u> | 14. <u>incubator</u> |
| 3. <u>chick</u> | 15. <u>membrane</u> |
| 4. <u>chicken</u> | 16. <u>peeps</u> |
| 5. <u>development</u> | 17. <u>rooster</u> |
| 6. <u>egg</u> | 18. <u>sac</u> |
| 7. <u>egg tooth</u> | 19. <u>shell</u> |
| 8. <u>embryo</u> | 20. <u>temperature</u> |
| 9. <u>feathers</u> | 21. <u>thermometer</u> |
| 10. <u>fertilized</u> | 22. <u>white</u> |
| 11. <u>hatch</u> | 23. <u>wings</u> |
| 12. <u>heart</u> | 24. <u>yolk</u> |

Choose 12 vocabulary words. Use each word in a complete sentence.

The Thermometer



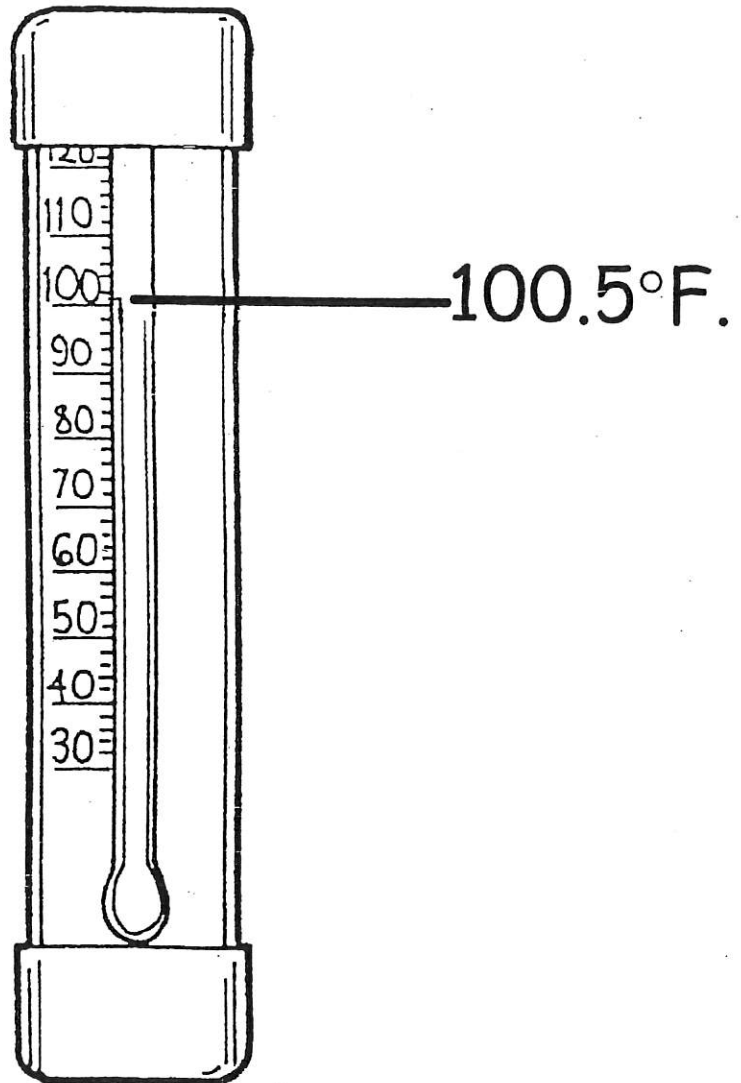
An instrument that measures temperature is a _____.

We tried to keep the temperature at _____. The temperature would _____ when the incubator was opened.

Color the mercury red.

KEY

The Thermometer



An instrument that measures temperature is a thermometer.
We tried to keep the temperature at 100.5°F. The temperature would drop when the incubator was opened.

Color the mercury red.

