

## OVERVIEW

In this simulation activity, the youngsters search for hibernation sites that will protect gelatin "animals" from freezing.



## BACKGROUND

Winter brings below-freezing temperatures to many regions. Animals living in those regions survive the winter cold in various ways. Some birds and mammals migrate to warmer areas. Other mammals (e.g. rodents and bats), insects, reptiles, amphibians, and even

fish pass the winter in a deathlike state called **hibernation**. During hibernation, animals exhibit a dramatic reduction in body temperature, heart rate, and breathing rate. Other animals, such as bears and raccoons, actually sleep through part or all of the winter without their life processes slowing down appreciably. True hibernators and winter sleepers both rely on stored fat deposits for nourishment while they are dormant.

# ANIMAL ANTI-FREEZE

BIO  
KEY

Animal Investigation  
Simulation  
Winter Survival



Before they settle down to sleep, hibernators and winter sleepers select sleeping sites that will help protect them from freezing temperatures. The selection of the winter sleeping site is crucial because the sleeping animals can freeze to death if the temperature of the sleeping site drops too low for too long a period of time.

In this activity, the youngsters locate places in the activity site that would protect a winter sleeper from freezing to death. The kids test their choices by placing imaginary animals (cups of gelatin) in the selected areas and noting how long it takes for the gelatin to set.

**CHALLENGE: FIND LOCATIONS THAT WILL PROTECT YOUR "GELATIN ANIMAL" FROM FREEZING.**



CHIPMUNK

## MATERIALS



### For each youngster:

- 4 small paper cups\* (89 ml or 3 oz. bathroom cups). Film cannisters or plastic pill vials can also be used, but everyone should use identical containers.
- 4 small paper cards\* or tops (to cover the cups)
- 1 hand trowel\* or other digging tool

### For the group:

- 1 30-ml (2 tablespoon) measuring spoon\*
- 1 liter of liquid gelatin\* for every ten kids (See the "Preparation" section.)
- 1 small box or knit cap
- 1 thermometer\*
- 1 large thermos bottle or picnic jug
- 1 tray for cups\* (A piece of thick cardboard is fine.)

\* Available from Delta Education.

## PREPARATION



**Group Size.** This activity is easier to conduct with small to medium-sized groups, but can also be used with large groups.

**Time.** Plan on forty to sixty minutes for this activity. Pick a day when the air temperature is 5° C (41° F) or lower.

**Site.** Any outdoor site with interesting nooks and crannies can be used. Trees, bushes, mounds of soil or leaves, wood or rock piles, hollow trees, and gopher holes make the activity more interesting by offering a variety of possible sleeping spots.

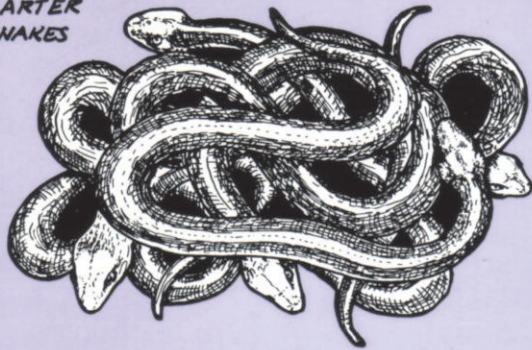
**Safety.** Make sure the kids dress warmly. On a very cold day, you may want to carry a jug of hot cocoa or soup and go inside to warm up between trials.

**Liquid Gelatin.** Before conducting the activity, experiment with the gelatin to become familiar with the procedure and to determine the best gelatin starting temperature for your site. The length of time it takes for the gelatin to set depends on the gelatin's starting temperature and the temperature outside in the site. To keep the kids from getting too cold (and from getting bored), a four- to eight-minute gelling time is best.





GARTER  
SNAKES



Mix the gelatin in warm water according to the directions on the package. (One liter of liquid gelatin will make about 30 gel animals.) Check the temperature with the thermometer, and measure out 30 ml with the measuring spoon into a paper cup. Cover the cup with a paper card and set it outside in an exposed place. See how long it takes for the gel to set.

The following table lists the approximate gelling time for 30 ml of liquid gelatin starting at a temperature between 10° C and 15° C in a paper cup covered with a paper card. Use the table as a guide. You may need to use a starting temperature less than 10° C, but be careful. You don't want the gel to set before you get to the activity site! Unflavored gelatin sets faster than flavored gelatin.

