DUAL LANGUAGE PROGRAMME

SCIENCE

FORM 4

KEMENTERIAN PENDIDIKAN MALAYSIA

KSSM

Chapter

3 Techniques of Measuring the Parameters of Body Health

Keywords

- Temperature
- Thermometer
- Fever
- Pulse
- Heart
- High blood pressure
- Obesity

What is the correct technique to measure body temperature?

What is pulse rate?

What is the instrument used to measure blood pressure?

How is blood pressure measured and recorded?

What is Body Mass Index (BMI)?

Science Digest

Healthy Lifestyle Campaign

There is a saying, 'health is wealth'. If we are experiencing health problems, we cannot carry out our daily activities effectively. Many campaigns have been organised to educate the public on taking care of their health such as the 'Healthy Lifestyle Campaign' so that people can remain healthy. One of the healthy lifestyle practices is to have regular scheduled medical check-ups. People should not only see a doctor when they are sick. Therefore, we must schedule regular medical check-ups to know the condition of our health so that we can take appropriate action. We can also measure the parameters of our body health if we know the correct technique. Let us learn about the techniques of measuring the parameters of body health in this topic.

You will learn about:

- body temperature
- pulse rate
- blood pressure
- Body Mass Index (BMI)

3.1 Body Temperature

Flashback

The skin and the endocrine system are important to regulate body temperature.

Do you know what temperature is? Temperature is a measurement of the degree of hotness and coldness of a substance. Body temperature is the measurement of the degree of hotness and coldness of our body. We must ensure that our body temperature is always in the normal range. Understanding body temperature is very important because any change in our body temperature whether it is higher or lower, is a sign that our body has a health problem. Our body temperature ensures our body functions at optimal levels. How do we measure body temperature and what instrument is used to measure body temperature?

Body temperature is measured by using a thermometer. There are four types of thermometers that can be used. Let us look at Figure 3.1 below.

Types of thermometers

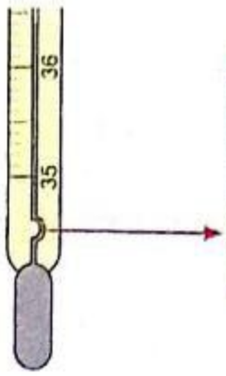
Clinical thermometer	Laboratory thermometer	Rectal thermometer	Infrared thermometer
• Measures body temperature • Measures temperature in the range of 35°C to 42°C	• Measures the temperature of liquids • Measures temperature in the range of -10°C to 110°C	• Measures body temperature through the rectum	• Measures body temperature without having any contact with the body

Figure 3.1 *Types of thermometers*

Measuring Body Temperature with the Correct Technique

Clinical Thermometer

1. Before using a thermometer, make sure its temperature is lower than 35°C. If the temperature exceeds 35°C, the thermometer should be shaken until the reading is lower than 35°C.
2. Place the thermometer under the armpit or in the mouth for about 2 to 3 minutes (or until a 'beep' sound is heard, if you are using a digital clinical thermometer).
3. Pull out the thermometer and record the reading.



The kink in the clinical thermometer is to ensure that the mercury does not go down quickly after it is removed from the mouth or the armpit. This is to give a more accurate reading. This kink is not found in the laboratory thermometer.

Figure 3.2 *Kink in the clinical thermometer*

Photograph 3.1 *Technique to measure body temperature using a clinical thermometer*

Laboratory Thermometer

1. The laboratory thermometer is not suitable to measure body temperature because the laboratory thermometer does not have a kink in the mercury tube.
2. When the thermometer is removed from the body, whether from the mouth or the armpit, the temperature reading will go down quickly. This will cause the reading to be inaccurate.
3. If the laboratory thermometer is used to measure body temperature, the reading must be taken when the thermometer is still in the mouth or under the armpit to ensure accuracy.

Flashback

The clinical thermometer can measure temperature with an accuracy of 0.1°C, whereas, the laboratory thermometer can measure temperature with an accuracy of 1°C.

Rectal Thermometer

1. The rectal thermometer is usually used for infants less than 3 months old. Make sure that the thermometer used is labelled for rectal use.
2. Clean the tip of the thermometer with alcohol.
3. Dab some petroleum jelly on the thermometer tip to make it easier for the thermometer to be inserted into the infant's rectum.
4. Raise the infant's legs as shown in Figure 3.3.
5. Insert 1.5 – 2.5 cm of the thermometer into the infant's rectum.
6. Allow the thermometer to remain there until a 'beep' sound is heard.
7. Record the temperature.