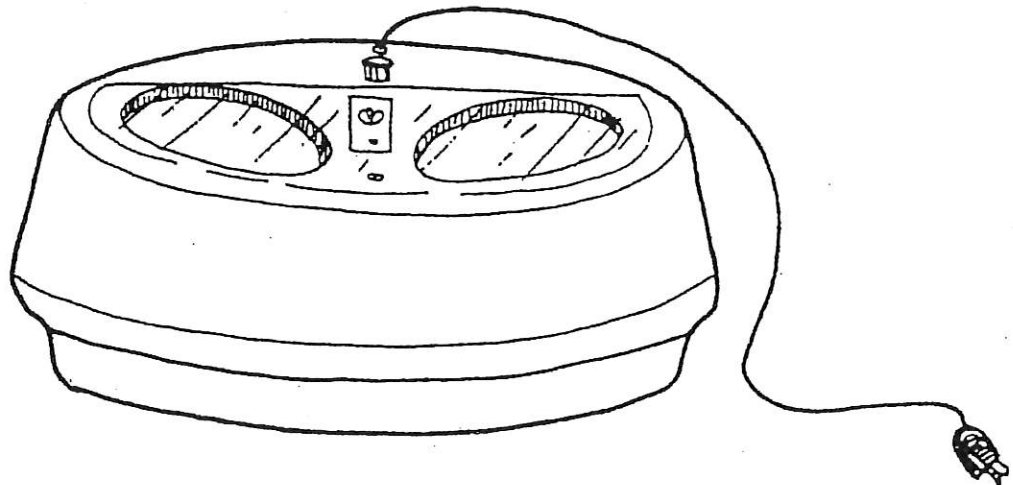
What Kind of Heat?

What kind of heat is keeping the eggs warm in the "incubators?"

1.



2.

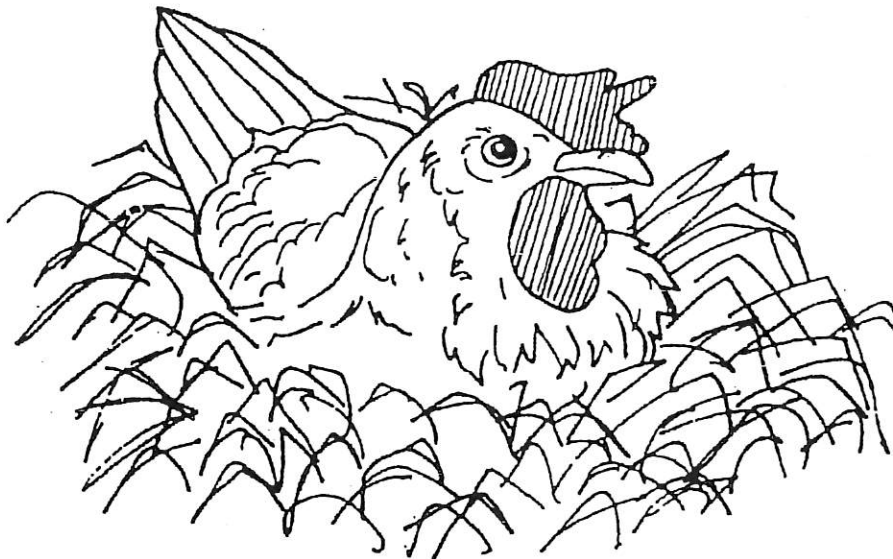


KEY

What Kind of Heat?

