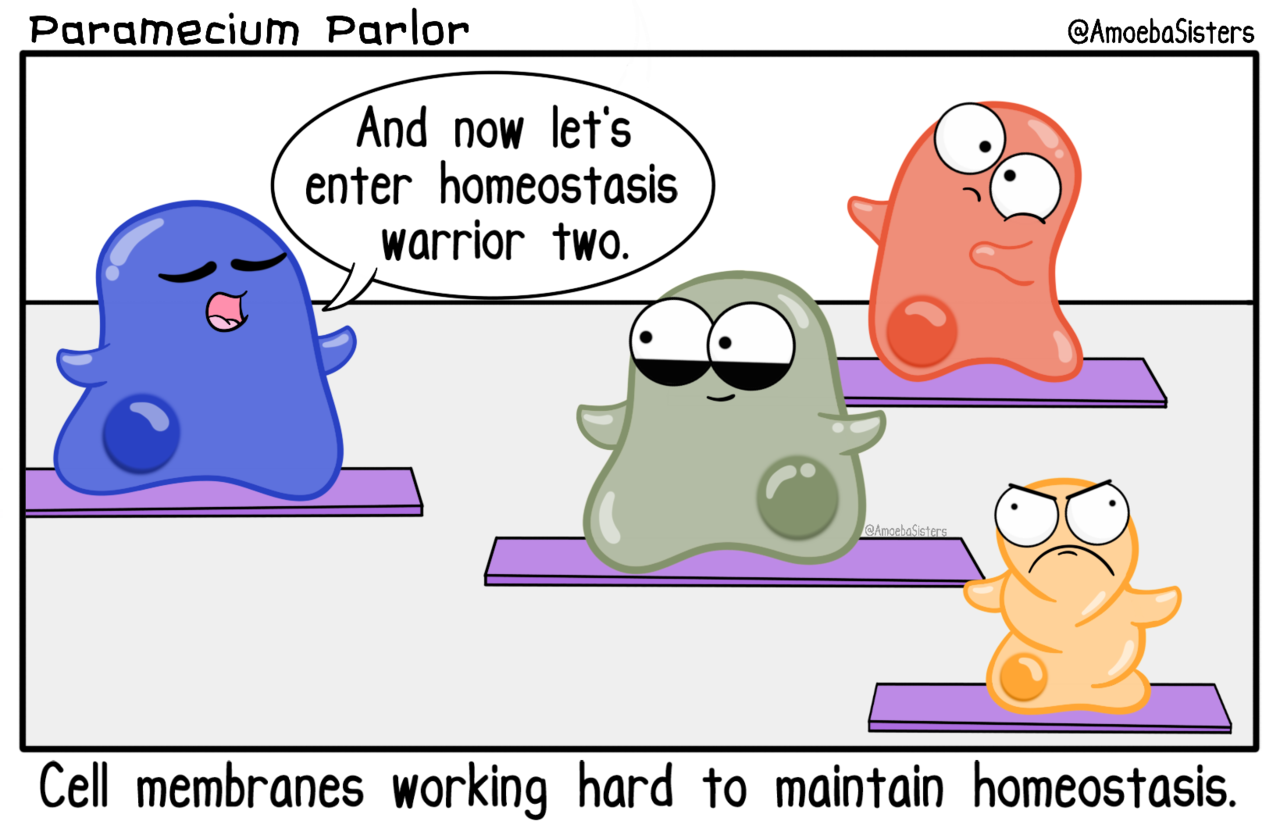
**YEAR 12 HUMAN BIOLOGY**

**ATAR UNIT 3**

**2023**

**Homeostasis**

**Chapters 5 & 6**

|  |  |  |
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| **Pages** | **Due Date** | **Initialised** |
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| **Homeostasis Test: Tuesday 9 May 2023** | | |

Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Syllabus Points**

* homeostatic processes involve nerves and hormones in maintaining the body’s internal environment within tolerance limits through the control of metabolism and physiological and behavioural activities (SU 3.11)
* thermoregulation occurs by the control of heat exchange and metabolic activity through physiological and behavioural mechanisms (SU 3.12)
* blood sugar levels are maintained by controlling of sugar uptake, its storage and release by cells and use in metabolism; these processes involve the hormones of the pancreas and adrenal glands (SU 3.13)
* body fluid concentrations are maintained by balancing water and salts via the skin, digestive system and the kidneys, which involve the actions of antidiuretic hormone and aldosterone on the nephron, and the thirst reflex (SU 3.14)
* gas concentrations are controlled by balancing the intake of oxygen and the removal of carbon dioxide via the lungs, through the actions of the medulla oblongata and the autonomic nervous system (SU 3.15)