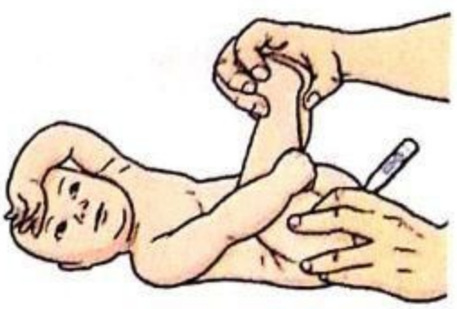


Figure 3.3 *Technique to measure body temperature using a rectal thermometer*

Infrared Thermometer

1. The infrared thermometer can be used without any contact with the individual.
2. Aim the thermometer on the forehead at a distance of about 5 cm from the individual (do not aim the thermometer directly or indirectly at the eyes).
3. Record the temperature.
4. Taking temperature with this thermometer is very quick.

Photograph 3.2 *Technique to measure body temperature using an infrared thermometer*

Flashback

Homeostasis is a mechanism that regulates body temperature so that it remains in a balanced and stable state.

Interpreting Body Temperature

A normal human body temperature is 36.9°C. The increase or decrease of this temperature shows that your body is not in a healthy condition. Do you know the factors that can cause your body temperature to be above the normal reading?

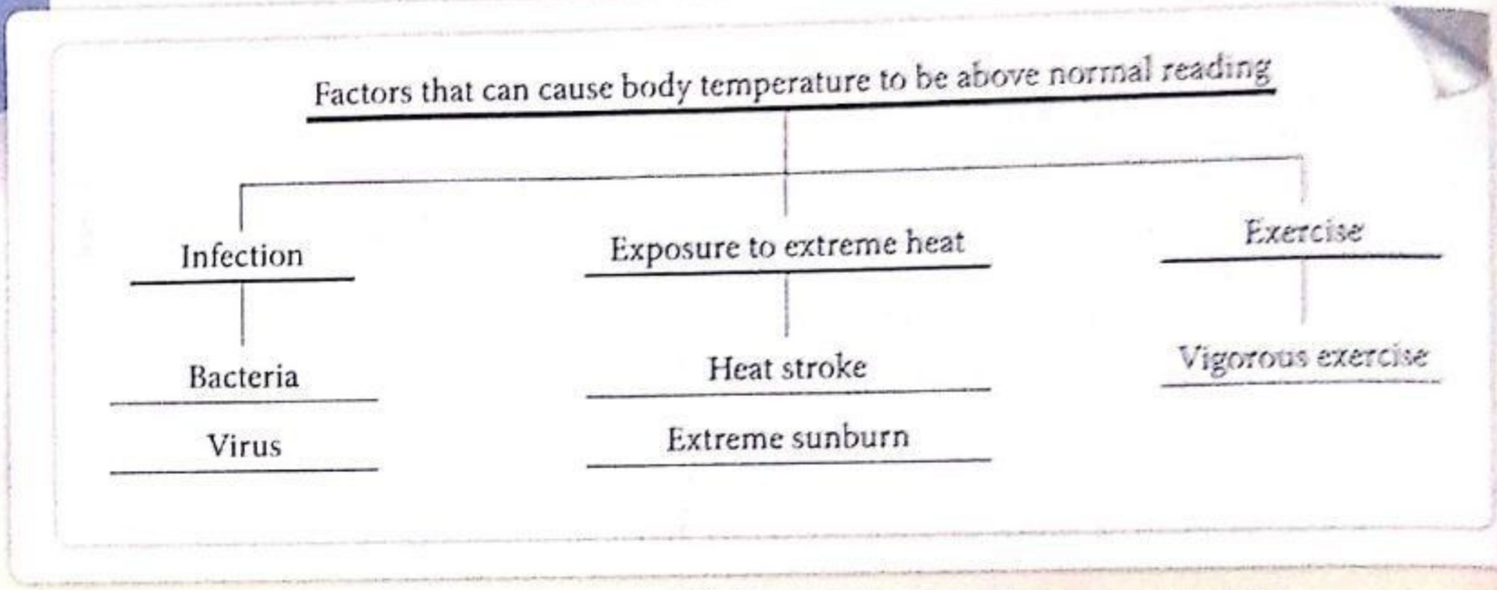


Figure 3.4 *Factors that can cause body temperature to be above normal reading*

When your body temperature is above 37°C, you may be having a fever. Body temperature also goes below the normal temperature if you are exposed to extreme cold. This condition can also lead to death.

FORMATIVE PRACTICE 3.1

1. State the differences between the clinical thermometer and the rectal thermometer.
2. State three factors that can cause body temperature to go above normal reading.
3. What do you need to do if your body temperature goes above normal reading for more than 3 days?