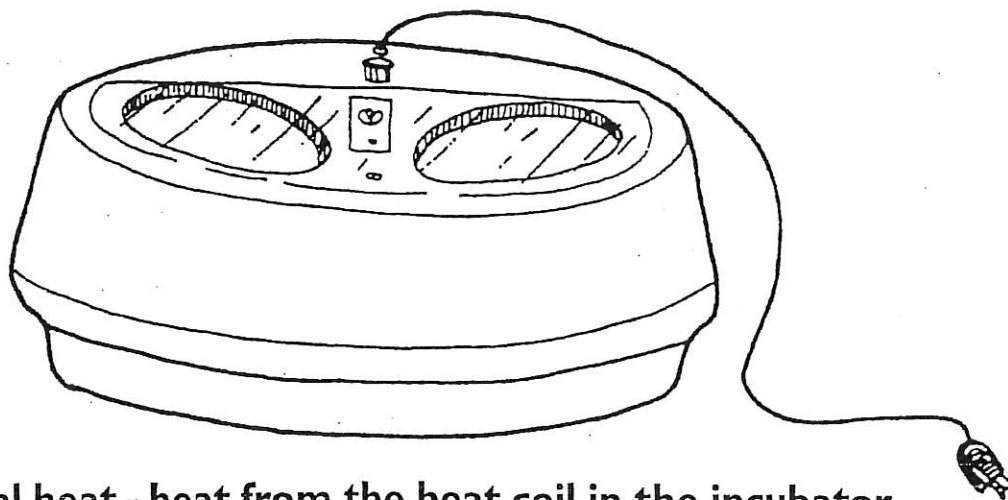
What kind of heat is keeping the eggs warm in the "incubators?"

1.



Natural heat - heat from the setting hen

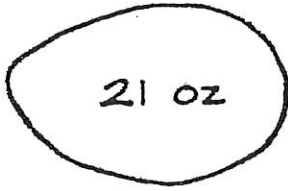
2.



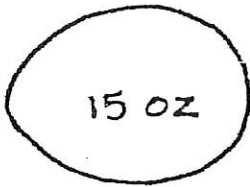
Artificial heat - heat from the heat coil in the incubator

Egg Sizing

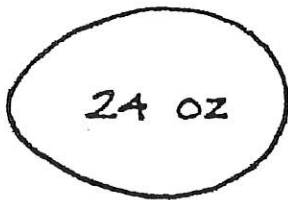
Match the egg to its size.



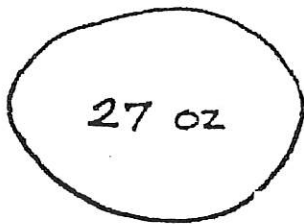
Pee Wee



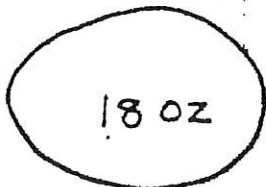
Medium



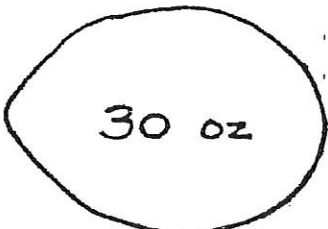
Small



Large



Extra Large

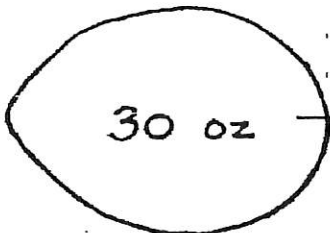
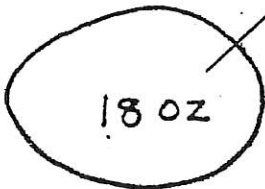
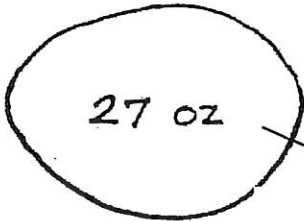
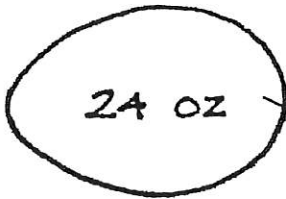
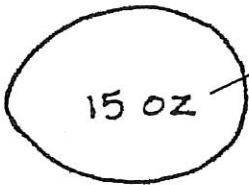
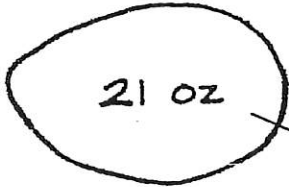


Jumbo

KEY

Egg Sizing

Match the egg to its size.



