

# **Temperature Measurement**

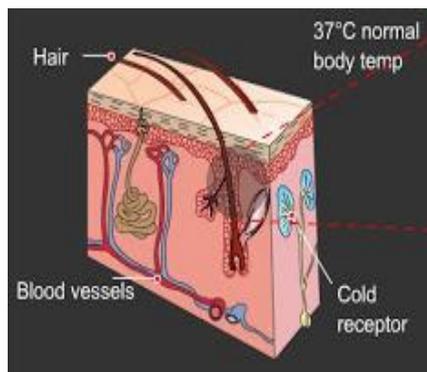
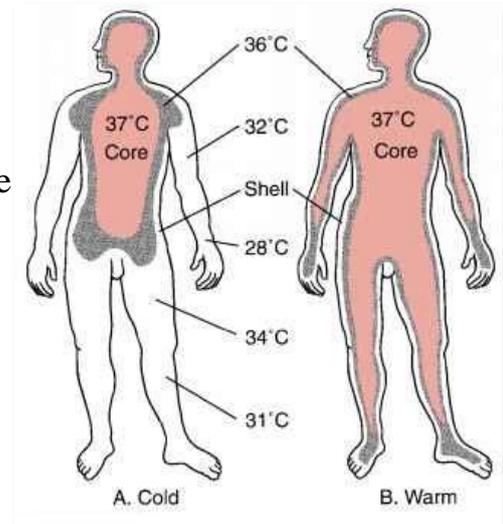
## The importance of temperature:

- To maintain the ideal homeostasis;
- The rate of chemical reactions in body is regulated by the temperature;
- If the temperature is too high or too low, the body's fluid balance is also affected.

## Types of Temperature:

**1. The Core Temperature** is the temperature of the deep tissues of the body.

- ▶ It remains relatively constant unless exposed to severe extremes in environmental temperature.
- ▶ It is assessed by using a thermometer.



**2. The Surface Temperature** is the temperature of the skin.

- It may vary a lot in response to the environment temperature.
- It is assessed by touching the skin.

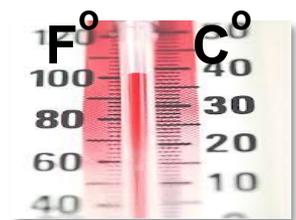
## Measuring the temperature:

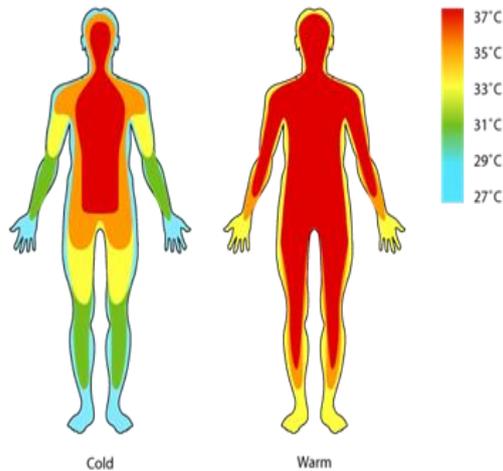
The temperature is measured using a thermometer on Fahrenheit or Celsius scale.

**The factors that may affect the temperature are:**

Eating, drinking hot or cold liquids and/or smoking can affect oral temperature.

The doctor should make sure that the patient has had nothing to eat, drink or smoke for at least 15 minutes prior to taking temperature.





### Normal variation in body temperature:

- ▶ The temperature is usually lower in the morning after the body has rested.
- ▶ The temperature is higher in the evening after muscular activity and food intake.
- ▶ The parts of the body where the temperature is measured can also lead to variations.

## Types of thermometers

### 1. Glass thermometers

- Consist of a slender glass tube containing mercury, which expands when exposed to heat.
- They are not commonly used because of risk of mercury poisoning and trauma if the glass breaks.



### 2. Heat-sensitive patches

- ▶ The patch is placed on the skin.

