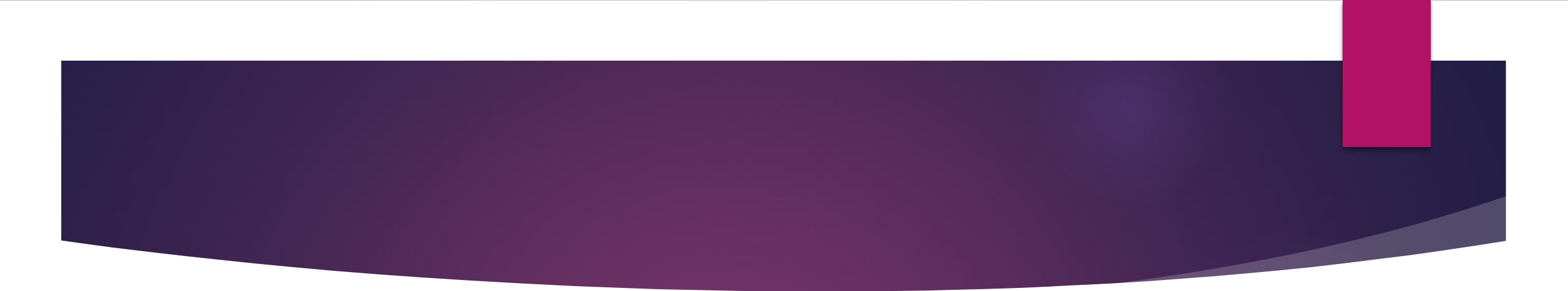
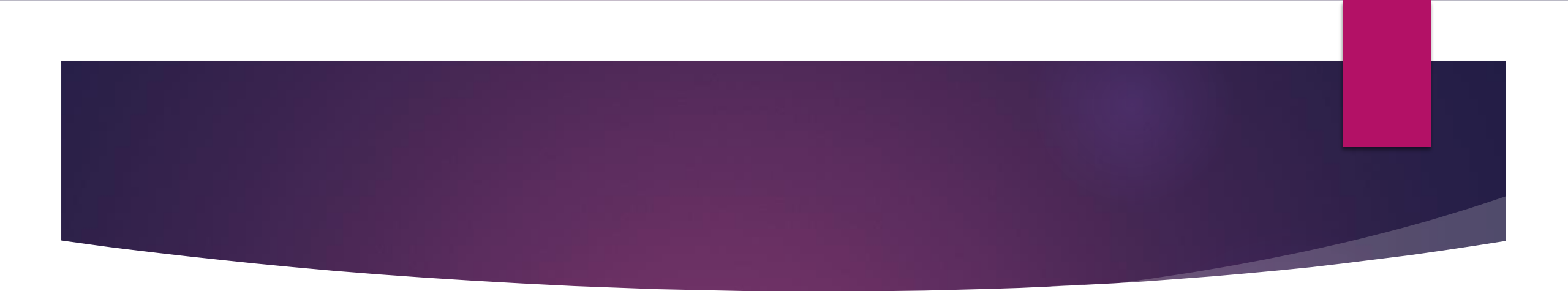


# Basal Metabolic Rate

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- ▶ The amount of energy required for any individual varies directly with the degree of activity and environmental conditions , but the rate of energy production in an individual is more or less constant under some standard conditions ,basal conditions and is known as basal metabolism .

# Definition

- ▶ The basal metabolic rate is the energy required by an awake individual during physical, emotional and digestive rest .
- ▶ It is the minimum amount of energy required to maintain life or sustain vital functions like the working of heart, circulation ,respiration and functions of brain .