Pee Wee

Medium

Small

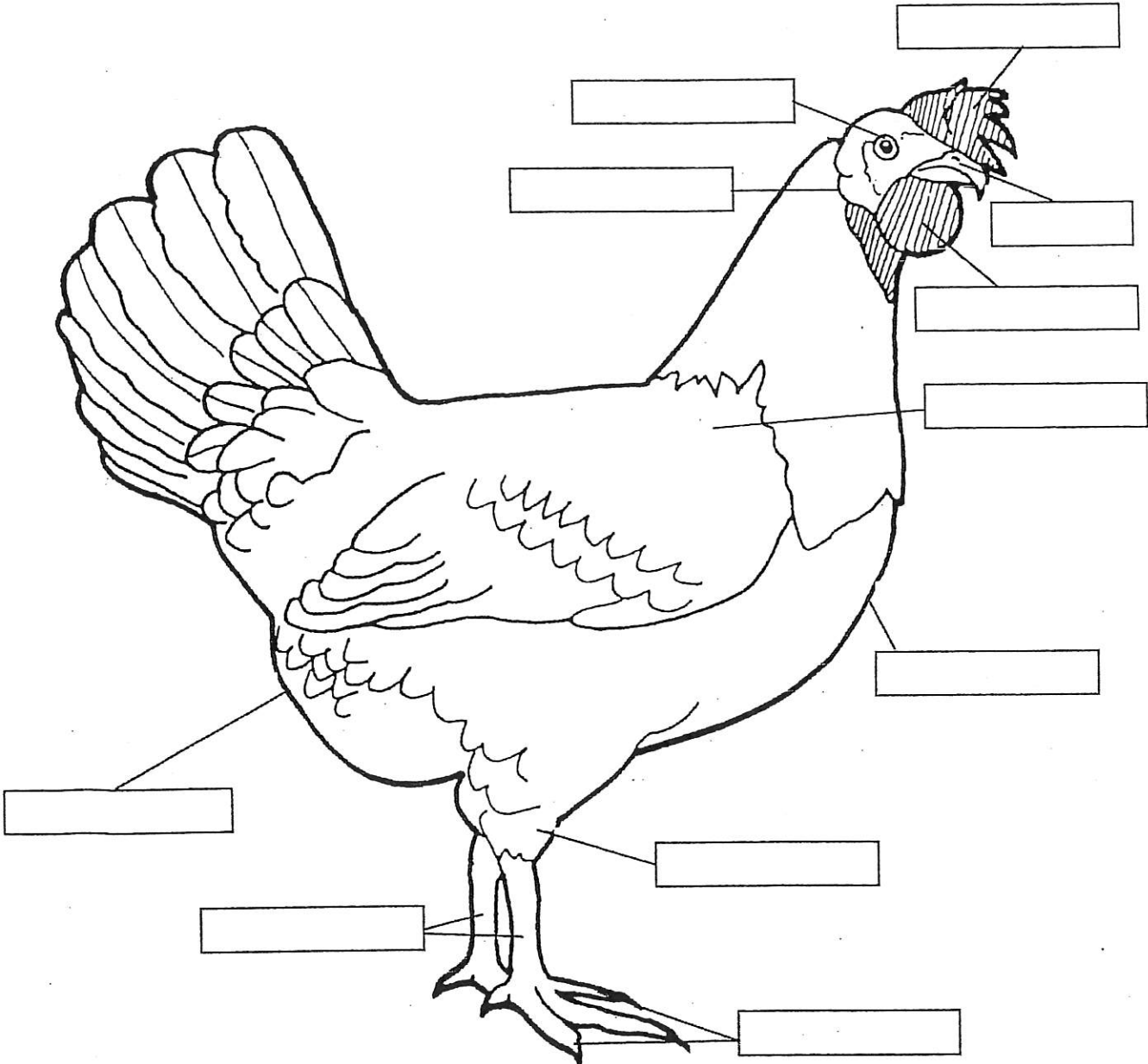
Large

Extra Large

Jumbo

Parts of a Chicken

Color and label the parts of a chicken.