|  |  |  |  |
| --- | --- | --- | --- |
| **Learning Objectives** | ☺ | 😐 | ☹ |
| 1. Define homeostasis |  |  |  |
| 1. Explain tolerance limits and steady state control |  |  |  |
| 1. Identify feedback loop components; stimulus, receptor, modulator, effector, response, feedback |  |  |  |
| 1. Distinguish between positive and negative feedback loops |  |  |  |
| 1. Explain the need to regulate the composition of body fluids |  |  |  |
| 1. Explain the relationship between cytoplasm, tissue fluid and plasma in terms of concentration of substances |  |  |  |
| 1. Describe the role of skin, digestive system and kidneys in osmoregulation |  |  |  |
| 1. Explain the effects of ADH and aldosterone on the activities of the nephron and construct feedback loops for both |  |  |  |
| 1. Describe the thirst reflex and construct feedback loop |  |  |  |
| 1. Distinguish between physiological and behavioural activitites / responses |  |  |  |
| 1. Define thermoregulation and explain the importance of maintaining a constant body temperature |  |  |  |
| 1. Describe the following methods of heat transfer and ways in which the body uses them to lose or gain heat - conduction, convection, radiation and evaporation |  |  |  |
| 1. Explain the following physiological mechanism of thermoregulation and construct negative feedback loops for each- TSH secretion, vasoconstriction/vasodilation, sweat production, shivering, adrenaline |  |  |  |
| 1. Explain the following behavioural mechanisms of thermoregulation and construct appropriate negative feedback loops |  |  |  |
| 1. Explain how the actions of the medulla oblongata and the ANS regulate gas exchange |  |  |  |
| 1. Describe the relationship between blood CO2, Hydrogen ions and pH |  |  |  |
| 1. Describe how CO2, Hydrogen ions and O2 concentration are involved in the regulation of breathing rate and depth |  |  |  |
| 1. State that the nervous control of breathing (rate and depth) by the respiratory muscles is by the breathing centre in medulla oblongata |  |  |  |
| 1. Construct a negative feedback look for breathing |  |  |  |
| 1. Explain why it important to have consious control over breathing |  |  |  |
| 1. Describe the risk of hyperventilation |  |  |  |
| 1. Describe the role of the liver, skeletal muscle, pancreas and adrenal glands in glucose regulation |  |  |  |
| 1. Differentiate between    * chemicals involved in blood sugar regulation (glucose, glycogen)    * the processes of regulation (glycogenolysis, glycogenesis, gluconeogenesis, lipolysis)    * the hormones controlling blood sugar levels (insulin, glucagon, cortisol, adrenaline/epinephrine)    * alpha and beta cells in the Islets of Langerhans of the pancreas |  |  |  |

Learning Objectives:

*Homeostatic processes involve nerves and hormones in maintaining the body’s internal environment within tolerance limits through the control of metabolism and physiological and behavioural activities (SU 3.11)*

* Define homeostasis
* Explain tolerance limits and steady state control
* Identify feedback loop components; stimulus, receptor, modulator, effector, response, feedback
* Distingusih between positive and negative feedback loops

**Homeostasis** (pages 105 - 108)

* + - 1. Define homeostasis and list the aspects of the internal environment that the body needs to regulate.

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* + - 1. Define the following terms

1. Feedback system

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1. Negative feedback system

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* + - 1. Diagram

         Description automatically generatedFill in the blanks below to define each component of a negative feedback system.
      2. Why is the stimulus-response-feedback mechanism referred to as a model?

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* + - 1. What is meant by the terms ‘dynamic equilibrium’, ‘set point’ and ‘tolerance limits’ and of what significance are these terms in homeostasis?

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* + - 1. Describe steady state control.

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* + - 1. Using examples, explain the difference between positive and negative feedback.

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* + - 1. Why would a positive feedback loop be unable to achieve homeostasis?

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* + - 1. Indicate whether the following are examples of positive or negative feedback.

|  |  |  |
| --- | --- | --- |
| **Example** | **Positive** | **Negative** |
| Drinking water when thirsty until your thirst is quenched |  |  |
| Calcium is released and stored in the bones according to the concentration in body fluids |  |  |
| Oxytocin is released when the baby’s head reaches the cervix at a certain force and causes the uterus to contract further, releasing additional oxytocin |  |  |
| After releasing the ovum, oestrogen is secreted to prevent any new eggs from maturing and being released |  |  |
| In lactation more milk is produces the more the baby suckles |  |  |

* + - 1. State the name and location of the receptors for each of the factors listed below.

|  |  |  |
| --- | --- | --- |
| **Factor** | **Receptor** | **Location(s)** |
| Oxygen |  |  |
| Carbon dioxide |  |  |
| Body fluid concentration |  |  |
| Glucose |  |  |
| pH |  |  |
| Temperature |  |  |

* + - 1. What are the normal operating ranges for the following in the human body?

