



MAXIMIZING YOUR MICROWAVE OVEN INVESTMENT

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- Microwave ovens are an investment.
- They can help individuals and families prepare nutritious meals and manage their resources wisely.
- The objective of this publication is to encourage microwave oven owners to take greater advantage of this appliance by doing more than basic reheating and defrosting.

Minimizing the Cost of Microwave Oven Use

As anyone who owns a microwave oven soon learns, microwave cooking requires users to give more mental and physical attention to the cooking process than does conventional cooking. Experienced cooks are accustomed to making cooking decisions almost without thinking because they have repeated the same cooking techniques with the same appliances so often. Indeed, some appliance features such as thermostatic controls free the cook from tending the food once it is placed in the appliance. In contrast, microwave oven users have to learn new habits of checking and adjusting the cooking process.

The additional attention needed for microwave cooking comes with a price tag if a monetary value is placed on the cook's time. In fact, in research at Virginia Tech the cost of the cook's time required to handle and manipulate food was a major factor in microwave-prepared foods having a higher total preparation cost than the same foods prepared with an electric range.

Help in reducing the requirements for a cook's attention is coming from the microwave oven industry as manufacturers introduce models with features that reduce the amount of food manipulation required, and from the food industry as manufacturers introduce more foods especially

designed for easier handling in microwave cooking.

There are some steps which microwave oven users themselves can take to reduce the amount of food tending. They include:

Consider the amount of cook's time needed as well as the cooking time in deciding whether to cook a food with the microwave oven or with a conventional range or portable appliance.

Stir or turn foods as needed for even heating, but don't overdo manipulation of foods. Experience will help determine the line between necessary and excessive attention.

Minimize the use of browning dishes to avoid extra steps and additional manipulation of food. These accessories require preheating before adding the food; some foods must be turned over during microwaving to cook both sides; sometimes the very hot dish must be removed from the oven to reach the food during the turning operation. Furthermore, the special dishes tend to be harder to clean than cookware used for microwave-only cooking.

If you buy convenience foods, look for items packaged so that they can be placed in the microwave oven in their original containers.

Microwave Cookware and Coverings

--Corning does not recommend its Pyrex brand cookware be used for candy--only glass-ceramic can adequately withstand the high temperatures.

--If you are considering buying plastic microwave cookware, be sure that it bears labeling that identifies it for microwave oven use.

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--There are two concerns related to using paper towels in the microwave oven. One of them is related to the color of the towels. White toweling has been recommended by some authorities to avoid any adverse reaction of paper towel dyes with food. Another concern is related to the danger of fires. If paper products are used, exercise caution. They should be in the oven for a short time (no more than 4 minutes) unless there is a lot of moisture present.

One company is now marketing a white paper towel labeled for microwave use. The difference between it and its regular paper towel product is that it doesn't contain dyes or tints. Other paper towel companies are saying that they have marketed towels primarily for clean-up, not for use in cooking.

--Don't use plastic wrappings from purchased refrigerated foods in a microwave oven since the plastic may melt. This kind of wrapping is different from packaged plastic wrap marketed for home use.

--Do buy frozen foods in dual oven trays so they can be cooked easily in the microwave.

--A study by Underwriters Laboratories for the Aluminum Foil Container Manufacturers Association concluded that the use of aluminum foil trays inside non-metal packaging cartons for microwave reheating of frozen food does not present a risk of microwave radiation, fire, or shock if used according to directions on the package.

--Do place oven cooking bags in a 2-inch deep microwave-safe supporting dish and cut 6-inch slits in the top of the bag before cooking. Close bag with nylon tie. Always add 1 tablespoon flour to bag, shake to coat inside.

Metal in the Microwave

The use of metal in the microwave is one of the most misunderstood concepts associated with microwave cooking. The question is often misrepresented on talk shows and in the news media. Manufacturers add to the confusion by sometimes stating in one place in their instruction book "do not use metal." Then later in the book, they refer to "shielding parts of a turkey with foil to prevent overcooking."

Since more items containing metal are being marketed today for the microwave oven, here is some information to help clarify some of the questions you may have.