Use each word only once:

beak
eye
toes

breast
hock
vent

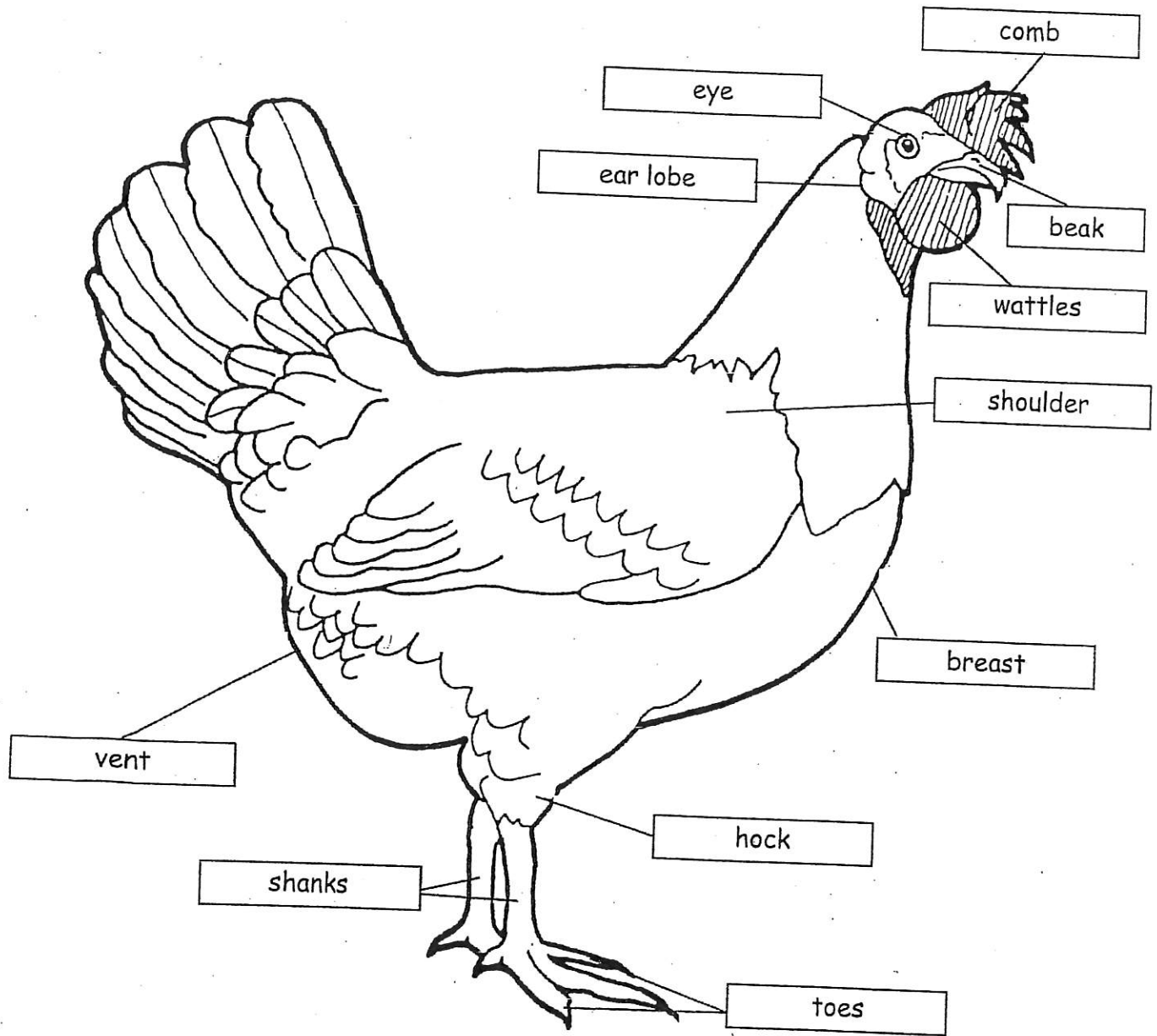
comb
shanks
wattles

ear lobe
shoulder

KEY

Parts of a Chicken

Color and label the parts of a chicken.