3.2 Pulse Rate

Pulse Points on the Body

You learned about pulse rate in Form 3. Pulse rate is the measurement of the number of heartbeats per minute (bpm). There are a few areas on the body where the pulse can be felt. These are **pulse points**. In these areas, the arteries are located very close to the surface of the skin. When the heart beats, the pulse is sent to these arteries and can be felt through the skin. Doctors usually take the pulse at the wrist because it is clear, prominent and easy. Figure 3.5 shows the pulse points on the human body.

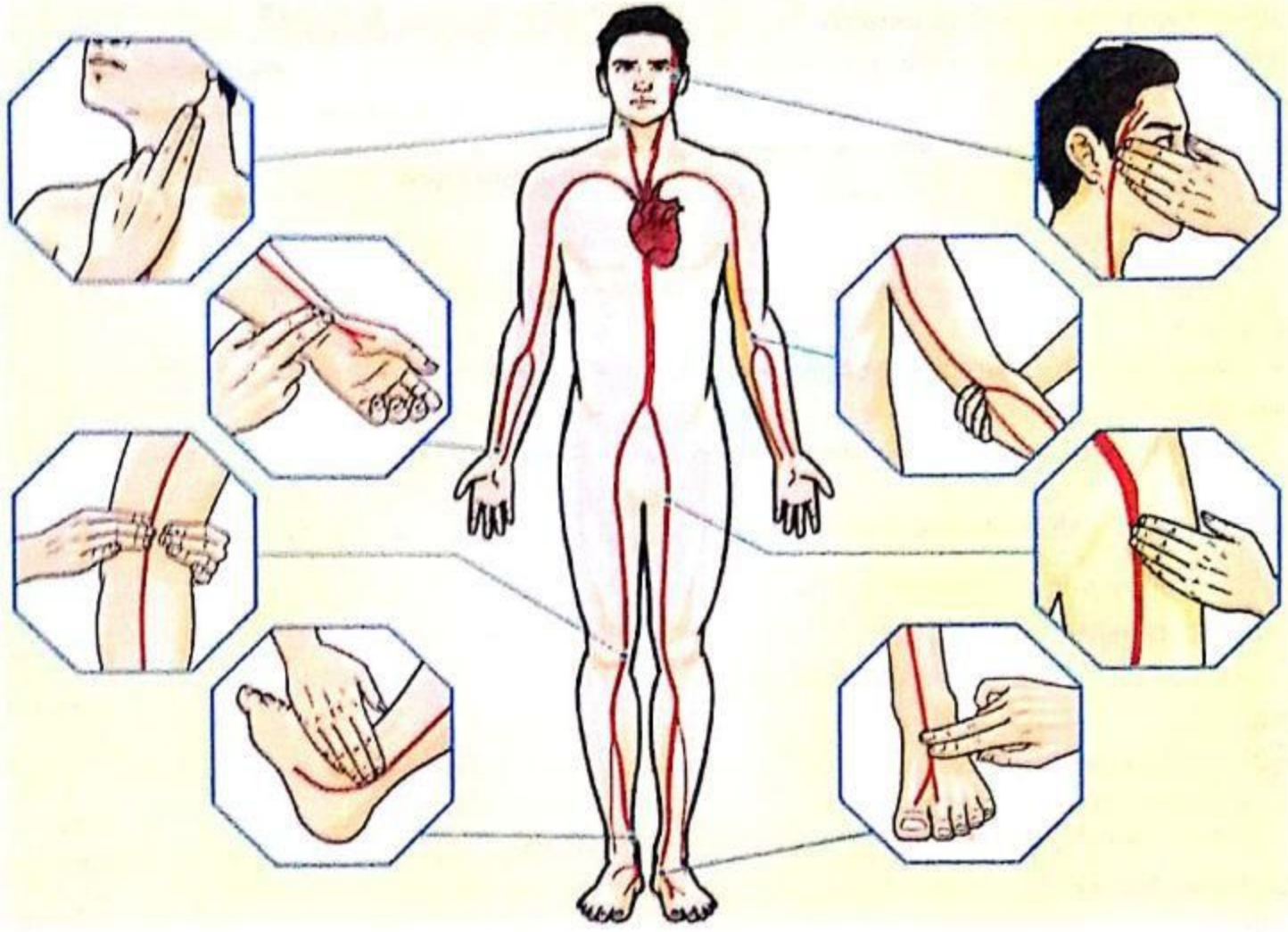


Figure 3.5 *Pulse points on the human body*

Let us carry a few experiments to determine how gender, age and physical activities affect our pulse rate.

Experiment 3.1

21st Century Skills

A Human pulse rate based on gender

Aim: To study the effect of gender on the human pulse rate.

Problem statement: Does the human pulse rate differ according to gender?

Hypothesis: Females have higher pulse rate compared to males.