The colour changes on the patch and indicates the temperature readings

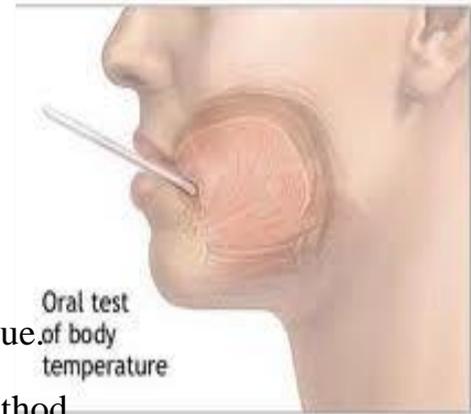
### 3. Electronic thermometers

- ⊙ They register the temperature on a display in a few seconds.
- ⊙ They are used to take oral, rectal and axillary temperature.
- ⊙ The disposable cover is placed over the thermometer prior to using to prevent cross-contamination from patient to patient.



#### **4. Tympanic thermometer**

- ▶ It is a special form of electronic thermometer; it is inserted into auditory canal.
- ▶ The disposable cover is placed over probe prior to using to prevent cross-contamination from patient to patient.



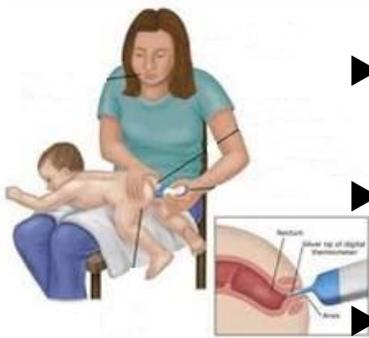
#### **Rules of temperature measurement**

##### **1. Oral temperature measurement:**

- ▶ The thermometer is placed in the mouth under the tongue.
- ▶ It is the most common, convenient and comfortable method.
- ▶ The clinical thermometer is left in place for 3 to 5 minutes.
- ▶ The normal ranges are from 36.6-37.2<sup>0</sup> C.

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##### **2. Rectal temperature measurement**



- ▶ It is the most accurate method because it is an internal measurement.
- ▶ The clinical thermometer is left in place for 3 to 5 minutes.
- ▶ The normal ranges are from 36.8-37.6<sup>0</sup> C.

##### **3. Axillary measurement**

- ▶ The axillary measurement is taken in armpit while the upper arm is held close to the body and the thermometer is inserted between two folds of skin.
- ▶ It is less accurate because it is the external body temperature.
- ▶ The clinical thermometer is left in place for 10 minutes.



- ▶ The normal ranges are from 36.2-36.9<sup>0</sup> C.

#### 4. Aural temperature measurement

- ▶ It is taken with a special thermometer that is placed in the ear or auditory canal.
- ▶ The thermometer detects and measures the thermal, infrared energy radiating from blood vessels in the tympanic membrane.
- ▶ Since this provides a measurement of body core temperature, there is no normal range for aural temperature.



#### **The causes of high Body Temperature may be the following:**

- ▶ Illness and infection;
- ▶ Exercise and/or excitement;
- ▶ High temperatures in the environment.

#### **The causes of low Body Temperature may be the following:**

- ▶ Starvation or fasting;
- ▶ Sleep;
- ▶ Decrease in muscular activity;
- ▶ Mouth breathing;
- ▶ Cold temperatures in the environment.

#### **Interpretation:**

##### 1. Normal temperature of the body:

Route	Normal Range °F / °C	Sites
Oral	98.6 °F / 37.0 °C	Mouth
Tympanic	99.6 °F / 37.6 °C	Ear
Rectal	99.6 °F / 37.6 °C	Rectum
Axillary	97.6 °F / 36.6 °C	Axilla (armpit)

2. **Fever (Hyperthermia):** the temperature is above the normal range.
3. **Hypothermia:** the core body temperature is lower than 35°C (below 95° F).
4. **Hyperpyrexia:** the body temperature exceeds 40-41°C (104-106°F) rectally.

