



Basic principle of microwave oven

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Salient features of Microwave Oven

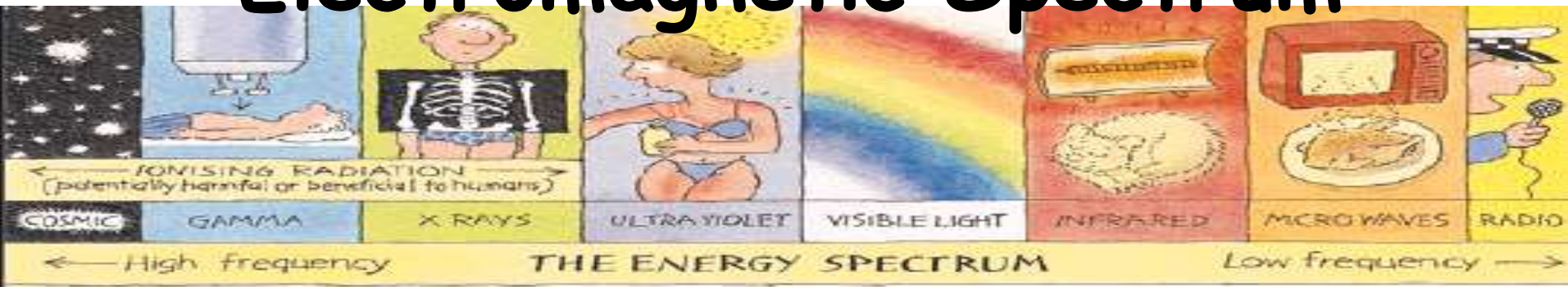


- **Saves Time**
- **Nutritious values of food are retained**
- **Moderate Power consumption**
- **Easy to use**
- **Easy transportation**
- **Easy maintenance**
- **Pollution free**

[What are Microwaves?]

- **Microwaves are a form of electromagnetic energy, like light waves or radio waves**
- **Microwaves are used extensively in communications**
 - such as to relay long-distance telephone signals, television programs and computer information across the earth or to a satellite in space.
- **Good for transmitting information because it can penetrate light rain and snow, clouds, and smoke.**
- **Also used in radars and in detecting speeding cars.**
- **Microwave has become most familiar as the energy source for cooking food.**

Electromagnetic Spectrum

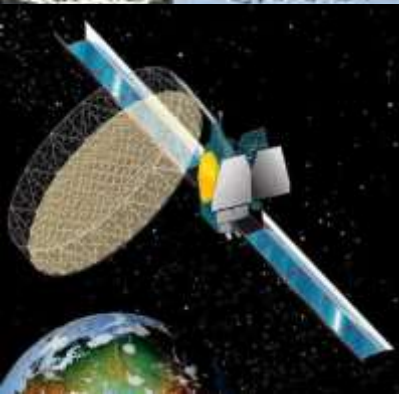


Band Name		Frequency Range	Common Application
VLF	Very Low Frequency	3 KHz-----30 KHz	Electronic Toys & Equipments
LF/ LW	Low Frequency/ Long Wave	30 KHz-----300 KHz	Commercial Radio Broadcast
MF/ MW	Medium Frequency/ Medium Wave	300 Khz-----3 Mhz	Commercial Radio Broadcast
HF/ SW	High Frequency/ Short Wave	3 MHz-----30 MHz	Commercial Radio Broadcast & Walky Talkies
VHF	Very High Frequency	30 Mhz-----300 MHz	Commercial TV, Radio Broadcast & Cordless Phones
UHF	Ultra High Frequency	300 MHz-----3 GHz	Commercial TV Broadcast & Microwave Oven
SHF	Super High Frequency	3 GHz-----30 GHz	RADAR, Satellite TV Transmission
EHF	Extremely High Frequency	30 GHz-----300 GHz	Merchant Navy & Space Stations

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Microwaves are usually represented in GHz