Variables:

(a) manipulated: Gender
(b) responding: Pulse rate
(c) constant: Time period, age and type of physical activity

Apparatus: Stopwatch

Procedure:

1. Carry out this activity in pairs.
2. Count the pulse of male students for 1 minute as shown in Figure 3.6. The female students hold the stopwatch to keep the time. The male students take the pulse count.
3. Record the pulse count in 1 minute.
4. Repeat steps 2 and 3 for the female students.

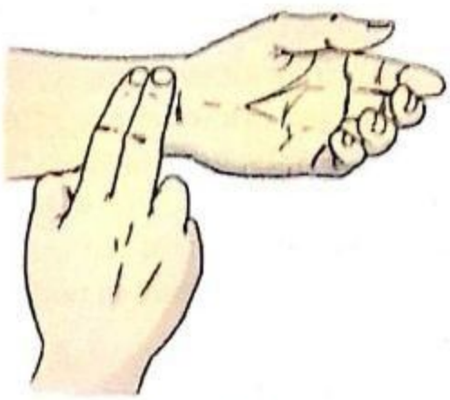


Figure 3.6

Result:

Gender	Pulse rate (bpm)
Male	
Female	

Conclusion:

Is the hypothesis of this experiment accepted? What is the conclusion of this experiment?

Question:

Is there a difference between the pulse rates of male and female students?

B Human pulse rate based on age

Aim: To study the effect of age on the human pulse rate.

Problem statement: Does the human pulse rate differ according to age?

Hypothesis: The older a person is, the lower his pulse rate.

Variables:

(a) manipulated: Age
(b) responding: Pulse rate
(c) constant: Time period, gender and type of physical activity

Apparatus: Stopwatch

Procedure:

1. Carry out this activity in groups.
2. Count the pulse of one of the students in the group as shown in Figure 3.6. Another student holds the stopwatch and keeps the time.

3. Record the pulse count in 1 minute.
4. Repeat steps 2 and 3 with your teacher and the laboratory assistant. Make sure the gender of the student taking the pulse count is the same as your teacher and the laboratory assistant.

Result:

Sample	Age	Pulse rate (bpm)
Student		
Teacher	42	70
Laboratory assistant	46	74

Conclusion:
Is the hypothesis of this experiment accepted? What is the conclusion of this experiment?

Question:
Is there a difference between the pulse rates based on the samples' age?

C Human pulse rate based on physical activity

Aim: To study the effect of physical activity on the human pulse rate.

Problem statement: Does the human pulse rate differ according to the type of physical activity?

Hypothesis: The more vigorous the physical activity, the higher the pulse rate.

Variables:
(a) manipulated: Type of physical activity
(b) responding: Pulse rate
(c) constant: Time period, age and gender

Apparatus: Stopwatch

Procedure:
1. Carry out this activity in groups.
2. Ask a student from each group to perform three activities, that is, resting, walking and running. Carry out each of the activities for two minutes.
   (**Note:** Make sure the student rests for 5 minutes before starting with the next activity.)
3. Count the pulse of the student for 1 minute after each activity and record the readings in the following table.

Result:

Type of physical activity	Pulse rate (bpm)					
	Student 1	Student 2	Student 3	Student 4	Student 5	Student 6
Resting						
Walking						
Running						

Conclusion:
Is the hypothesis of this experiment accepted? What is the conclusion of this experiment?

Questions:
1. What is the inference that can be made based on the data obtained?
2. Does every student have the same pulse rate? Explain why.

Brain Teaser

When resting, the pulse rate of an athlete is lower than the non-athletes. Why?

Activity 3.1

21st Century Skills

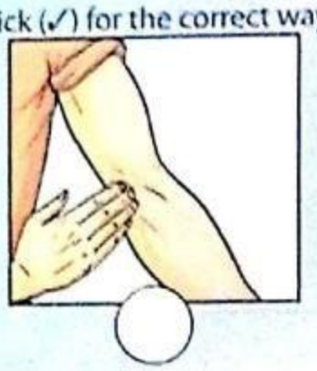
Aim: To gather the information on the human pulse rate.

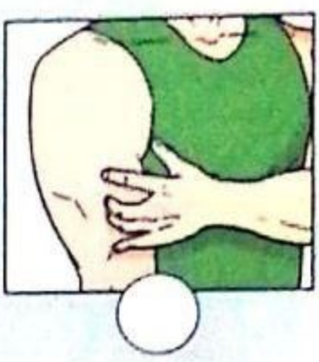
Instructions:

1. Carry out this activity in groups. Each group consists of four members.
2. Gather information about the human pulse rate in relation to:
   (a) health level
   (b) fitness level
   (c) emotions
   (d) stress
3. Obtain information from printed media, electronic media or interviews.
4. Pass your respective findings in a clockwise direction. The other members of the group must correct their friend's findings if there is any error.
5. After 30 minutes, present your findings.