1. Temperature \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. Glucose \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. pH \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Complete 5.2 Review question 1-6 on page 109 of your textbook.**

**Complete Chapter 5 Review Question 1, 2, 10 – 12 on page 127 of your textbook.**

Learning Objectives:

*Thermoregulation occurs by the control of heat exchange and metabolic activity through physiological and behavioural mechanisms (SU 3.12)*

* Define thermoregulation and explain the importance of maintaining a constant body temperature
* Describe the following methods of heat transfer and ways in which the body uses them to lose or gain heat - conduction, convention, radiation and evaporation
* Explain the following physiological mechanism of thermoregulation and construct negative feedback loops for each- TSH secretion, vasoconstriction/vasodilation, sweat production, shivering, adrenaline
* Explain behavioural mechanisms of thermoregulation and construct appropriate negative feedback loops

**Thermoregulation** (pages 114 - 1)

* + - 1. Define thermoregulation.

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* + - 1. State the optimum internal body temperature. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
      2. Explain why a constant body temperature is important.

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* + - 1. Describe the following four mechanisms of heat loss / gain.

|  |  |
| --- | --- |
| **Method** | **Description** |
| Conduction |  |
| Convection |  |
| Radiation |  |
| Evaporation |  |

* + - 1. Compare peripheral and central thermoreceptors.

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* + - 1. Explain the role of the hypothalamus in thermoregulation.

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* + - 1. Diagram

         Description automatically generatedList the ways the human body gains and loses heat in the diagram below.
      2. Define the following terms.

|  |  |
| --- | --- |
| **Term** | **Definition** |
| Metabolism |  |
| Basal Metabolic Rate |  |

* + - 1. Write the word equation for cellular respiration in the space below.

Preventing body temperature from falling

If the cold receptors in the skin detect a drop in environmental temperature and a message is sent to the hypothalamus, the hypothalamus sends out impulses aimed at reducing heat loss and increasing heat gain.

In the table below, describe how the following mechanisms **prevent heat loss** from the body and identify if they are either physiological or behavioral responses.

|  |  |  |
| --- | --- | --- |
| **Decrease heat loss** | | |
| **Change** | **Description** | **Physiological or Behavioural** |
| Vasoconstriction |  |  |
| Shelter |  |  |
| Clothing |  |  |
| Reduce surface area |  |  |

In the table below, describe how the following mechanisms **increase heat production** from the body and identify if they are either physiological or behavioral responses.

|  |  |  |
| --- | --- | --- |
| **Increase heat production** | | |
| **Change** | **Description** | **Physiological or Behavioural** |
| Shivering |  |  |
| Stimulation of adrenal medulla |  |  |
| Increase in voluntary activity |  |  |
| Increase thyroxine (long-term response) |  |  |

Preventing body temperature from rising

When the outside temperature is warm, or when we exercise, the heat produced by metabolism is greater than that needed to maintain a constant body. To prevent core temperature rising, excess heat needs to be lost. Most heat loss occurs through the skin with smaller amounts of heat loss through exhalation, urine and faeces.

In the table below, describe how the following mechanisms **increase heat loss** from the body and identify if they are either physiological or behavioral responses.

|  |  |  |
| --- | --- | --- |
| **Increase heat loss** | | |
| **Change** | **Description** | **Physiological or Behavioural** |
| Vasodilation |  |  |
| Seeking shade / fan |  |  |
| Clothing |  |  |
| Sweating |  |  |

In the table below, describe how the following mechanisms **prevent heat production** from the body and identify if they are either physiological or behavioral responses.

|  |  |  |
| --- | --- | --- |
| **Decrease heat production** | | |
| **Change** | **Description** | **Physiological or Behavioural** |
| Decrease physical activity |  |  |
| Decrease thyroxine (long term response) |  |  |

**Activity: Temperature Control**

**Purposes**: to measure heat loss in different solutions and to explore factors affecting heat loss

**Materials**

|  |  |  |
| --- | --- | --- |
| * + - * 4 thermometers | * + - * Timer | * + - * 2 x 600ml beakers |
| * + - * Boiling water | * + - * Cotton wool | * + - * Card for fanning |

**Procedure**

1. Diagram

   Description automatically generatedJoin a team of 4 students. Make one member of the team responsible for each condition and if a fifth member is available, they will be the timekeeper.
2. Fill one beaker with hot water at about 50oC
3. Put the four thermometers into the hot water until their temperature’s readings become steady (they may not all read the same temp)
4. When the timekeeper says “Go”

**Experimenter A**: transfer the thermometer quickly to the beaker of water at room temperature

**Experimenter B**: take the thermometer out and quickly wipe the bulb dry with cotton wool. Hold the thermometer by the end opposite the bulb in air without moving it

**Experimenter C**: take the thermometer out and quickly wipe the bulb dry with a piece of cotton wool. Hold the thermometer and fan it in the air with the piece of card

**Experimenter D**: take the thermometer out. Do not dry the bulb. Hold the thermometer by the end opposite the bulb in the air without moving it.