### Taking axillary temperature by using a glass thermometer

#### *Purpose:*

- ▶ *To determine the body temperature;*
- ▶ *To assist in diagnosis;*
- ▶ *To evaluate the patient's recovery from illness;*
- ▶ *To determine if immediate measures should be taken to reduce dangerously elevated body temperature or converse body heat when body temperature is dangerously low.*

#### **Procedure**

- Wash your hands - Handwashing prevents spreading of infection.
- Prepare all the necessary equipment – the glass thermometer, gloves (if necessary), cotton pads.
- Explain the purpose of the procedure to the patient, ask about his or her consent:



*Now, I would like to take your temperature. The temperature is an important vital sign; depending on it, I will prescribe you investigations and treatment, do you agree?*

After that, you should explain what you want to do:



▶ *Please, relax, don't worry, this procedure is safe and not complicated. I will put the glass thermometer in the axillary region, don't speak and try to be still during the procedure, it will take about 10 minutes. Please, open your axillary region.*

- ▶ Take the thermometer and wipe it with a cotton spirit pad from the bulb towards the tube.
- ▶ If the thermometer was disposed in disinfectant solution, wash and dry it.
- ▶ Shake the thermometer with strong wrist movements until the mercury line falls to at least 35 °C.
- ▶ Make sure the patient's axilla is dry. If it is moist, dry gently before placing the thermometer.



- Place the bulb of the thermometer in the hollow of axilla at anterior inferior with 45 degree or horizontally.
- Keep the arm flexed across the chest, close to the body.
- Hold the thermometer for 10 minutes.

- Remove the thermometer and read the level of mercury at eye level.
- Shake the mercury down carefully and wipe the thermometer from the stem to bulb with a cotton spirit pad.
- Explain the result to the patient.
- Dispose of the equipment properly. Wash your hands.

### **Questions to control your knowledge**

1. What is the importance of body temperature:
  - Maintains ideal homeostasis;

- The rate of chemical reactions in the body is regulated by body temperature;
  - If the body temperature is too high or too low the fluid balance in the body is also affected.
2. List the types of body temperature:
    - Internal temperature is the temperature of the deep tissues of the body. It remains relatively constant if not exposed to extreme temperatures of the environment.  
It can be evaluated with a thermometer.
    - Surface temperature is the skin temperature, it is specific that:  
It can vary in response to the environment.  
It can be assessed by physical contact with the skin.
  3. The general rules for measuring body temperature are:
    - The temperature can be measured using the thermometer in Fahrenheit or Celsius.
    - Factors that can alter the temperature are: food, hot drinks or cold liquids; smoking can alter the temperature of the oral cavity.
    - The doctor must make sure that the patient has not eaten or drunk anything or even smoked for at least 15 minutes before measuring the temperature.
  4. Normal variations in body temperature can be considered:
    - Body temperature is usually lower in the morning when the body is rested.
    - Body temperature is higher in the evening after muscle activity and food intake.
    - The temperature variation, however, depends on the parts of the body in which it can be measured.
  5. What Types of Thermometers Are There?
    - Glass thermometers

It is composed of thin glass tube containing mercury that expands at high temperatures.

Usually this type of thermometers are not used because of the risk of mercury poisoning and trauma if the glass breaks. Mercury was replaced with alcohol to maintain this thermometer model.

- Heat sensitive plates

The plate is placed on the skin.

The color of the plate changes and indicates temperature

- Electronic thermometer

It records the temperature on the display in a few seconds.

It is used to record oral, rectal and axillary temperature.

It has elements available that are changed or disinfected before use to prevent contamination of one patient by another.

- The tympanic thermometer

It is a special form of electronic thermometer; it is placed in the external auditory canal.