FORMATIVE PRACTICE 3.2

1. What is the meaning of pulse rate?
2. Tick (✓) for the correct way of finding a pulse.





3. Ruzzana is pregnant. In your opinion, is Ruzanna's pulse rate the same as a woman who is not pregnant? Justify your answer.
4. One day, Azril took his pulse. After running in a park near his home, Azril took his pulse again. In your opinion, will the pulse readings be the same? Justify your answer.

3.3 Blood Pressure

Blood Pressure Measuring Instrument

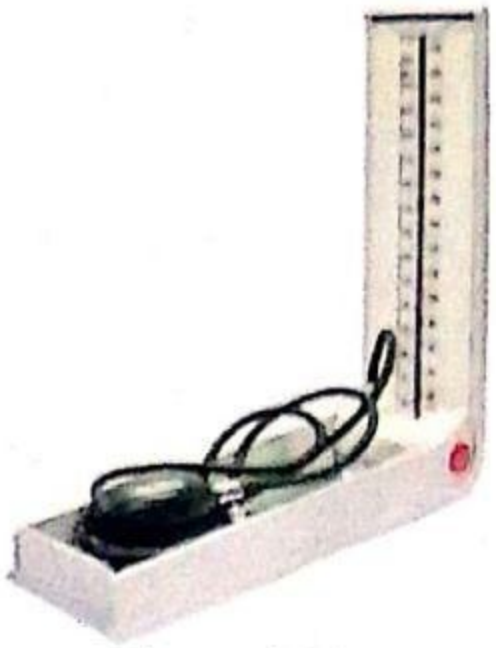
You learned about measuring blood pressure in Form 3. Blood pressure is the pressure applied by the blood on the walls of the blood vessels during blood circulation. Blood pressure is measured by using a **sphygmomanometer**. The unit for measuring blood pressure is **millimetres of mercury** and the symbol is **mmHg**.

Photograph 3.3 *Digital sphygmomanometer*

The best standard instrument to measure blood pressure is the sphygmomanometer that is used by medical practitioners in hospitals and clinics along with the stethoscope. Nevertheless, monitoring blood pressure at home can be done by using a digital sphygmomanometer.

Measuring and Recording Blood Pressure

Blood pressure is measured by taking two readings. The top number shows the pressure applied on the wall of blood vessels when the heart muscles contract. This pressure is systolic pressure. The bottom number shows the pressure applied on the wall of blood vessels when the heart muscle is resting (between heartbeats), and is called diastolic pressure. Both pressures are stated in millimetres of mercury (mmHg) because mercury was used in the first accurate pressure gauges and is still used as the standard unit of measurement for pressure in medicine. The measurement of blood pressure is recorded as systolic/diastolic (referred to as systolic per diastolic).



Photograph 3.4 *Sphygmomanometer*

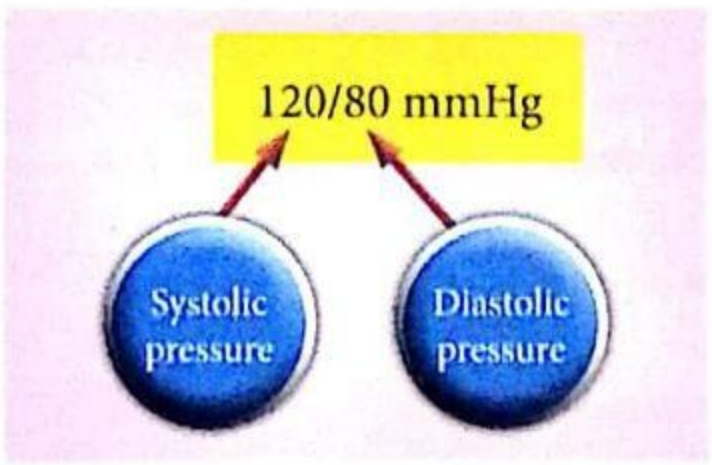
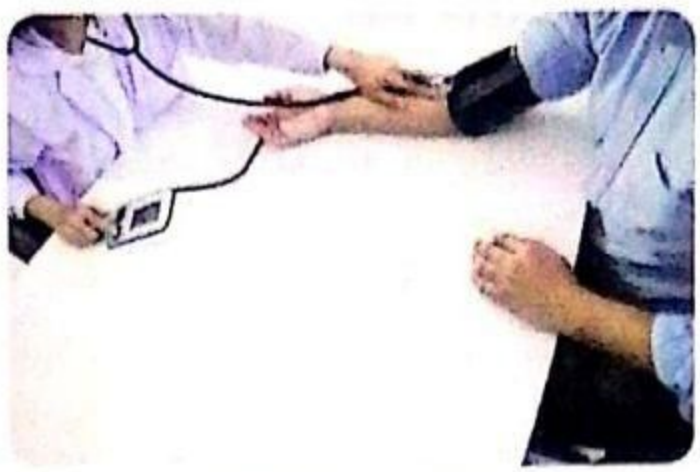