Metal has always been used as part of microwave ovens. Oven walls and floor (the part under the glass shelf) are made of metal because metal reflects microwaves and keeps the microwaves within the cooking cavity. Some interior oven walls are painted with an acrylic paint so they may not readily look like metal, but they are.

Generally, use of metal containers is not recommended because the metal reflects the microwaves and prevents them from reaching the food from all sides. However, more and more frozen food products are being developed that are packaged in special containers using metal to enhance the crisping of the food. Also, microwave accessories are available, such as browning dishes and egg poachers, that use metal to enhance the microwave cooking.

If not properly used, metal can cause damage to the microwave oven. Small pieces of metal, such as the wire inside of a twist-tie or the thin strip of gold or silver trim on fine china, can cause arcing. Arcing takes place when an electromagnetic field sets up between a thin piece of metal and the metal oven walls or between two pieces of metal in close proximity. Arcing is similar to sparks or lightning and can ignite anything flammable. It can also melt the metal trim on a dish or melt a hole in the side of the oven. When arcing occurs, it is important to stop the oven immediately to prevent damage to the container or the oven.

So, the two dangers of using metal in the microwave oven are small thin pieces of metal and metal that comes in contact with the oven walls. If your oven has a metal shelf, you will notice that the metal grids are spaced far apart and that plastic guides prevent the shelf from ever touching the metal oven sides.

As long as metal is designed in such a way that it is not setting up an electromagnetic field inside of the oven, arcing will not occur. Then metal can be used to advantage to either shield certain parts of a food or be combined with a substance that absorbs microwaves so that the metal surface will become hot enough to crisp or brown foods. In all of these uses, small, thin pieces of metal are avoided and plastic or other material is used as the framework around the metal to prevent the metal from coming in contact with oven walls.

An example of this is the foil base now being used in packaging for some frozen pizza, potato and sandwich products. The foil has a special coating that attracts and absorbs microwaves. The metal surface becomes hot enough to help crisp whatever food is in contact with it. Since

this makes the food more like a conventionally-heated product, we will probably be seeing increased use of this type packaging.

Because use of metal is potentially dangerous, manufacturer's instructions should be followed carefully. Before products are marketed, hours of testing in various ovens have taken place to help assure not only good but also safe results.

What about making your own shielding and packaging from foil? This process is less controlled than a commercial food package and so more care should be used. Be sure any metal (foil) molds tightly to the food and take care that the metal is not in contact with oven walls or an oven shelf. Whenever using foil in this way, remember to have at least half of the food exposed to microwave energy and do not leave the oven unattended. Shielding can be helpful when wrapping thin parts of meat or poultry during the first part of cooking to prevent overcooking, when thawing only a portion of a frozen package and when protecting an area that seems to be cooking too fast. The use of the foil sometimes affects the cooking in the adjacent areas so occasionally check the food to be sure the cooking is progressing the way you wish.

Today, many cook books and use and care manuals advise against use of metal in the microwave. Generally, this is a good rule to follow and most of your microwave cooking will not require the use of metal. However, there are safe accessories as well as food packaging that include metal to aid your microwave cooking. If you follow the steps outlined above, you need not fear occasional use of metal in the microwave. Used properly, metal can make your microwave cooking even better. (Reprinted with permission from *The Microwave Times*, March/April 1987, a newsletter published on a subscription basis by Recipes Unlimited, Inc., Box 1271, Burnsville, MN55337.)

Seafood Perfect for Microwave Cookery

Most everyone today is looking for nutritious, less expensive recipes and short cuts in the kitchen that don't subtract from the quality in flavor or appearance of cooked foods. According to Virginia home economist and culinary author Jan Carlton, an answer for many consumers in seafood states, such as Virginia, is preparing fresh seafood by microwave cooking. "Seafood is high in quality, protein, B vitamins, and minerals, and most is lower in calories than other protein foods," Carlton says, who adds: "It is easily prepared in a matter of minutes by microwaving,

resulting in a tasty cooked product that is moist and tender with a fresh just-caught flavor." Regarding availability of fresh seafood locally, Carlton claims this should not be a problem since the seafood industries in Virginia and a few other Mid-Atlantic states ship fresh shellfish and finfish year-round to retail markets throughout the eastern half of the nation.