Applications of Microwaves



Imaging



Remote



Mobiles



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MICROWAVE OVEN

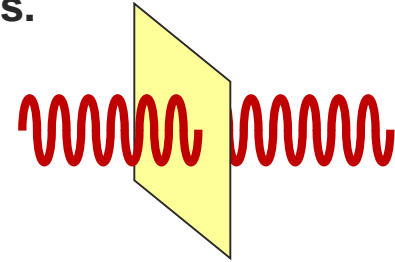
Satellite communication

Communication Tower

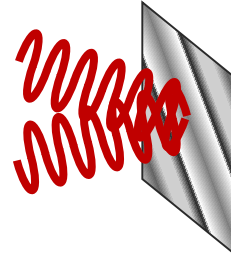


Three Basic Properties of Microwaves

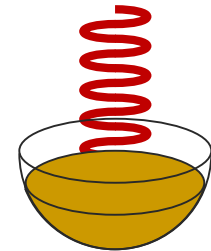
1. Microwaves can pass through Glass, Paper, Plastic & Organic materials.



2. Microwaves are reflected by metal surfaces.



3. Microwaves penetrate and are absorbed by some substances like fats, sugar, water molecules



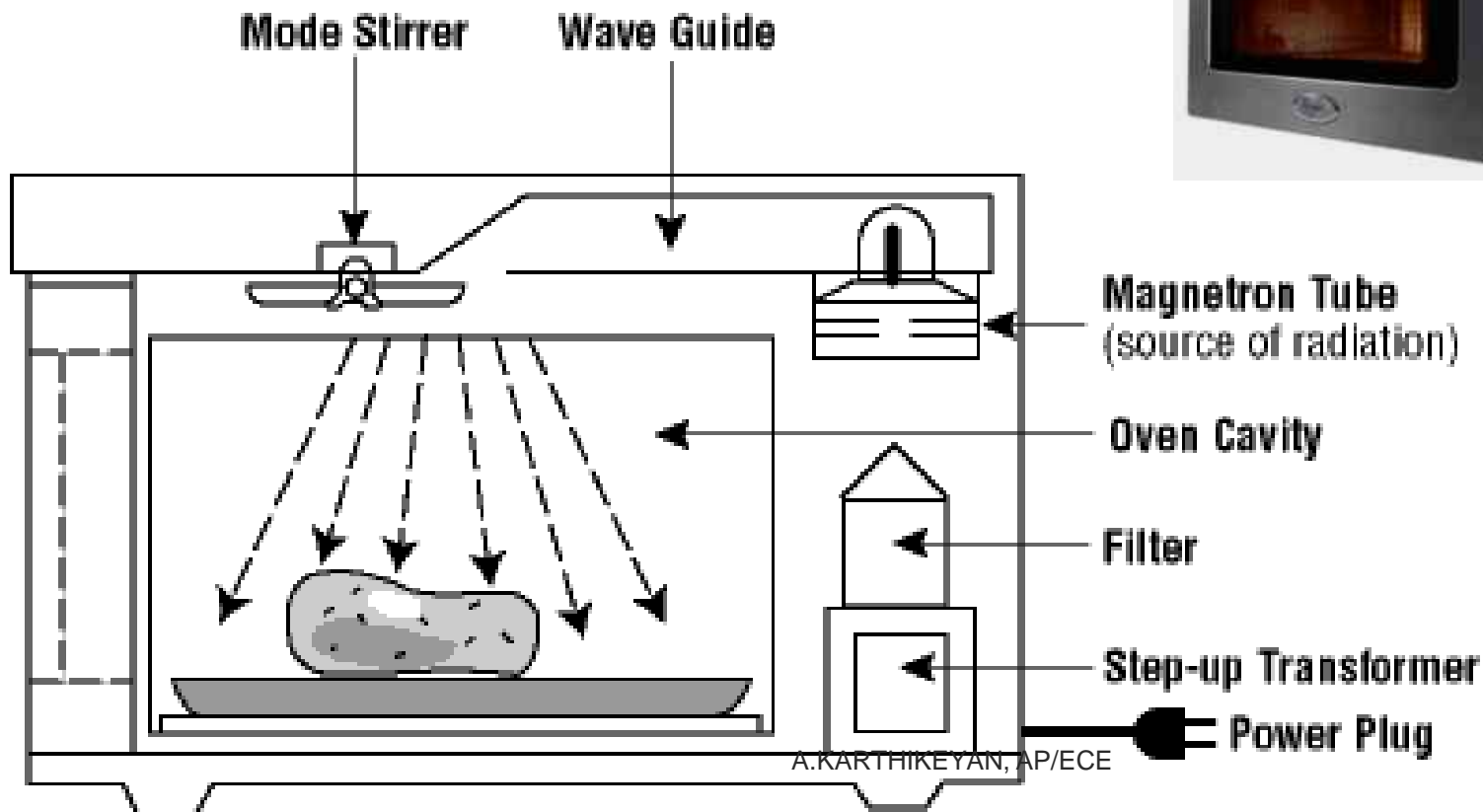
[History



- Invented accidentally by **Dr. Percy LeBaron Spencer**
- While testing a magnetron during work, he discovered the candy bar in his pocket melted
- Experimented with other food products (popcorn and eggs), and realized microwaves can cook foods quickly
- **At 1947, 1st commercial microwave oven produced (called Radarange)**
 - Mostly used by restaurants, railroad cars, ocean liners and military
- Improvement and refinements made ~ by 1967, 1st domestic microwave oven produced



How the Oven Works



[How the Oven Works]

- The magnetron converts the high voltage in to the microwave frequency for cooking
- The microwave energy is transmitted into a waveguide
- When the door is opened, or the timer reaches zero, the microwave energy stops.