Figure 3.7 *Blood pressure reading*



Photograph 3.5 *Measuring blood pressure*

3.3.1
3.3.2

Blood Pressure Reading

Regular blood pressure readings can help you to measure your body's health levels. Blood pressure readings that are high and prolonged show that you might be experiencing high blood pressure. Blood pressure readings that are low and prolonged show that you might be experiencing low blood pressure. Table 3.1 shows blood pressure readings and their explanation.

Table 3.1 *Classification of blood pressure readings for adults*

Blood pressure category	Systolic pressure (mmHg)	Diastolic pressure (mmHg)
Optimal	Less than 120	Less than 80
Normal	120 – 129	80 – 84
At risk	130 – 139	85 – 89
High blood pressure stage 1	140 – 159	90 – 99
High blood pressure stage 2	160 – 179	100 – 109
High blood pressure stage 3	180 and above	110 and above

(*Source: Clinical Practice Guidelines on Management of Hypertension, 5th Edition, 2018*)

High blood pressure does not usually have any clear symptoms. If this problem is not well-controlled, it can lead to more serious problems such as stroke. The best way to track this problem is by having regular medical check-ups.

Activity 3.2

Role play

21st Century Skills

Aim: To demonstrate the way to take a blood pressure reading.

Instructions:

1. Carry out this activity in groups.
2. A student plays the role of a doctor while another student plays the role of a patient.
3. Prepare to play the character of a doctor taking the blood pressure reading of a patient.
4. Role play in front of the class.

FORMATIVE PRACTICE 3.3

1. What is the meaning of blood pressure?
2. What is the instrument used to measure blood pressure?
3. State the steps of measuring blood pressure.
4. What are the effects of having high blood pressure?
5. Give four early prevention steps to avoid high blood pressure.

3.4 Body Mass Index (BMI)

Calculating and Determining Body Mass Index

Body Mass Index, commonly known as BMI, is the measurement of body mass against height. BMI can be calculated using a formula.

$$\text{BMI} = \frac{\text{Body mass (kg)}}{(\text{Height})^2\ (\text{m}^2)}$$

Activity 3.3

Spin-N-Think

21st Century Skills

Aim: To calculate and determine one's BMI.

Instructions:

1. Carry out this activity in groups.
2. The teacher supplies a spinning arrow.
3. Spin the arrow to determine which student needs to measure his/her BMI.
4. The student with the arrow pointed at him/her is the one who has to take his/her mass and height measurements. Calculate the student's BMI together.
5. Repeat this activity until all the group members know their respective BMI.

What is the importance of knowing our BMI? BMI is a way to determine whether we have a body mass problem or not.

After obtaining your BMI result, the chart in Table 3.2 below can be used to determine whether you are overweight, normal or underweight.

Table 3.2 *Body Mass Index chart*

BMI (kg m^{-2})	Category:
< 18.5	Underweight
18.5 – 24.9	Desirable weight
25.0 – 29.9	Overweight
30.0 or more	Obese

Science Gallery

Studies show that the lifespan of a person with an ideal BMI, which is, between 18.5 – 24.9 kg m^{-2} is longer than a person with a lower or higher BMI.

Source: myHEALTH Portal

Brain Teaser

What are factors that can cause a person to be overweight?

3.4.1

Interpreting Body Mass Index

Studies show that being overweight can cause serious health issues. Being overweight increases the risk of suffering from serious illnesses such as heart attack, high blood pressure, stroke, diabetes mellitus and complications of joints and bones.

Being underweight can also increase the risk of acquiring health problems such as heart diseases, decrease in body's defence against diseases, fatigue, anaemia and depression. Nevertheless, achieving and maintaining an ideal body weight through a healthy diet and consistent physical activities can prevent these illnesses.