Outside Temperature	Approximate Unprotected Setting Time
-20° C to -10° C (-4° F to 14° F)	3 to 6 min.
-10° C to -5° C (14° F to 23° F)	6 to 12 min.
-5° C to 0° C (23° F to 32° F)	12 to 18 min.
0° C to 5° C (32° F to 41° F)	18 to 25 min.

Transport the liquid gelatin to the site in a thermos bottle.

Note: At temperatures below -20° C, you can use plain water at 10° C rather than gelatin. When outside temperatures are between 6° C and 12° C (43° F and 53° F), reduce the water used in making the gelatin by 25%. The more concentrated gelatin will set more quickly.

## ACTION

1. Explain that a hibernating animal (a chipmunk) or a winter sleeper (a bear) must select a sleeping spot that will provide protection from the winter cold. If the temperature of the sleeping spot falls too low, the sleeping animal may freeze to death. Ask the participants to imagine that they are small animals looking for winter sleeping spots that will protect them from freezing. Say that they will test their selections by placing gelatin "animals" (hold up a gel cup) in the sleeping spots and noting how long it takes for the animals to freeze (that is, get too firm to pour). Each cup will have exactly the same amount of gelatin in it.
2. Give the youngsters five minutes to select likely sleeping spots. Hand out the digging tools and explain that burrowing and building with non-living materials is permitted. After describing boundaries for the activity site, ask the kids to search for sleeping spots. Pour 30 ml of gelatin into a cup for each youngster just before you call them back.
3. Call the participants together, and give each one a gelatin animal and a card. Mention that the cards are for covering their cups. When everyone is next to his or her spot, shout, "Put your animals in place!". You should set one gelatin animal out in the open (unprotected) and one gelatin animal under a small box or knit cap (semi-protected) as trial controls. The trial ends when the gelatin animal under your box or knit cap sets. While the kids are waiting for the trial to end, encourage them to visit each others' sleeping spots. When the gelatin animal under the box or knit cap sets, ask the youngsters to check their gelatin animals. If the gelatin is still liquid, the animal survived. If the gelatin has set and will not pour, the animal froze to death.

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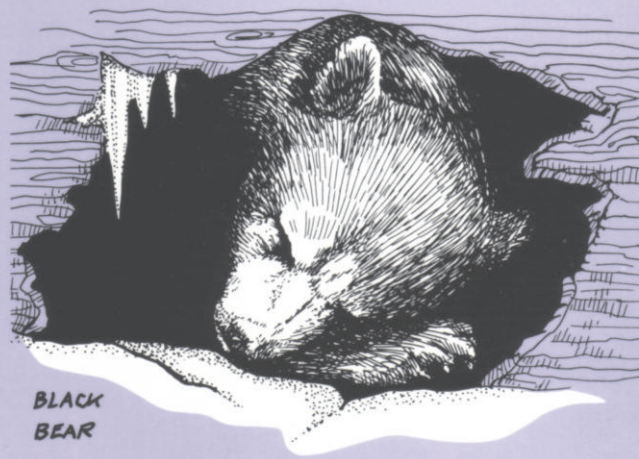
4. Hold several trials to allow your imaginary hibernators to try out several sleeping spots. Every two minutes, signal the kids to check their gelatin animals to find out which spots keep the gelatin from setting.

5. After two or three trials, announce that it is time for a freeze-off among the good spots. Ask each kid to select his/her trial sleeping spot that offers the best protection from the cold. Hand out new gelatin animals and hold the freeze-off to discover which spot provides the most protection, that is, allows the gelatin to remain a liquid the longest. This time the trial runs until only one gelatin animal (the winner) is still in the liquid state.

## CHILLING THOUGHTS



1. What areas seem to provide the best protection from the cold?
2. How did burying or using natural materials such as leaves or soil to cover the gelatin animals affect their freezing times?
3. Why would a gelatin animal always eventually freeze in sub-freezing temperatures, while a rabbit might not?
4. If you were stranded outside in a winter storm without a fire, how could you keep from freezing?



BLACK  
BEAR

## BRANCHING OUT



1. Provide insulating materials such as feathers, wool, paper, foam rubber, and styrofoam, and repeat the activity.
2. How does constant stirring of the gelatin affect its gelling time?
3. Using the same containers, double the volume of liquid gelatin. What happens? After experimenting with the gelling time of different volumes of gelatin, ask the kids if they think small animals or large animals might have a more difficult time of conserving their heat.
4. Compare the temperature under 30 cm or more of snow or soil with the air temperature at the surface. Does soil or snow seem to act as an insulator? (Use the Thermometer Dip-Stick from the activity *Wintergreen* in this module.)