Use each word only once:

beak
eye
toes

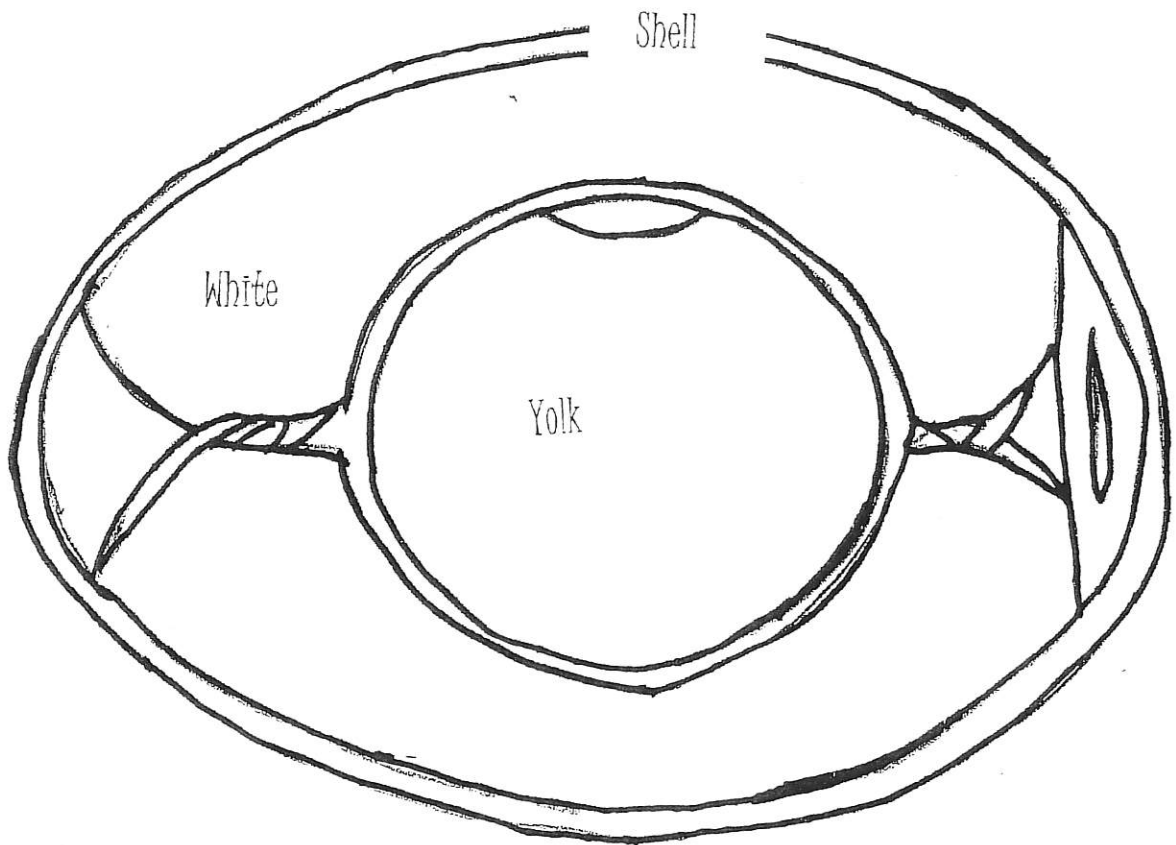
breast
hock
vent

comb
shanks
wattles

ear lobe
shoulder

Color My Insides!!