Microwave cooking of seafood takes little time and preparation. However, there are several tips to keep in mind when cooking by microwave.

Do not overcook. Because microwave cooking is so fast, the minimum amount of time recommended in a recipe should be used and time added, if needed, to further cook shellfish or finfish in one or two minute increments. Over-microwaved fish can be tough, dry, and unappetizing. Additional minutes of microwaving can always be added but never subtracted. The most accurate guide for judging the microwave cooking minutes required is the "doneness test": shellfish and finfish turn opaque white in color, and shellfish cut and finfish flake easily when tested with a fork.

Fresh seafood prepared in a microwave oven should be placed on plastic or glass baking dishes and covered with clear plastic wrap.

LEARNING ACTIVITY

Try a fish or seafood recipe in your microwave oven cookbook. Or, you can try the following recipe:

Coated Fish Fillets

2 tablespoons butter or margarine
8 ozs. fish fillets
2 tablespoons finely chopped almonds
2 tablespoons wheat germ
1 tablespoon Parmesan cheese
1/4 teaspoon salt

1. Microwave (high) butter in shallow 1 1/2-quart glass baking dish 1/2 to 1 minute or until melted.
2. Arrange fillets in butter, turning to coat both sides. Combine almonds, wheat germ, Parmesan cheese, and salt. Spoon onto fillets. Cover with paper towel.
3. Microwave (high) 2 1/2 to 3 1/2 minutes or until fish flakes apart easily with fork.

For a double recipe, increase time in step 3 to 4 to 5 minutes.

If desired, toast almonds before adding to topping. Place in glass pie plate and microwave (high) 4 to 5 minutes, stirring every minute. (Source: *The Microwave Times*, published by Recipes Unlimited).

Team Up Your Microwave Oven and Outdoor Grill

Your microwave oven and outdoor grill can work together for cooking many foods. You can pre-cook many foods such as chicken or spareribs before grilling to speed up the grilling process. With this technique you can have fully cooked meat with outdoor flavor. For some foods you can begin them on the grill and complete cooking in the microwave oven.

To capture the outdoor flavor for more meals, you can cook extra meat while the grill is hot and freeze it. If you completely cook the meat on the grill, just reheat it in the microwave oven.

Remember too that the microwave oven can be used to precook some vegetables for outdoor grilled kabobs.

Reheating Meats in the Microwave Oven

Do microwave reheated foods really taste better than those foods reheated by conventional methods?

Judging from recent research, sometimes.

In research at the University of Missouri-Columbia, methods of reheating-- conventional oven or microwave oven--did not influence sensory scores for warmed-over flavor or aroma. The two methods of reheating also did not influence the amount of oxidation as measured by an objective test. Oxidation is the factor considered responsible for warmed-over flavor in meats and meat products.

However, in research at Indiana University of Pennsylvania, microwave reheating of chicken breasts produced less warmed-over flavor than conventional reheating.

Use of the Microwave Oven Temperature Probe

Has your microwave oven temperature probe been relegated to an obscure spot in your

kitchen? If so, you are missing out on the convenience it can offer.

A probe is a temperature-sensing device connected to a socket within the oven which is inserted into the food. The oven, which is set according to the desired end temperature by the user, cooks until the probe senses this temperature, at which time (for many models), the oven automatically shuts off.

Recipes Unlimited, Inc., publisher of the newsletter, *The Microwave Times*, recommends setting the temperature for the probe about 10 to 15 degrees lower than the desired internal temperature when microwaving with full power (High) to allow for a temperature rise during standing time. When using a lower power (30 to 50%), set the temperature at or near desired internal temperature, since there will be less of a temperature rise. When cooking meat with the probe, recheck the temperature after the standing period to be sure the meat is done.

The probe can be used for foods which cook to temperatures below 190 degrees F. The main exceptions are candies, jams, and jellies.