Ways to increase body mass

- Practise healthy and balanced diet based on the Malaysian food pyramid and the Malaysian Healthy Plate
- Eat at fixed times
- Consume snacks that are packed with nutrients to increase calories
- Eat more nutritious food

Figure 3.8 *Malaysian Healthy Plate*

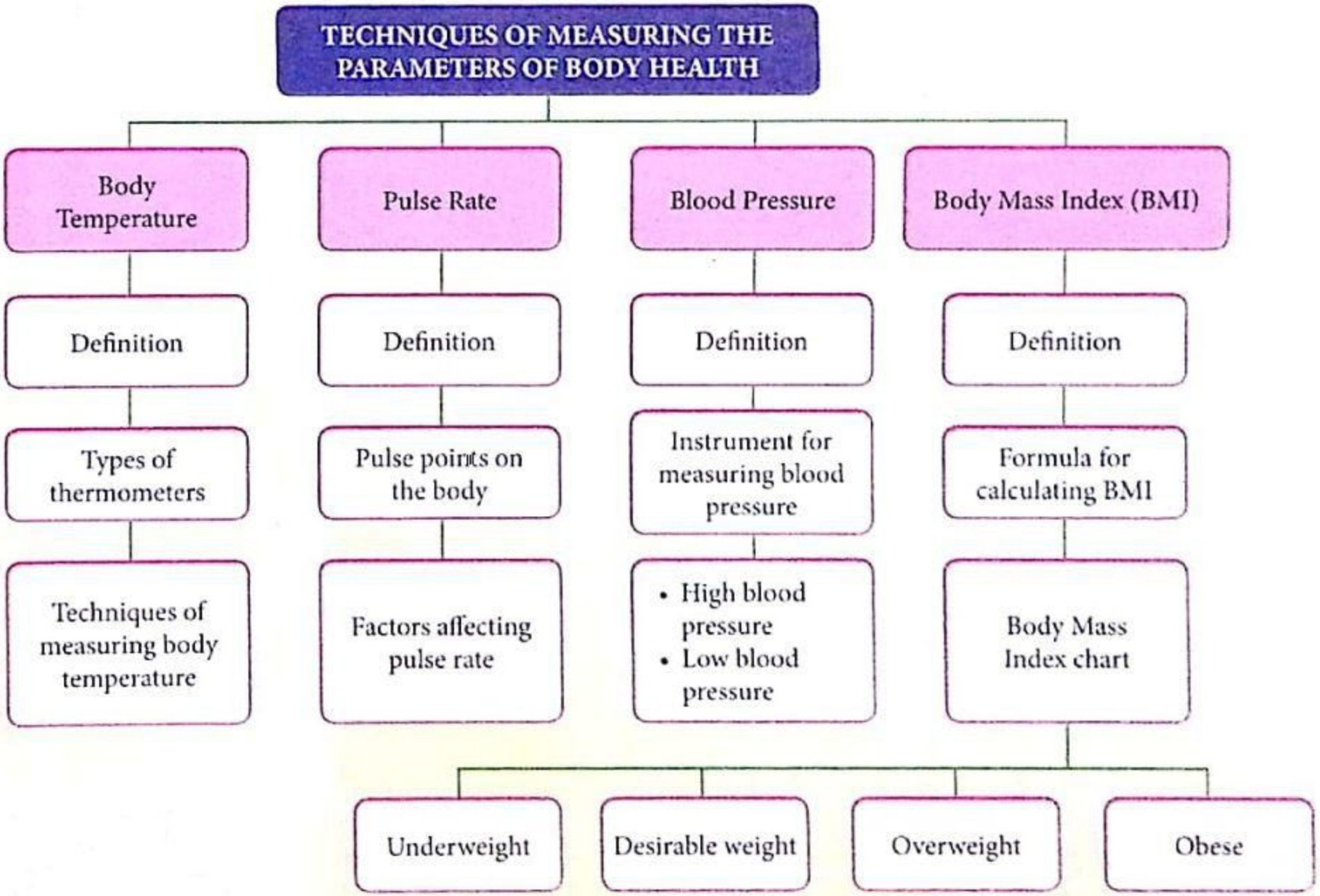
Ways to decrease body mass

- Set a realistic goal such as reducing half a kilogram of mass weekly
- Monitor and record your body mass once a week
- Eat healthy foods in moderation based on the Malaysian food pyramid and the Malaysian Healthy Plate
- Make a few changes to your eating habits such as changing your food preparation method
- Reduce or avoid food with high sugar or fat content
- Do moderate exercises such as brisk walking, cycling and swimming for at least 30 minutes, three times a week
- Gain support from those who are close to you

FORMATIVE PRACTICE 3.4

1. What is the meaning of Body Mass Index?
2. What is the importance of calculating Body Mass Index?
3. If you have a BMI of 30.0, which category are you in?
4. What are the risks of being obese?
5. If we are underweight, will we be free of health issues? Justify your answer.