It has elements available that are used before use to prevent the contamination of one patient from changing or disinfecting another.

6. What are the regions for measuring body temperature?

- Oral temperature measurement

a) The thermometer is placed in the mouth cavity under the tongue.

b) This is the most convenient and common method.

c) This thermometer is placed on 3 to 5 minutes.

d) The normal figures are 36.6-37.20 C.

- Rectal temperature measurement

a) This is the most accurate method of measuring the internal temperature.

b) This thermometer is put on for 3-5 minutes.

c) Normal figures are 36.8-37.60 C.

- Measurement of axillary temperature

a) The axillary measurement was performed in the axillary fossa while the arm is held close to the body and the thermometer is placed in the axillary fossa.

b) This method is less accurate because it measures the external temperature.

c) The thermometer is set for 10 minutes.

d) Normal figures are 36.2-36.90 C.

- Measurement of auricular temperature

a) It is performed with a special thermometer that is placed in the ear or in the external auditory canal.

b) The thermometer detects and measures the thermal and infrared energy radiated from blood vessels in the tympanic membrane.

c) Even though this method allows the measurement of the internal temperature, the auricular temperature does not show the normal figures.

7. What are the causes of hyperthermia?

- Diseases and infections;
  - Exercises or excitations;
  - High ambient temperatures.
8. What are the causes of Hypothermia?
- Hunger or fasting;
  - sleep;
  - Decreased muscle activity;
  - Mouth breathing;
  - Low ambient temperatures.
9. Name the method, normal body temperature and path of determination.

Oral-37.0-mouth

Tympanic-37.6- the external auditory canal

Rectal-37.6-anus

Axillary-36.6- armpit

10. What is Fever (Hyperthermia):

the temperature is higher than normal.

11. What is Hypothermia:

the internal temperature is less than 35C (95 ° F).

12. What is Hyperpyrexia:

body temperature is higher than 40-41C(104-106 ° F) rectal.

13. Why is the axillary temperature measured using the glass thermometer?

- To determine body temperature;
- To assist in establishing the diagnosis;
- To evaluate the patient's recovery time;
- To determine whether immediate measures should be implemented to reduce dangerously high or extremely low body temperature.

14. What are the main steps for measuring the axillary temperature with the glass thermometer?

- Wash your hands - this can prevent the spread of infection.
  - Prepare everything necessary equipment - glass thermometer, gloves (if necessary), gauze pads.
- Explain to the patient the purpose of the procedure, ask his consent:

Now I will measure your body temperature. Temperature is an important parameter of health, depending on the temperature level I will prescribe the necessary investigations and treatment. Do you agree?

➤ Then explain what you want to do:

Please do not relive, relax, the given procedure is harmless, I will place your thermometer in the region of the axillary fossa, do not move and do not speak during the procedure. The duration is 10 minutes. Please release the axillary region.

- Take the thermometer and wipe with alcohol swab from the bulb to the top.
- If the thermometer was kept in disinfectant solution, wash it and dry it.
- Shake the thermometer with strong movements until the mercury line drops to at least 35 °C.
- Make sure the patient's axillary fossa is dry. If it is wet, dry it before putting on the thermometer.
- Place the thermometer bulb in the lower anterior axillary fossa 45 horizontally.
- Keep your hand flexed over your chest, close to the side of your body.
- Hold the thermometer for 10 minutes.
- Take out the speedometer and read the mercury level on the eye level.
- Shake the mercury carefully and wipe the thermometer with an alcohol swab.
- Explain the patient's result.
- Dispose of the equipment properly. Wash your hands.

### **Test**

1. What is the importance of body temperature:
  - a. \* Maintains ideal homeostasis.
  - b. \* The rate of chemical reactions in the body is regulated by body temperature.
  - c. \* If the body temperature is too high or too low the fluid balance in the body is also affected.
  - d. Adjusts the rate of filtration in the twisted renal tubules.
  - e. Maintains the optimal level of hormones in the body.