Using the temperature probe is one technique designed to help eliminate the guesswork often associated with cooking by time. Correct placement of the probe helps insure success. With meat, be sure that the probe does not touch a bone or fat layer, and is not shielded by a bone or fat. Bones and fat distort the temperature reading. Place the tip of the probe in the center of the food. The first 1/3 of the probe must be located in the food to obtain accurate readings. The temperature-sensing end of the probe should never be allowed to touch the interior walls or oven door while the oven is in operation. Do not force it into frozen foods. If the food surface close to the probe seems to be overcooking, consider moving the probe. Microwaves are attracted to the metal rod and thus to the food touching it. Stir foods when recommended during cooking so they will cook more evenly. Relocate the probe after stirring.

Remember, a temperature probe provides only one guide to doneness. You will need to use it in conjunction with other doneness tests to avoid disappointing results.

If you're having poor results with your probe, you may want to check its accuracy. Heat a cup of water in the microwave oven with the probe and double check the temperature of the water with a thermometer that you know is accurate.

Use the chart below to help determine the desired end temperature for various foods. Look at the directions for your microwave oven to determine which setting you should use to give each of the temperatures and complete the chart.

Food	Temperature (degrees F)	Setting for Your Oven
Dissolve yeast	105 to 110	
Warm baked goods	110 to 120	
Syrup, ice cream toppings, milk-based soups, custard, reheating leftovers	130 to 140	
Precooked casseroles*, liquids for coffee, tea	150 to 160	

*When using high power, set probe 10 to 15 degrees lower.

LEARNING ACTIVITY

Here is a recipe you may want to try with your temperature probe:

Easy Beef and Tater Bake

1 pound ground chuck
 1 tablespoon instant minced onion
 1/2 teaspoon salt
 1/8 teaspoon pepper
 1 pound package frozen shredded potato nuggets
 1 can condensed cheddar cheese soup
 1 can condensed cream of mushroom soup

1. Crumble beef into 2-quart casserole. Place in microwave oven and cook 5 minutes, stirring after 3 minutes. Drain.
2. Distribute onion, salt, pepper, and potato nuggets over browned meat.
3. Mix soups together and spoon over top.
4. Cover with plastic wrap. Insert temperature probe into the center. Cook to 150 to 160 degrees F. Serves 4-6. (Missouri Cooperative Extension Service)

Some Answers to Your Microwave Questions

Do Microwaves Escape with the Steam?

The doors on microwave ovens are not vapor tight, so some steam may escape when you're cooking moist foods. This in no way indicates microwave leakage. As you probably know by

now, microwaves do not pass through metal. The oven door has a special metallic seal called a "choke" to prevent the waves from escaping--they are reflected back into the oven. All of the other parts of the oven are also designed to keep the microwave energy inside. For example, the holes in the metal screen in the door allow you to see inside the oven, but they are too small for the waves to penetrate. The clear window covering the screen is there to ease cleaning and to prevent anything from being inserted through the holes.

Does Light Showing Around the Door Indicate Microwave Leakage?

The microwave oven door has a gasket, but this is not the primary seal. A tight fit (as on a refrigerator door, for example) is not required. Only obvious damage, such as broken or loose hinges and bending or warping of the door, would require having the oven checked by a service technician.

Oven light can reflect out around the door, hinges, or parts of the outer cabinet, but this is not an indication of any microwave leakage.

How Often Should the Oven Be Checked?

Unless there has been some damage to or abuse of the oven, there is no reason for routine, periodic checks for microwave leakage. The ovens comply with strict U.S. Government standards which limit microwave leakage not only in new ovens, but also over their expected useful life. If for any reason you do want to check for leakage, have the oven tested with a properly designed instrument by a qualified service technician. Buying an inexpensive "home tester" is not a reliable way of checking for any possible microwave leakage.

What Causes a Microwave Oven to Make Unusual Popping Noises While Cooking?

1. *Reason:* Spattering from food high in fat content. *Remedy:* Use a covering to reduce spattering (just as when frying food on top of a range).