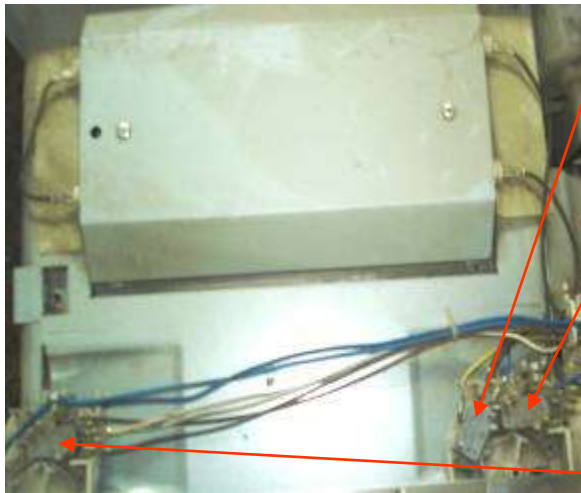
Components used in Microwave Oven



Power Cord



RFI Filter



Monitor Switch

Primary Switch

Secondary Switch

Interlock Switches



Grill Heater

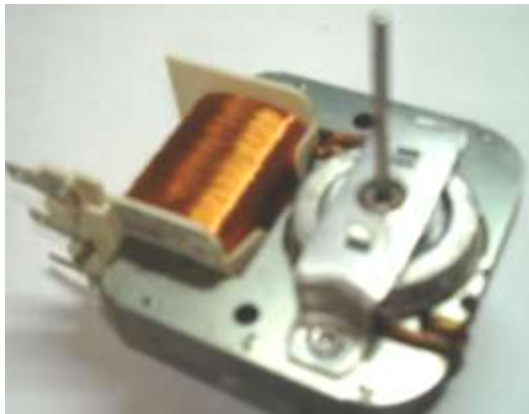
Components used in Microwave Oven



Convection Heater



Fan Motor



Convection Motor

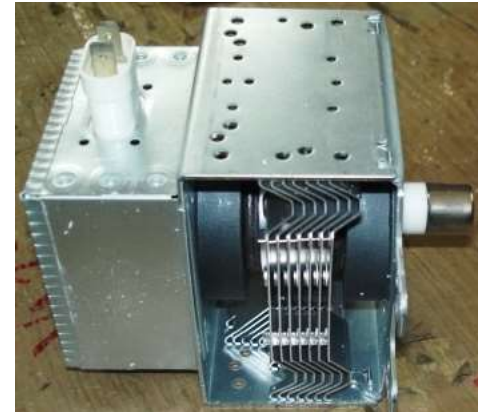


Thermal Cutout

Components used in Microwave Oven



Turntable Motor



Magnetron



HV Diode



HV Capacitor

Components used in Microwave Oven



HV Transformer



PCB

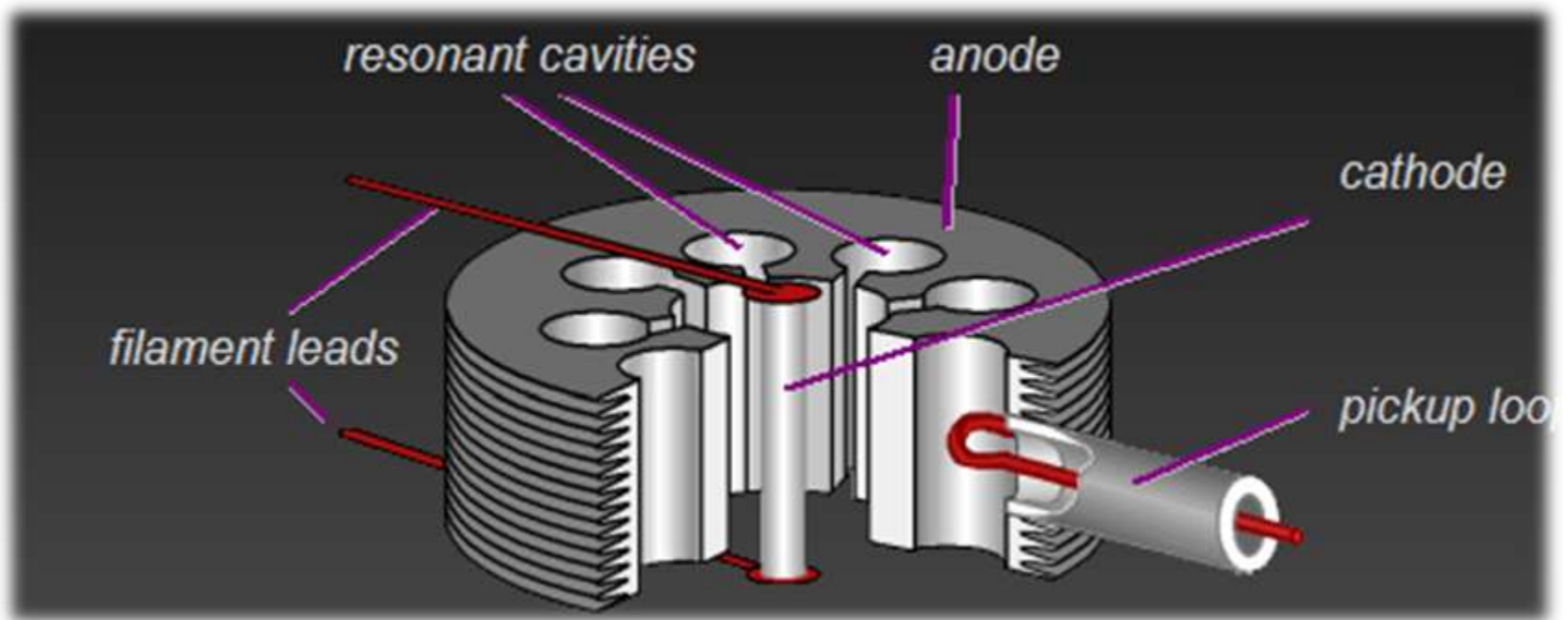