- 
- ▶ BASAL CONDITIONS ARE
  - ▶ Person should be awake but at complete rest both physical and mental .
  - ▶ Person should be without food at least 12 to 18 hrs , i.e in the “post absorptive state”



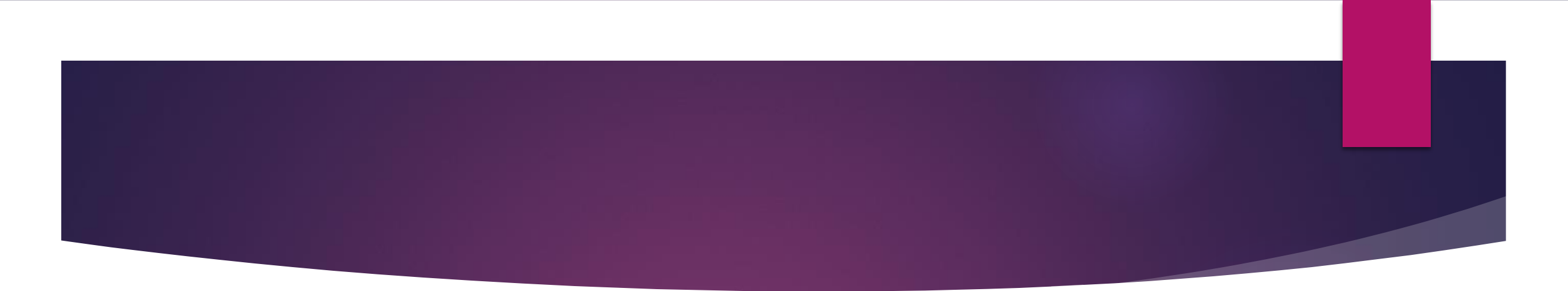
► Post absorptive state

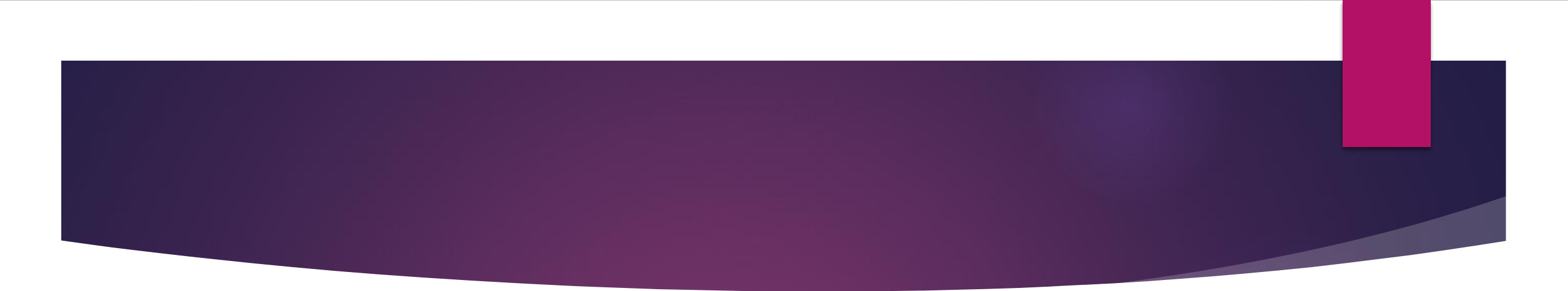
This period is allowed to pass for avoiding effects of digestion and absorption

The effects of SDA ( Specific Dynamic Action ) of foodstuffs

➤ To prevent any chances of starvation .

Person should be in recumbent position in bed

- 
- ▶ Person should remain in normal condition of environment , i.e at normal temperature , pressure and humidity , environmental temperature should be between 20°C to 25° c.

- 
- ▶ The metabolic rate during sleep is less than BMR.
  - ▶ Resting metabolic rate (RMR) is the measure of energy required to maintain life or vital functions. The subject is awake and non fasting. It is approximately about 3 percent higher than the BMR