2. *Reason:* Pressure built-up in food with tight membrane, peel or skin due to fast cooking. *Remedy:* This is normal in microwave cooking and unavoidable in foods like peas and beans. Pierce skin of foods such as potatoes, squash, tomatoes, and egg yolks with a fork or wooden pick; cut a small opening in cooking bags.

Should a Microwave Oven be Unplugged During an Electrical Storm?

It is a good idea to unplug a microwave oven, TV, and similar appliances during an electrical storm to avoid damage from a high voltage surge of electricity.

Meeting the Needs of Consumers with Physical Limitations

Does, or can, the microwave oven and its companion household appliances meet the needs of consumers with physical limitations? The Whirlpool Corporation feels that the microwave oven comes close to being the "ideal" cooking appliance for such consumers.

In some instances, its basic design characteristics meet the needs of consumers with physical limitations with no modifications needed. For example, features of a microwave oven such as side-opening door and front-mounted controls are suited to consumers who work from wheelchairs, who are blind, or have specific reach or mobility restrictions. Other microwave oven characteristics which meet many general needs of consumers with physical limitations are cooking speed, cool oven cavity, and opportunity for use of light-weight plastic serving dishes for cooking. These characteristics aid consumers with weaknesses of the arms and hands. They also help prevent accidental burns and save food preparation and clean-up time for those with limited stamina and physical energy.

The microwave oven has another design characteristic that makes it usable by people with a variety of limitations. Unlike most other appliances, the microwave oven offers excellent installation flexibility. It can be installed at a broad range of height levels, providing easy access and use. The countertop unit can be installed toward the back of a counter, giving

necessary hand-hold room and landing space for dishes.

For some consumers, however, some modifications of the microwave oven are required. For example, the Whirlpool Corporation has added a Plexiglas overlay with open "windows" above the touch control pads. Braille nomenclature is applied to the overlay. With this adaptation, the blind user can read the Braille, then reach into the window to select and set the cooking cycles needed. Another feature helpful to blind microwave users is a model with touch controls and audible feedback.

Whirlpool is one of several manufacturers who offer appliance modifications for persons with physical limitations.

Some Considerations for Helpful and Safe Use of the Microwave Oven by Children

Generally, microwave cooking minimizes the danger of burns and dangerous spillovers so it is a safe method of cooking for children. The addition of convection heating to microwave cooking, and the use of a browning element or browning dish increases the danger of burns, however. A microwave oven placed too high for a child to reach and remove hot food such as a bowl of soup also increases the safety hazard.

Another benefit of encouraging the use of the microwave oven by children is that it is easy for them to prepare servings for one or two persons. Too, microwave cooking generally eliminates the need for cleaning up dirty range surfaces and ovens and makes clean-up of cooking dishes easier.

Many children are intrigued by the microwave oven. One microwave oven authority suggests capitalizing on this natural curiosity by having children try some recipes especially tailored to their tastes and skills. Remember that, just as with any cooking, children should have some guidance and supervision from parents at the beginning.

According to a report based on a study conducted by *Good Housekeeping* magazine, the median age when children begin using the microwave oven supervised was 10 and unsupervised, 12. Research by Sweaney and Wallinga at the University of Georgia found that parents perceived that children could use the microwave without adult assistance from ages 9 to 10. One microwave cookbook is aimed at children age 8 and older.

Some adult microwave cookbooks include recipes designed for the junior chef. Also, there are several cookbooks aimed just at teen or pre-teen cooks.

Microwave Heating For Infants

Infant formula can be heated in the microwave oven if you take proper precautions. Use dishwasher-safe plastic or glass bottles. Microwave heating of bottles with plastic liners is not recommended. When heating the formula, only a few seconds will be needed. After heating, slightly shake the bottle and then test the heated formula on your wrist to make sure it's not too hot.

By far the greatest concern involved in heating infant formula in a microwave oven is due to the fact that a bottle can feel comfortably warm on the outside, yet contain hot formula on the inside. A recent study at the University of Virginia compared baby formula heated in glass and plastic bottles. They found that the temperatures of the formula in glass bottles were higher than those of the formula in plastic bottles when heated for the same time. Heating times should be adjusted depending on the type of bottle used. There have been some reports of esophageal burns to infants from formula heated in the microwave oven.