Summary


TECHNIQUES OF MEASURING THE PARAMETERS OF BODY HEALTH
Body Temperature
Pulse Rate
Blood Pressure
Body Mass Index (BMI)
Definition
Definition
Definition
Definition
Types of thermometers
Pulse points on the body
Instrument for measuring blood pressure
Formula for calculating BMI
Techniques of measuring body temperature
Factors affecting pulse rate
• High blood pressure
• Low blood pressure
Body Mass Index chart
Underweight
Desirable weight
Overweight
Obese

Self-reflection

After studying this chapter, you are able to:

3.1 Body Temperature

- ☐ Measure body temperature using the correct technique.
- ☐ Interpret body temperature readings.

3.2 Pulse Rate

- ☐ Identify the pulse points on the body.
- ☐ Carry out an experiment to determine the human pulse rate.

3.3 Blood Pressure

- ☐ Identify the instrument for measuring blood pressure.
- ☐ Measure and record blood pressure.
- ☐ Interpret data from blood pressure readings.

3.4 Body Mass Index (BMI)

- ☐ Calculate and determine Body Mass Index
- ☐ Interpret the Body Mass Index and make decisions on what to do next.

Summative Practice 3

QUIZ

Objective Questions
http://bukuteksssm.my/Science/F4/Q3

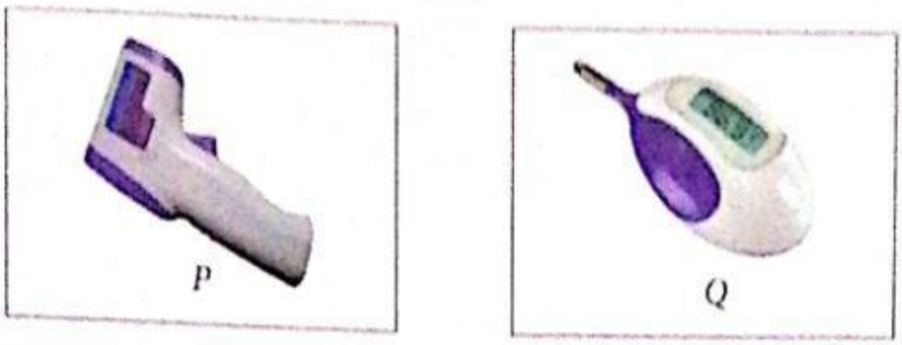
1. You have a fever if your body temperature is above 37°C. Extreme cold can also cause body temperature to be below normal.

   (a) Based on the statement above, state three factors that can cause fever.

   (b) What is the normal body temperature?

   (c) Which type of thermometer is the most suitable for an infant who is less than 4 months old?

2. Photograph 1 shows two types of thermometers.



Photograph 1

(a) State the names of thermometer *P* and *Q*.

(b) What are these thermometers for?

(c) Suraya is 21 years old. Which thermometer is more suitable to measure her body temperature?

(d) State the effects if a fever is allowed to continue without immediate treatment.

3. A student has carried out an experiment to investigate the pulse rate of four individuals of different ages. Table 1 below shows the readings that were obtained.

Table 1

Age	Pulse rate (bpm)
2 months	
6 years	100
10 years	80
20 years	70

(a) Complete the table above.

(b) State the:

(i) manipulated variable

(ii) responding variable

(c) State the hypothesis from the experiment that was carried out.

(d) What is the pulse rate of a trained athlete?

4. Fareeza attends a routine pulse check at the hospital.

(a) Which part of the body is the pulse taken from by the nurse?

(b) If Fareeza is a 22-year-old trained athlete, predict her pulse rate.

(c) In addition to pulse check, Fareeza also goes for a blood pressure check. She finds that her blood pressure is normal. Predict her blood pressure reading.

(d) How can Fareeza ensure that she is always healthy?

5. Siva checks his blood pressure for 3 continuous days. He finds that his blood pressure is approximately 150/95 mmHg each day.

(a) What is the blood pressure reading of a normal person?

(b) Based on the information above, state one inference on Siva's condition.

(c) What does Siva need to do next?

6. Generally, high blood pressure does not show any clear signs, but if it is not controlled, it will cause other health problems such as heart attack and stroke.

(a) State other health problems that might be faced by a person with high blood pressure.

(b) What instrument is used to measure blood pressure?

(c) State the difference between systolic pressure and diastolic pressure.

Mind Challenge

7. Azni is 27 years old. She finds that her body temperature is not consistent. Can Azni use a rectal thermometer to measure her body temperature?

8. Excess body mass can increase the risk of acquiring serious illnesses.

(a) State five serious illnesses that can be acquired if you have excessive body mass.

(b) Nur Antasya is overweight. If you are a dietician who is treating her, what advice would you give to her.

9. The information below shows a list of foods that are sold during breakfast at the school canteen.

Egg sandwich	Fried noodles with fried egg	Nasi lemak and spicy fried chicken

Marissa is trying to lose weight. Which of these foods is suitable to be consumed by Marissa for breakfast? Justify your answer.