1. When the timekeeper says “time” at exactly one minute, read and record the temperature for each.

|  |  |  |  |
| --- | --- | --- | --- |
| Treatment | Initial Temperature (°C) | Final temperature (°C) | Change in temp (°C) |
| Experiment A  (room temp water) |  |  |  |
| Experiment B  (dry in still air) |  |  |  |
| Experiment C  (dry in moving air) |  |  |  |
| Experiment D  (wet in still air) |  |  |  |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Treatment | Change in temperature (°C) | | | | | |
| Group 1 | Group 2 | Group 3 | Group 4 | Group 5 | Average |
| Experiment A  (room temp water) |  |  |  |  |  |  |
| Experiment B  (dry in still air) |  |  |  |  |  |  |
| Experiment C  (dry in moving air) |  |  |  |  |  |  |
| Experiment D  (wet in still air) |  |  |  |  |  |  |

Discussion

1. Did all the thermometers produce the same temperature reading when placed in the hot water? Explain your answer. Will this affect the outcome of the investigation?

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1. Was the temperature of the hot water the same for each trial? Will this affect the investigation?

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1. Which thermometer (A, B, C or D) showed the greatest temperature drop after one minute? What heat loss process was responsible for this change?

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1. Compare the wet and dry bulbs in still air. Outline the causes of any difference.

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1. What heat loss process would be affected if the wet bulb was placed in moving air? What effect would it have on the magnitude of the heat loss?

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1. Explain at the molecular level:
   1. how evaporation removes heat from a surface.

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* 1. how heat is transferred between skin and a solid surface

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* 1. how heat is gained by radiation

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1. On a hot day student come into the science lab and turn the ceiling fans on high.
   1. Explain why this makes students feel cool.

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* 1. After a few minutes the students are not getting the same cooling effect from the fan. Why is this?

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* 1. When the fan is on a lower setting, students feel the cooling effect of the fan for a longer period of time. Why is this?

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1. On hot days, people with loose, long hair complain of being hotter than those with short hair or long hair tied up. Explain why this happens.

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1. When people are cold, they tend to sit with their arms close by their sides and legs close together. How would this affect heat loss from the body?

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1. When a person has a blood nose, ice packs are often placed on the forehead and the back of the neck. The result is that blood flow is reduced quickly, allowing clotting to occur. How does applying ice packs to the forehead and back of the neck change the blood flow to the nose.

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Draw a stimulus-response model for an **increase** in temperature

Diagram

Description automatically generated

Draw a stimulus-response model for a **decrease** in temperature

Diagram

Description automatically generated

Practice Questions

1. The fundamental function of thyroxine is to maintain body temperature at 37°C to provide for essential body processes. The basal metabolic rate (BMR) is the amount of energy expended when a person is in a steady state of rest. It represents the energy needed to maintain a constant body temperature. The following graph shows the BMR of an adult whose thyroid gland in not working.

Chart, line chart

Description automatically generated

1. How much less than normal is this persons BMR?

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1. What symptoms would you expect the patient to display?

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1. What was the effect on BRM of the injection of thyroxine at the beginning of period B?

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1. What was the effect on BMR of the injection of tri-ido-thyroxine at the beginning of period C?

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1. What symptoms would a person with hyperthyroidism display?

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1. Discuss how thyroid gland secretions are controlled.

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1. Summaries how the body can conserve and increase heat production when body temperature is falling and rising by completing the tables blow.

|  |  |  |  |
| --- | --- | --- | --- |
| Core  Temp.  <37oC | Heat  Conservation | Behavioural |  |
| Physiological |  |
| Increased heat  Production | Behavioural |  |
| Physiological |  |

|  |  |  |  |
| --- | --- | --- | --- |
| Core  Temp.  >37oC | Heat  Conservation | Behavioural |  |
| Physiological |  |
| Increased heat  Production | Behavioural |  |
| Physiological |  |

1. How will change in temperature affect the rates of reactions in cells?

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1. There have been several cases of people surviving for long periods of time submerged in cold water. Early 2009 in England (during winter), a two year old girl made a complete recovery after spending 20 minutes at the bottom of a pool. In 2008, a 35 year old man was found floating in the cold water off Cape Town. It was thought he had been without a pulse for about an hour. Explain how low body temperature could allow these people to survive, when at normal body temperature they would die.

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1. In the USA, on average 38 people, mainly infants, have died each year over the last 8 years from being left in a hot vehicle. Children thermoregulatory systems are not as efficient as adults and their body temperatures warm 3-5 times faster than adults. Use this information to describe why it is dangerous to leave young children in a vehicle on a mild day, especially a dark coloured car.