2. Name the types of body temperature:

- a. \* Internal temperature
- b. \* Surface Temperature
- c. Approximate temperature
- d. Higher temperature
- e. Peak temperature

3. The general rules for measuring body temperature are:

- a. \* The temperature can be measured using a thermometer in Fahrenheit or Celsius.
- b. \* The factors that can alter the temperature are: food, hot drinks or cold liquids; smoking can alter the temperature of the oral cavity.
- c. \* The doctor must make sure that the patient has not eaten or drunk anything or even smoked for at least 15 minutes before measuring the temperature.
- d. Body temperature cannot be influenced from the outside.
- e. The temperature can only be measured with a Celsius thermometer.

4. Normal variations in body temperature can be considered:

- a. \* Body temperature is usually lower in the morning when the body is rested.
- b. \* Body temperature is higher in the evening after muscle activity and food intake.
- c. \* The temperature variation, however, depends on the parts of the body in which it can be measured.
- d. Body temperature is usually lower in the evening when the body is at rest.
- e. The temperature variation does not depend on the parts of the body in which it can be measured.

5. Specific for glass thermometers is:

- a. \* It is composed of the thin glass tube containing mercury which extends at high temperatures.
- b. \* Usually, this type of thermometer is not used because of the risk of mercury poisoning and trauma if the glass breaks.

- c. Mercury was replaced with alcohol to keep this thermometer model.
- d. It is used to record oral, rectal and axillary temperatures.
- e. It is a special form of the electronic thermometer; it is placed in the external auditory canal.

6. Specific for thermometers with heat sensitive plates is:

- a. \* The plate is placed on the skin.
- b. \* The color of the plate changes and indicates the temperature.
- c. It is used to record oral, rectal and axillary temperatures.
- d. It is a special form of electronic thermometer; it is placed in the external auditory canal.
- e. It is composed of a thin glass tube containing mercury that expands at high temperatures.

7. Specific for the electronic thermometer is:

- a. \* It records the temperature on the display in a few seconds.
- b. \* It is used to record oral, rectal and axillary temperatures.
- c. \* It has available elements that are changed or disinfected before use in order to prevent contamination of one patient from another.
- d. It is composed of the thin glass tube containing mercury which extends at high temperatures.
- e. Usually, this type of thermometer is not used because of the risk of mercury poisoning and trauma if the glass breaks.

8. Specific for the tympanic thermometer is:

- a. \* It is a special form of the electronic thermometer; it is placed in the external auditory canal.
- b. \* It has elements available that, before use, to prevent contamination of one patient from exchange or disinfect another.
- c. It records the temperature on the dyspnea in a few minutes.
- d. It is used to record oral, rectal and axillary temperatures.

e. Usually this type of thermometer is not used because of the risk of mercury poisoning and trauma if the glass breaks.

9. What are the regions for measuring body temperature?

- a. \* Measurement of oral temperature.
- b. \* Rectal temperature measurement.
- c. \* Measurement of axillary temperature.
- d. \* Ear temperature measurement.
- e. Central temperature measurement.

10. The measurement of the oral temperature implies:

- a. \* The thermometer is placed in the oral cavity under the tongue.
- b. \* This is the most convenient and common method.
- c. \* Put this thermometer on for 3 to 5 minutes.
- d. \* Normal figures are 36.6-37.20 C.
- e. The normal figures are 36.8-37.60 C.

11. Rectal temperature measurement involves:

- a. \* This is the most accurate method for measuring the internal temperature.
- b. \* This thermometer is set for 3-5 minutes.
- c. \* Normal figures are 36.8-37.60 C.
- d. This is the most convenient and common method.
- e. The normal figures are 36.6-37.20 C.