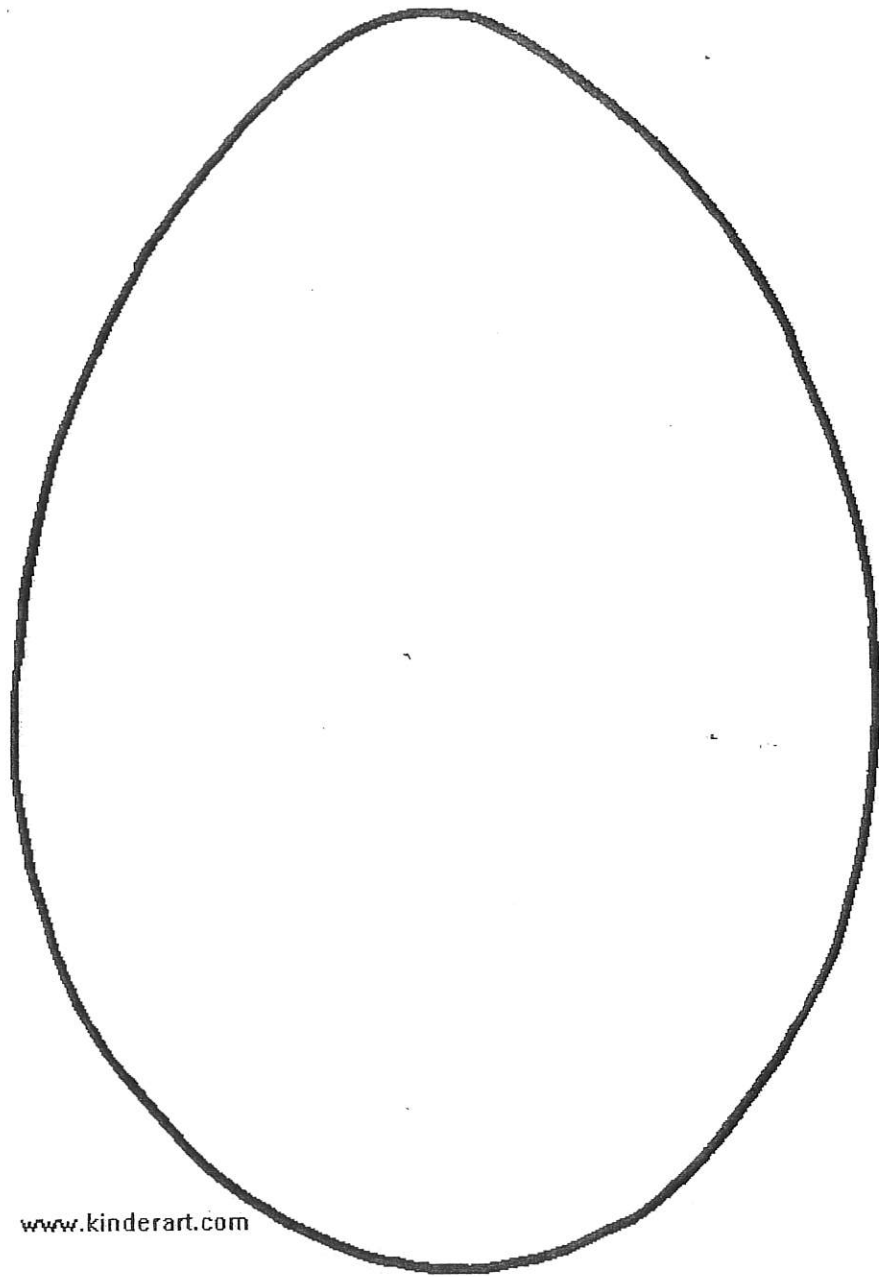
In order to learn about the inside of the egg have your leader go over the parts while you color!