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**Complete 5.3 Review Questions 1-13 on page 122 of your textbook.**

**Complete Chapter 5 Review Questions 7-9, 15, 16, 19 – 21 and 23 on page 127 of your textbook.**

Learning Objectives:

*Homeostatic processes involve nerves and hormones in maintaining the body’s internal environment within tolerance limits through the control of metabolism and physiological and behavioural activities (SU 3.11)*

* Explain the need to regulate the composition of body fluids
* Explain the relationship between cytoplasm, tissue fluid and plasma in terms of concentration of substances
* Describe the role of skin, digestive system and kidneys in osmoregulation
* Explain the effects of ADH and aldosterone on the activities of the nephron and construct feedback loops
* Describe the thirst reflex and construct feedback loop

A picture containing text

Description automatically generated**Osmoregulation** (pages 130 – 137)

1. Label the diagram below.
2. Distinguish between intercellular and extracellular fluid and explain the relationship between cytosol, tissue fluid and plasma in terms of concentration of substances.

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1. Define metabolic water.

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1. Explain the need to regulate the composition of body fluids.

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1. Define the term osmolarity.

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1. Explain why the kidneys is the only organ in which water loss can be regulated.

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1. Diagram

   Description automatically generatedIn the image below, identify each structure and describe it structure / function.
2. Describe the function of the nephron.

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1. Label the following structures on the diagram below:

*afferent arteriole glomerular capsule proximal convoluted tubules distal convoluted tubules efferent arterioles loop of Henle glomerulus collecting duct peritubular capillaries*

Diagram

Description automatically generated

1. Recall the three processes of urine formation; filtration, reabsorption and secretion.

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ADH

1. Discuss in detail the effect of ADH on fluid balance.

Diagram

Description automatically generated\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Fill in the boxes in the diagram above to illustrate the release of ADH.
2. Describe how the posterior pituitary is influenced by the hypothalamus to release ADH.

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1. Diagram

   Description automatically generatedDraw a stimulus-response model for the regulation of water by ADH.

Aldosterone

* + - 1. Discuss the part played by aldosterone in the regulation of water output.

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* + - 1. Aldosterone regulates the amount of sodium in the blood. Explain why:

1. aldosterone influences the amount of water excreted from the body.

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1. aldosterone affects blood pressure.

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Thirst

1. Describe the events that bring about the intake of water (thirst reflex).

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1. Diagram

   Description automatically generatedDraw a stimulus-response model for the regulation of water intake by the thirst mechanism.

Practice Questions

Explain why excretion is closely related to maintaining fluid balance.

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**Table

Description automatically generated**The table below shows the water loss from a person’s skin and kidneys under different conditions. Use the data in the table to explain the relationship between the regulation of body temperature and regulation of fluid content of the body.

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Diagram

Description automatically generated

1. On the diagram above, indicate the parts of the nephron that are influence by ADH and aldosterone.
2. Why does the kidney receive blood at a higher pressure than other organs?

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1. Describe the difference between water reabsorption in the loops of Henle and the distal convoluted tubules.

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1. A person lost in the desert would suffer extreme dehydration. Although the thirst receptors would try to initiate drinking behaviour, the lack of available water would not allow this to be met. Describe the mechanisms the body would employ to conserve water while getting rid of metabolic wastes.

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1. Explain the following observations made by a student. On a very hot day, little urine was produced and it was dark in colour. On a cold day, urination occurred more frequently and the urine was pale in colour.

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1. An athlete had blood samples taken before and after a vigorous training session on a hot, dry day. The sample taken after training had a much higher concentration of ADH than the sample taken before training. Explain why there would be a difference in concentrations.

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1. People suffering from heat exhaustion or a hangover share a symptom; a headache. Alcohol inhibits the production of ADH. Heat exhaustion is caused when the body loses fluid due to heat. The headache is caused by the effect of very concentrated blood on the brain cells.
2. Explain how low ADH can cause dehydration.

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1. How could you avoid a hangover after drinking alcohol?

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1. Explain why dehydration is common in hot environments.

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1. In industries located in hot dry climates eg Pilbara area, there is usually a urine colour chart at the back of the door of the toilet. Why is it important to know if you are dehydrated?

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1. Table

   Description automatically generatedThe volume of urine production by Student A was measured every half hour for several hours. Student A drank a litre of tap water 1 hour after the measurements started and then stayed quiet watching movies during the time the data was collected. The results are shown below.
   * 1. Why were urine volumes collected before the person drank water?

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* + 1. Graph the data on the grid below.

A picture containing shoji, tiled

Description automatically generated

1. How long did it take for the water to affect urine volume? Explain why.

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1. Indicate on the graph expected times of increased levels of ADH and aldosterone.