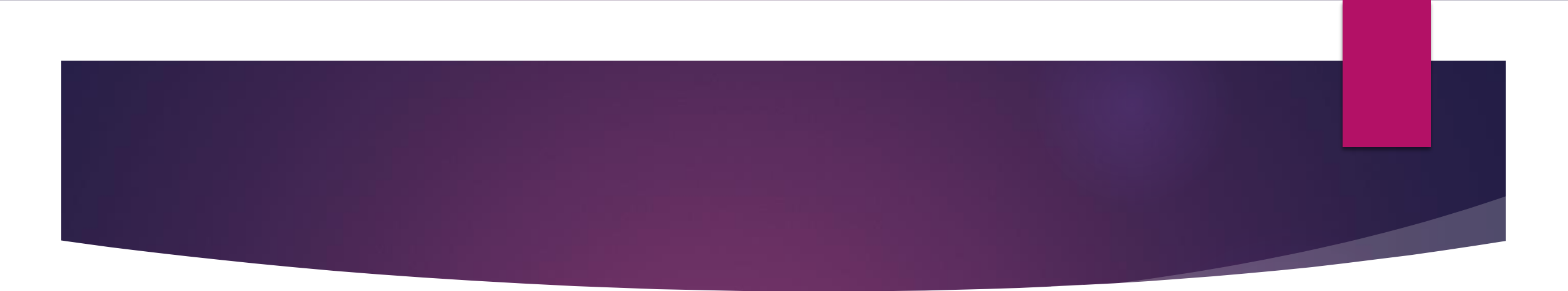
## **DIFFERENCES BETWEEN BMR AND RMR**

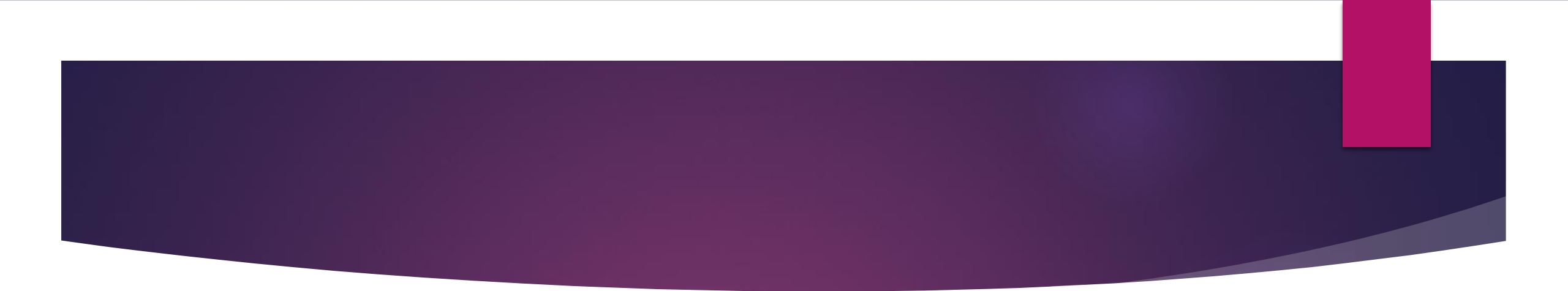
### **BASAL METABOLIC RATE**

Basal metabolic rate is the rate that an organism gives off heat while at complete rest .

It is measured while the person is awake but at complete rest .



- 
- ▶ It is often conducted in a darkened room upon a person, waking up after at least 8 hours of sleep .
  - ▶ To get the BMR of a person, it is important that he does not exert any extra energy while doing the test. This is why a person who is being subjected to a BMR test is required to stay at the testing facility the night prior to the test .

- 
- ▶ He is in a reclining position, resting completely .
  - ▶ He is required to fast for 12 hours before testing to ensure that his digestive system is not working during the procedure .
  - ▶ During this time the energy released by his body should only be sufficient to let his vital body organs to function .



## ▶ **RESTING METABOLIC RATE**

- ▶ Resting Metabolic Rate is measured under less restrictive conditions than Basal Metabolic Rate.
- ▶ It does not require the person to spend the night in the testing facility to ensure at least 8 hours of sleep and rest before testing .