Reaching Our Kids.com

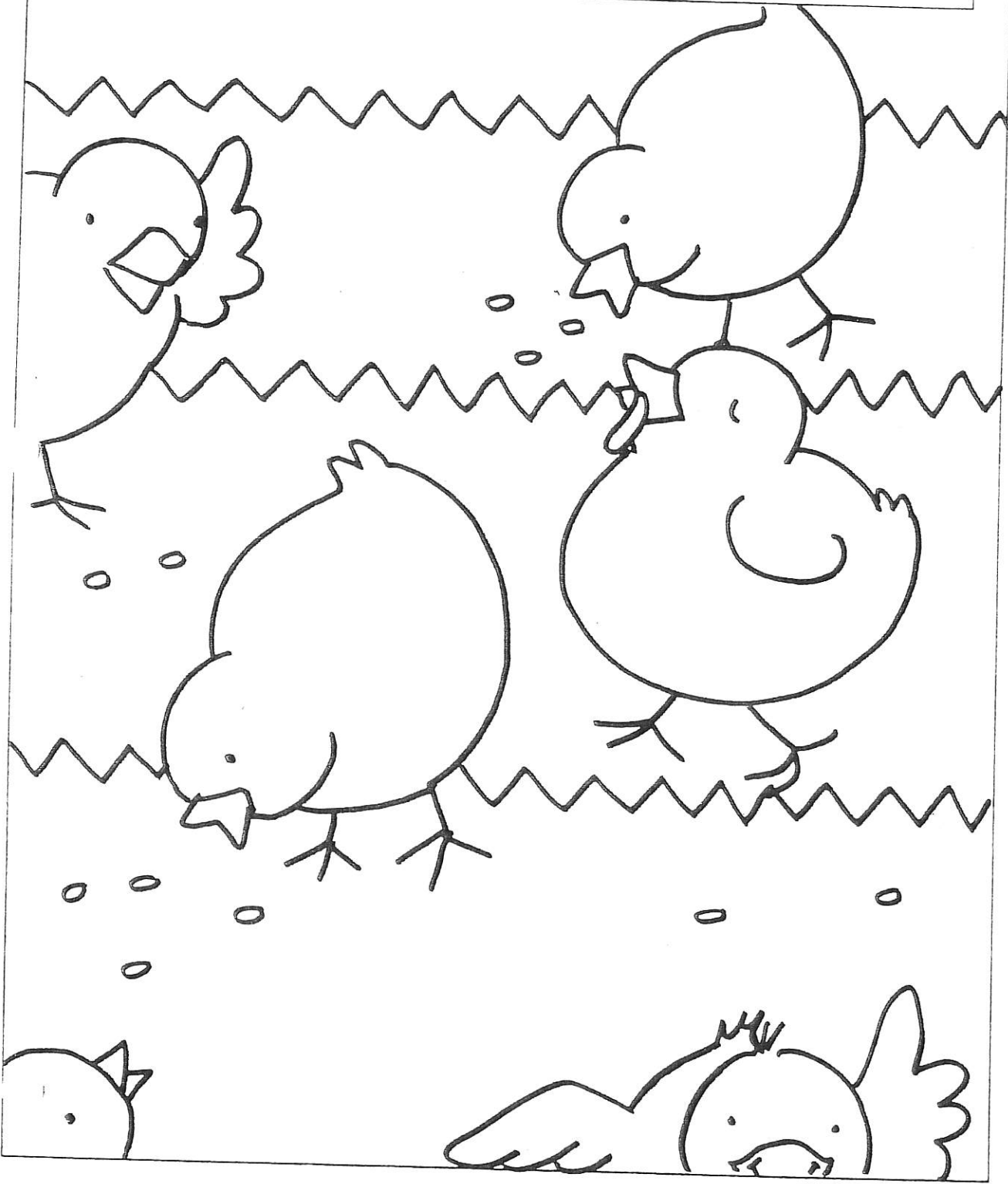
- | | | | |
|----------|---------|----------|---------|
| 1—Red | 3—Blue | 5—Orange | 7—Brown |
| 2—Yellow | 4—Green | 6—Purple | 8—Black |



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Look at all the little chicks.
Can you make a sound like a chick?





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