**Complete 6.1 Review Questions on page 138 of your textbook.**

**Complete Chapter 6 Review Question 1a, 2, 3, 6, 7, 10, 12-16 on page 152 of your textbook.**

Learning Objectives:

*Gas concentrations are controlled by balancing the intake of oxygen and the removal of carbon dioxide via the lungs, through the actions of the medulla oblongata and the autonomic nervous system (SU 3.15)*

* Explain how the actions of the medulla oblongata and the ANS regulate gas exchange
* Describe the relationship between blood CO2, Hydrogen ions and pH
* CO2, hydrogen ions and O2 concentration are involved in the regulation of breathing rate and depth
* State that the nervous control of breathing (rate and depth) by the respiratory muscles is by the breathing centre in medulla oblongata
* Construct a negative feedback look for breathing
* Explain why it important to have consious control over breathing
* Describe the risk of hyperventilation

**Regulation of gas concentration** (pages 139 – 142)

1. Explain how both the respiratory system and the circulatory system are involved in the regulation of gas concentrations.

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1. Identify the muscle involved in breathing and state the nerve the innervates them.

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1. Briefly explain the mechanisms involved in inspiration and expiration. This is a review of Year 11 work and will help your understanding.

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1. Explain how the concentration of carbon dioxide in the blood plasma affects the concentration of hydrogen ions. Write a word and formula equation in the space below.

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1. Name and describe the function of the two regions within the respiratory centre.

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1. List the three chemicals that are carried in the blood that affect breathing rate.

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1. Describe the effect of a low pH on the rate and depth of breathing.

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1. Construct a stimulus-response negative feedback model for Question 7.

Diagram

Description automatically generated

1. Discuss the role of oxygen concentration on breathing rate.

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1. Suggest why blood pH is a good mechanism by which to regulate breathing rate.

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1. Identify other receptors that can influence breathing rate.

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1. Discuss the importance of voluntary breathing.

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1. Explain how a person can breathe voluntarily.

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1. Define hyperventilation.

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1. When hyperventilation occurs, a person breathes faster and more deeply the normal.
2. What effect would this have on the level of oxygen in the blood? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

ii) What effect would this have on the level of carbon dioxide in the blood? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

iii) Where in the brain would this change in carbon dioxide level be detected? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Some divers will hyperventilate before diving in order to hold their breath for a longer period of tie. Explain why hyperventilation before diving can be extremely dangerous.

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1. A girl had the pH levels in her blood taken immediately before and after swimming 500 meters in a pool. The results showed a drop in pH from 7.4 to 7.3 What caused this drop in to occur?

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1. Why is plasma concentration of carbon dioxide a useful indicator of the body’s energy requirement?

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1. Summarise the three stimuli for breathing.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Oxygen** | **Carbon dioxide** | **pH (H+)** |
| Stimulus |  |  |  |
| Strength of stimuli |  |  |  |
| Rector system |  |  |  |
| Receptor location |  |  |  |
| Modulator |  |  |  |
| Effector |  |  |  |
| Response |  |  |  |
| Negative Feedback |  |  |  |

Chart, line chart

Description automatically generated

1. Use the graph below to answer the following questions.

a)From the graph above – how much more air is taken in at 7 minutes compared to 1 min? ( Show all your working)

b) Explain why more air is taken in at 7 minutes.

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c) Where is the respiratory centre that controls breathing situated?

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d) List three stimuli that may affect breathing other than conditions in the blood.

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1. Label and annotate the image below to summarise how breathing rate is regulated.

Diagram, schematic

Description automatically generated

**Complete 6.2 Review Question on page 143 of your textbook.**

**Complete Chapter 6 Review Question 1b, 4, 5, 8, 9, 11, 17 – 19 on page 152 - 153 of your textbook.**

Learning Objectives:

*Body fluid concentrations are maintained by balancing water and salts via the skin, digestive system and kidneys, which involve the actions of antidiuretic hormone and aldosterone on the nephron, and the thirst reflex (SU 3.14)*

* Describe the role of the liver, skeletal muscle, pancreas and adrenal glands in glucose regulation
* Differentiate between
  + chemicals involved in blood sugar regulation (glucose, glycogen)
  + the processes of regulation (glycogenolysis, glycogenesis, gluconeogenesis, lipolysis)
  + the hormones controlling blood sugar levels (insulin, glucagon, cortisol, adrenaline/epinephrine)
  + alpha and beta cells in the Islets of Langerhans of the pancreas

**Regulation of blood sugar** (pages 109 – 114)

* + - 1. Describe the difference between glucose and glycogen.

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* + - 1. Define the following terms.

|  |  |
| --- | --- |
| **Term** | **Definition** |
| Glycogenesis |  |
| Glycogenolysis |  |
| Gluconeogenesis |  |
| Lipogenesis |  |

Diagram

Description automatically generatedGlucose regulation is under the control three organs in the body: liver, pancreas and adrenal glands. Label each on the diagram below.

Role of the Liver

Explain the role of the liver in glucose regulation.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Diagram

Description automatically generatedUse page 110 to label the diagram below.