Microwave heating can provide very dependable results when the power and time settings are appropriate for the quantity and temperature of the

formula. Problems arise when parents accidentally heat half-full or slightly warm bottles of formula at the time and power settings used for full bottles of cold formula. Also, the output wattage of microwave ovens is different so formula may reach a higher temperature when heated in two different microwaves for the same amount of time.

The age-old practice of testing heated formula on the wrist is still recommended when heating formula in a microwave oven.

Microwave heating of baby food is generally not recommended because of the danger of burning the baby's mouth.

Reference: Risk Factors For Microwave Scald Injuries in Infants by W.C. Sando, K.S. Gallaher, and B.M. Rodgers, *Journal of Pediatrics*, December 1984.

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MICROWAVE OVEN MANAGEMENT EDUCATION

Please take a few minutes to complete this form so that we can tell how useful our microwave oven management education has been.

1. In the past year have you taken the Extension Microwave Oven Learn-by-Mail Course?
 YES NO
2. In the past year have you attended any demonstrations or classes on using the microwave oven sponsored by your local Extension office?
 YES NO
3. To what extent have the Extension sponsored classes and/or publications (including this one) improved your skills in using the microwave oven? (Circle one.)

VERY GREAT	GREAT	SOME	LITTLE
4	3	2	1
4. Do you own a microwave oven?
 YES
 NO, go to question 12.
5. How many microwave ovens have you owned since 1972?
 ONE TWO MORE THAN TWO
6. How many times a week is the microwave oven used in your household for preparing the following meals and snacks? (Indicate by circling one number for each use.)

UsesNumber of Times Per Week

Breakfast.....	0	1	2	3	4	5	6	7	more than 7
Lunch.....	0	1	2	3	4	5	6	7	more than 7
Dinner.....	0	1	2	3	4	5	6	7	more than 7
Snacks.....	0	1	2	3	4	5	6	7	more than 7

7. Do you feel you save time by heating and/or cooking with the microwave oven?
 YES, go to question 8.
 NO, go to question 10.
8. How much time do you think you generally save per day by heating or cooking with the microwave oven? For example, you may feel that you save 5 minutes in preparing dinner compared with before you acquired the microwave. (Circle one number for each use.)

UsesMinutes Saved Per Day

Preparing breakfast	1	2	3	4	5	10	12	15	20	25	30	45	60
Preparing lunch	1	2	3	4	5	10	12	15	20	25	30	45	60
Preparing dinner	1	2	3	4	5	10	12	15	20	25	30	45	60
Preparing snacks	1	2	3	4	5	10	12	15	20	25	30	45	60

9. Which of the following best describes the benefits to you and/or your family from the time saved in meal preparation associated with the use of the microwave oven? (Check as many of the following as apply.)

- spend more time with your family and/or friends
- enable you to eat more meals at home
- spend more time in leisure activities
- spend more time in volunteer activities
- spend more time in paid work
- other _____

(Please specify)

10. In what year did you acquire the microwave oven you now use most frequently? _____

11. How much did this microwave oven cost? (Check one answer)

- less than \$100 \$100 to 199 \$200 to 299 \$300 to 399
- \$400 to 499 \$500 to 599 \$600 or more

Please tell us a little about yourself: (Check the suitable answers or fill in the blanks below.)

12. What is your sex? FEMALE MALE

13. What is your age? UNDER 20 20 to 35 36 to 50
 51 to 65 OVER 65

14. What is your race? WHITE BLACK ASIAN
 HISPANIC AMERICAN INDIAN

15. What is the highest level of school you've completed:
 LESS THAN HIGH SCHOOL HIGH SCHOOL GRADUATE
 SOME SCHOOLING BEYOND HIGH SCHOOL COLLEGE GRADUATE

16. How many persons live in your household? _____

17. What is the usual number of hours you work for pay a week? _____

Additional comments:

Please return to:

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