Thermistor

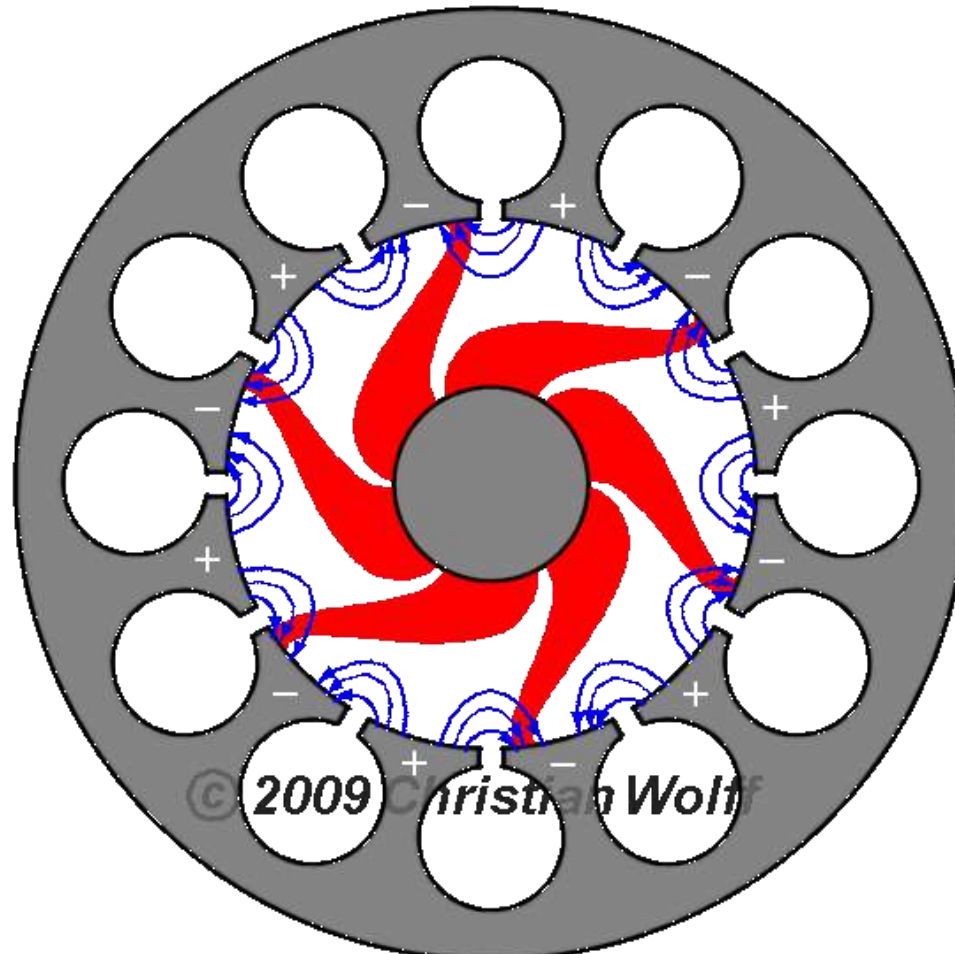


Oven Lamp

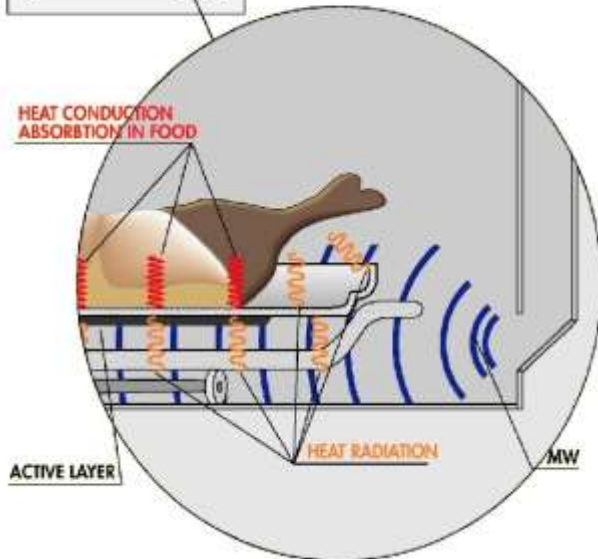
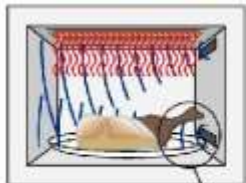
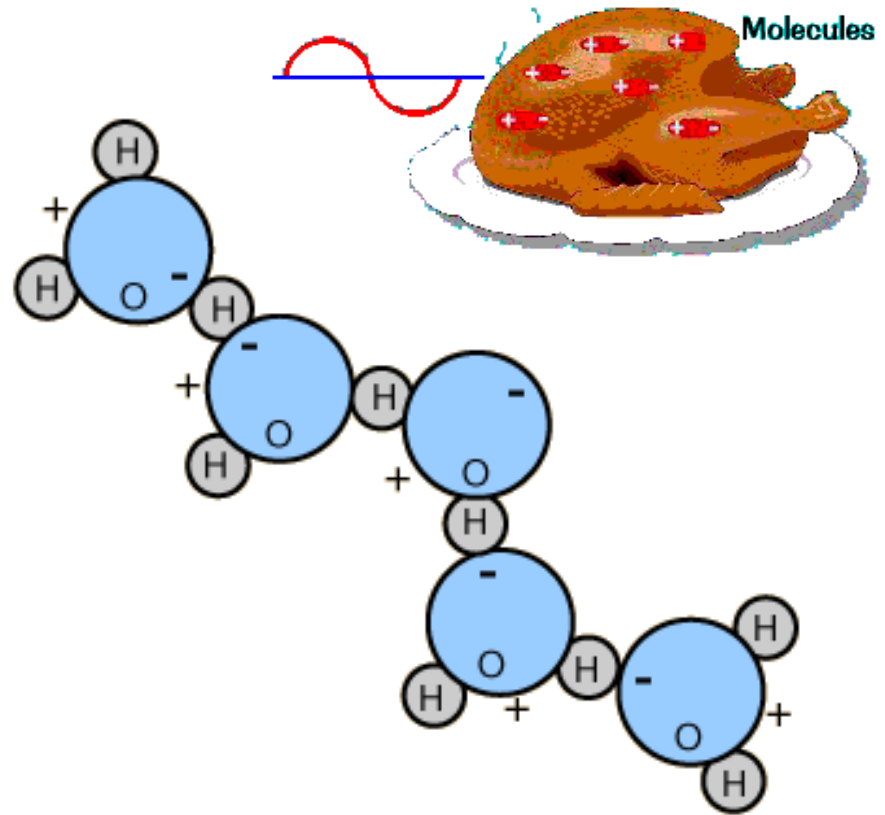
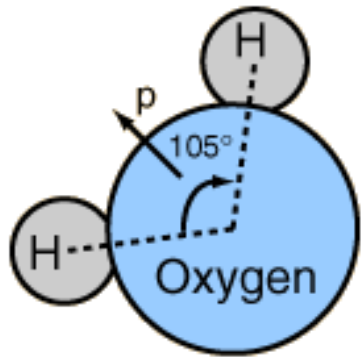
MAGNETRON



Travelling electron bunches



How Foods Get Cooked ?



[How Foods Get Cooked]

- The microwaves that penetrate the food have an electric field that oscillates 2.45 billion times a second, a frequency that is well absorbed by polar liquid molecules such as water, sugars, fats and other food molecules.
- Water interacts with the microwave:
 - flipping its orientation back and forth very rapidly
 - bumping into one another and producing heat, cooking the food.
- Glass, paper, ceramic, or plastic containers are used in microwave cooking because the microwaves pass through them
- Metal reflects microwaves
 - Unsafe to have metal pans/aluminum foil in oven, may damage oven

[Health Hazards]

- It is known that microwave radiation can heat body tissue the same way it heats food.
- Exposure to **high levels of microwaves** can cause a painful burn
 - Ex. the lens of the eye ~ exposure to high levels of microwaves can cause cataracts.
- Still uncertain in the effects of humans from long term exposure to low level of microwaves
 - Still experimenting
- Best to stay a way (an arm's length) in reducing exposure to microwaves

[MCQ]

1. Ribblet short-slot coupler consists of two waveguides that are separated by a distance “d”.
 - a) True
 - b) False

2. Schwinger reversed phase coupler is a waveguide coupler designed so that the path lengths for the two coupling apertures are the same for _____
 - a) Coupled port
 - b) Uncoupled port
 - c) Back port
 - d) Isolated port



Thank you