Role of the pancreas

Scattered throughout the pancreas are small masses of endocrine tissue called \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

|  |  |  |
| --- | --- | --- |
| **Hormone** | **Secreted from** | **Effect** |
| Insulin |  |  |
| Glucagon |  |  |

Draw a stimulus-response feedback model for the regulation of glucose after eating.

Diagram

Description automatically generated

Diagram

Description automatically generatedDraw a stimulus-response feedback model for the regulation of glucose after eating.

Role of the adrenal glands

1. Explain how adrenaline and noradrenaline are stimulated to be secreted from the adrenal cortex.

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1. Describe the effect of adrenaline and noradrenaline of glucose blood levels.

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1. Explain how cortisol is stimulated to be secreted from the adrenal medulla.

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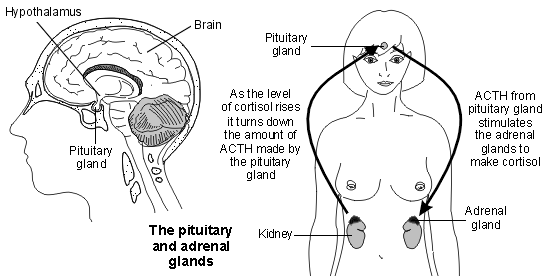
1. Describe the effect of cortisol of glucose blood levels.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Diagram

   Description automatically generatedCompose a stimulus-response feedback model for adrenaline.
2. Diagram

   Description automatically generatedCompose a stimulus-response feedback model for cortisol.



Chart, line chart

Description automatically generatedPractice Questions

1. What is the normal blood glucose level? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. State how the body detects blood glucose levels. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. Identify on the graph the time(s) of day the individual ate a meal.
4. Describe the process that led to a change in blood glucose level after a meal was eater.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Label times of glucagon secretion on the graph.
2. Describe the process that led to the change in blood glucose levels that you identified in Q4.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Propose why blood glucose levels plateaued from ~1am.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Diagram

Description automatically generatedThe liver plays a central role in carbohydrate metabolism, specifically the production of glucose from non-carbohydrate sources, and the interconversion of glucose and glycogen. These processes ensure carbohydrates are stored or are made available to cells as required and are regulated by hormones.

The role of the liver is illistrated in the adjacent picutre.

1. Name and describe the processes labelled as 1, 2 and 3 in the diagram.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Explain why it is important that the body can readily convert and produce different forms of carbohydrates.

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**Complete 5.2 Review Questions on page 14 of your textbook.**

**Complete Chapter 5 Review Questions 3-6, 13, 14, 17, 18 and 24 on page 127 of your textbook.**

ENDOCRINE PAST WACE EXAM QUESTIONS

**Question 1** – 2013 **(26 marks)**

A recent study investigating the effects of MDMA (ecstasy) on human thermoregulation. The research team selected 10 individuals (male and female) ages between 18 and 35 years. Each participate attended two sessions, one week apart. At the first session participants receives, in tablet form, either a placebo or 2 mg/kg of MDMA. If at the first session participants received a placebo, at the second session they received MDMA and visa versa.

At each session, participates assembled in a room at 10 am with the room temperature at 23°C. After 30 minutes, the room was changed to 30°C, which took about 2 minutes. Data collection began at 11 am, when the drug or placebo tablet wad given with a small amount of water. Recordings of core temperature were taken every hour for the next 4 hours, when the session concluding at 3pm. Data for each of the five time periods were averaged and recorded (in order of time starting at 11am) in a notebook as follows.

MDMA: 36.9°C, 37.1°C, 37.5°C, 37.6°C, 37.6°C Placebo: 36.9°C, 37°C, 37°C, 37.1°C, 37.1°C

1. Present the above data in a table. (5 marks)
2. Formulate a hypothesis for this experiment. (1 mark)

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1. Explain why each participant did not receive the same amount of MDMA: that is, they received 2 mg of MDMA per kilogram of body mass of the participant. (1 mark)

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. i) Describe two variables that were controlled adequately in the experiment. (2 marks)

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ii) For one of the variables described in part di) explain why it is needed to be controlled. (1 mark)

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1. The research team also recorded the oxygen consumption of participants over the same time period. They found that oxygen consumption after administration of the placebo remain constant, they found that it increased significantly after the administration of MDMA. Using this information and data from the table, suggest what caused the observed effect of MDMA on core body temperature. (1 mark)

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. During both sessions, the research team took recordings of skin temperature for 5 hours from 10 am. Between 10:30 and 11 am, the skin temperature increased 1°C to administration of the placebo and MDMA. Explain why this occurred. (1 mark)

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1. After 12:30 pm, the skin temperature, following administration of MDMA, steadily at 0.5 °C above the skin temperature following administration of the placebo. Account for what might have caused the difference in skin temperature between the two treatments. (1 mark)