12. Measurement of axillary temperature involves:

- a. \* Axillary measurement is performed in the axillary fossa while the arm is held close to the body and the thermometer is placed in the axillary fossa.
- b. \* This method is less accurate because the external temperature is measured.
- c. \* Set the thermometer to 10 minutes.
- d. \* Normal figures are 36.2-36.90 C.
- e. The normal figures are 36.6-37.20 C.

13. The measurement of auricular temperature implies:

- a. \* It is performed with a special thermometer that is placed in the ear or in the external auditory canal.
- b. \* The thermometer detects and measures the thermal and infrared energy radiated from blood vessels in the tympanic membrane.
- c. \* Even if this method allows the measurement of the internal temperature, the ear temperature does not show the normal figures.
- d. Set the thermometer to 10 minutes.
- e. The normal figures are 36.2-36.90 C.

14. What are the causes of hyperthermia?

- a. Diseases and infections.
- b. Exercises or excitations.
- c. High ambient temperatures.
- d. Sleep;
- e. Decreased muscle activity;

15. What are the causes of hypothermia?

- a. \* Hunger or fasting.
- b. \* Sleep.
- c. \* Decreased muscle activity.
- d. \* Mouth breathing.
- e. High ambient temperatures.

16. What is Fever (Hyperthermia):

- a. \* The temperature is higher than normal figures.
- b. the temperature is lower than the normal figures
- c. the temperature is undetectable.
- d. The temperature is higher than 42 C.
- e. no answer is correct.

17. What is Hypothermia:

- a. \* The internal temperature is less than 35C (95 ° F).
- b. the temperature is higher than the normal figures
- c. the temperature is undetectable.
- d. The temperature is higher than 42 C.
- e. no answer is correct.

18. What is Hyperpyrexia:

- a. \* The body temperature is higher than 40-41C(104-106 ° F) rectal.
- b. The temperature is lower than the normal figures
- c. the temperature is undetectable.
- d. The temperature is higher than 42 C.
- e. no answer is correct.

19. What is the measurement of the axillary temperature with the glass thermometer?

- a. \* To determine body temperature.
- b. \* To assist in establishing the diagnosis.
- c. \* To assess the patient's recovery time.
- d. \* To determine if immediate measures need to be implemented to reduce dangerously high or extremely low body temperature.
- e. To set the discharge date.

20. What are the main steps for measuring the axillary temperature with the glass thermometer?

- a. \* Wash your hands - this can prevent the spread of the infection.
- b. \* Prepare all the necessary equipment - the glass thermometer, gloves (if necessary), gauze pads.
- c. \* Explain the purpose of the procedure to the patient, ask his agreement.
- d. \* Then explain what you want to do.

e. The procedure and importance of thermometry do not have to be explained to the patient, because everything is implied.

21. What are the main steps for measuring the axillary temperature with the glass thermometer?

- a. \* Take the thermometer and wipe with an alcohol swab from the bulb to the top.
- b. \* If the thermometer was kept in disinfectant solution, wash it and dry it.
- c. \* Shake the thermometer with strong movements until the mercury line drops to at least 35 °C.
- d. \* Make sure the patient's axillary fossa is dry. If it is wet, dry it before putting on the thermometer.
- e. Thermometers of this construction must not be shaken.

22. What are the main steps for measuring the axillary temperature with the glass thermometer?

- a. \* Place the thermometer bulb in the lower anterior axillary fossa with 45 C horizontally.
- b. \* Keep your hand flexed over your chest, close to the side of your body.
- c. \* Hold the thermometer for up to 10 minutes.
- d. \* Remove the thermometer and read the mercury level on the eye level.
- e. Hold the thermometer for 2-3 minutes.

23. What are the main steps for measuring the axillary temperature with the glass thermometer?

- a. \* Shake the mercury carefully and wipe the thermometer with an alcohol swab.
- b. \* Explain patient outcome.
- c. \* Dispose of the equipment properly. Wash your hands.
- d. It is not necessary to explain the patient's result in order not to stress him.
- e. Thermometers of such construction must not be shaken