BMR is measured directly by the heat

- ▶ Evolved or indirectly by the volume of oxygen consumed and carbon dioxide evolved per unit time

# Measurement of BMR

- ▶ Procedure; Atwater Benedict Roth basal metabolism apparatus (closed circuit method ) is used. The person should be awake, but at physical and mental rest. The temperature of surroundings should be comfortable



The subject breathes in oxygen from a metal cylinder .The carbon dioxide

- ▶ produced is absorbed in soda lime.The subject is asked to breathe through a mouthpiece for 6 minutes.The oxygen present in the cylinder is utilized during this time.The volume of oxygen consumed is recorded

Calculation; The BMR is calculated from oxygen consumption , calorific

- ▶ Value and surface area. Let oxygen consumed in 6 minutes be “Y “liters, it is shown that calorific value of oxygen is 4.8, that is when 1 liter of oxygen is utilized 4.8 kilocalories are generated . Therefore heat produced in 6 minutes =  $4.8 \cdot y$  or heat produced in 24 hours =  $4.8 \cdot 10 \cdot y \times 24$  kilocalories

## Indirect calorimetry; when deuterium

- ▶ ( $^2\text{H}$ ) and  $^{18}\text{O}$  labelled water is given these isotopes are eliminated at different rates. Deuterium is eliminated only as water while oxygen is eliminated as  $\text{CO}_2$  as well as water. The difference between the two elimination rates is therefore a measure of  $\text{CO}_2$  production



# The double labelled water method

- ▶ Provides a measure of total  $\text{CO}_2$  production over 2 to 3 weeks. The method is useful to measure alteration in energy requirements during growth, pregnancy, lactation etc.

# Factors Affecting BMR

- ▶ AGE; During the period of active growth BMR is high it reaches a maximum by 5 years of age. In old age BMR is lowered
- ▶ SEX Males have a higher BMR than females

Exercise ; The increase in BMR during exercise is due to increased cardiac

- ▶ Output. Starvation lowers BMR
- ▶ Temperature; BMR increases in cold climate as a compensatory mechanism to maintain body temperature

# Fever; 12% increase in BMR is noticed

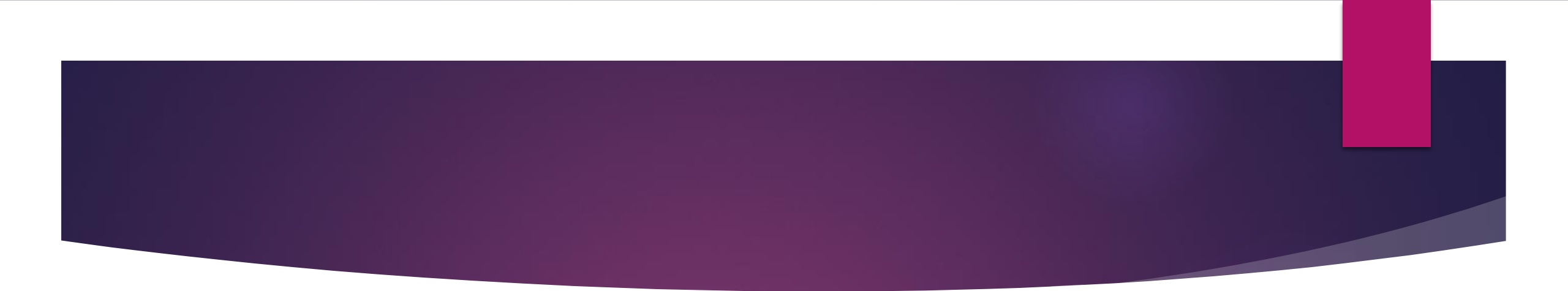
- ▶ Per degree centigrade rise in temperature.
- ▶ Thyroid hormones; Since thyroid hormones have a general stimulant effect on rate of metabolism and heat production. BMR is raised in hyperthyroidism and lowered in hypothyroidism

# Normal Value For BMR

- ▶ Since BMR is affected by body surface area it is usually expressed in kilocalories per hour /square meter of body surface. Body surface area is calculated using the formula  $A = W \cdot H \times 71.84$  where as A is area in sq cm H is height in cm and W is weight in kg . The BMR is then calculated from the values of oxygen consumption calorific value and surface area

For adult men normal value for BMR is

- ▶ 34 to 37 kcal/square meter/hour and for women 30 to 35 kcal/sq m /hour
- ▶ BMR for an adult is fixed as 25 kcal/kg body weight /day

- 
- ▶ **IMPORTANCE OF BMR**
  - ▶ **As a diagnostic aid**
  - ▶ **For calculation of caloric requirement**
  - ▶ **Effects of food and drugs**