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. In 2009, 17 year old Gemma Thoms attended the Big Day Out (BDO) at Claremont showgrounds in Perth. It was a 35°C day and Gemma spent most of the day dancing. Gemma consumed one MDMA tablet before leaving home and swallowed two more tablets while lining up to enter the event because she was concerned police at the BDO would charge her with possession of an illegal substance. She collapsed at the concert and died in hospital 12 hours later.
2. MDMA has been shown to increase metabolic rate as well as result in vasoconstriction of blood vessels to the skin and reduce sweating. Describe how MDMA and the environment in which it was taken, contributed to Gemma’s death. (3 marks)

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1. Increase body temperature usually results in increase sweating and vasodilation of the blood vessels to the skin. Select one of these cooling mechanisms and explain why and how it occurs. (4 marks)

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1. MDMA has also been linked to water intoxication (hyponatremia) as a result of increased ADH levels. Describe how increase ADH can lead to water intoxication. (4 marks)

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1. Describe why water intoxication is so dangerous. (2 marks)

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**Question 2** - 2009 (20 marks)

Chart, line chart

Description automatically generatedBrad was part of a research group investigating the control of blood glucose levels in different people. The graph below shows the changes in his blood glucose levels over a period of 24 hours.

1. Explain the changes in Brads blood glucose concentration between 16 hours and 24 hours. (8 marks)

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1. Tony (Brads fellow researcher) also monitored his blood glucose concentration in the investigation. Tony is a diabetic and requires insulin: they had their meals and exercised together. From the graph, state when Tony would need to have his insulin injections and explain why these times. (6 marks)

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1. Before Tony was diagnosed with diabetes, he was always thirsty, urinated frequently and was always tired. Explain how these symptoms link to high blood glucose caused by diabetes. (6 marks)

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**Question 3 – 2013 (12 marks)**

The following question refers to the information and the graph below.

Prior to having a morning operation, a patient was told to fast (go without food) after an evening mean the night prior. The graph below shows changes to the blood glucose concentration throughout the night, which the patient was resting, starting 30 minutes after the evening meal.

Chart

Description automatically generated

1. Describe how the graph illustrates a negative feedback model. (2 marks)

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1. The following questions refer to the changes in the blood glucose concentration between Points Y and Z.
2. Name the hormone that causes the change in blood glucose concentrations between times Y and Z on the graph. (1 mark)

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1. Name the cell type and the specific location within the organ from which the hormone state in part b)(i) was secreted. (2 marks)

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1. Describe two responses that led to the change in blood glucose concentration between times Y and Z o the graph. (2 marks)

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1. (i) On the axes below, draw the blood glucose levels of a person suffering Type 2 diabetes (untreated) over the same time period. (1 mark)

Chart

Description automatically generated

1. Explain the shape of your graph above in terms of glues regulation. (4 marks)

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**WACE Past Paper Questions**

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| --- | --- | --- | --- |
| **Exam** | **Multiple Choice** | **Short Answer** | **Extended Response** |
| 2021 |  |  |  |
| 2020 | 4,8,12,13,14,23,24 | 31  33 | 39(a) |
| 2019 | 19,21,22,25 | 34  36 | 41 |
| 2018 | 28, | 32  35  37 |  |
| 2017 | 3,4 | 34  36 |  |
| 2016 | 5,6 | 35  36 | 40 |

Extended Response Practise

1. A person got stranded on a desert island after their boat hit some rocks and capsized. There was limited fresh water and they were unsure of what plants they could eat. They had set off a rescue beacon, but the closest community was a day’s boat ride away.

a) Outline what would happen to their body fluid and sugar levels in the first 24hours. (10 marks)

b) Describe the homeostatic mechanisms to control the change in fluid and sugar levels. (10 marks)

1. On a hot day you spend several hours working or playing sport and notice that your skin becomes red and your clothes wet with sweat. You feel thirsty and you have several large drinks of water. When you get home you notice that your urine is darker than normal and you recall with some surprise that you hadn’t felt the need to empty your bladder since you left home that morning. Outline the way in the sweating, the thirst and the low volume of concentrated urine produced, can be related to the physiological process of homeostasis. (20 marks)
2. A patient was in a coma for a long period of time due to damage to his cerebrum. He was able to maintain some crucial functions such as breathing, within the normal tolerance limits without the use of medical intervention. Use your knowledge of the function of the brain and negative feedback models to explain how he was able to continue breathing normally even though part of his cerebrum was damaged. (7 marks)
3. Glucose is required in body cells for the production on energy during cellular respiration. To maintain glucose levels in a cell, negative feedback mechanisms are necessary for more glucose to be released into the bloodstream and to enter the cell. Identify, name the source and describe the role of three hormones in increasing glucose levels in the blood. (12 marks)