**HUMAN BIOLOGY – YEAR 12**

**TASK 6 – REFLEX AND REACTIONS INVESTIGATION**

**NAME: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ WEIGHTING: 8% MARK:\_\_\_\_\_ /70**

**Part A = \_\_\_\_/ 30**

**Part B = \_\_\_\_/40**

**The structure of the eye, ear and receptors in the skin allow the body to react to changes in the external environment. Receptors detect stimuli which include light, sound, changes in position, chemicals, touch, pressure, pain and temperature. Reflex actions are automatic and rapid, which involve sensory neurons, interneurons and motor neurons.**

**Part B – Experimentation**

Complete a series of experiments and use knowledge gained from research to explain what occurs in the experiments.

***BACKGROUND INFORMATION***

**RECEPTORS**

**Receptors** monitor changes in the external and internal environment and denf nerve impulses via **sensory nerves** to the **sensory cortex** of the brain. The brain interprets the stimulus and sends nerve impulse by **motor nerves** to the muscles or glands (**effectors**) to bring about a response.

The **skin** is divided into the **outer epidermis** and the **inner epidermis.** The skin has touch, pain, pressure, vibration and temperature receptors. Every square centimetre if your skin contains around 200 pain receptors, but only 15 receptors for pressure, 6 for cold and 1 for warmth. These receptors are not evenly distributed. They are close together on the finger tips and face, and far apart on the back, legs, arms and stomach.

The receptor, such as the cold and warm **temperature receptors,** adapt and become less sensitive if a stimulus is continued. This adaptation allows us to tune out to background influences/get used to a situation such as background noise, smells, sensation of clothing and lose awareness of the temperature of the immediate environment.

**REFLEXES and REACTIONS**

The **brain** controls **voluntary actions** which are under our conscious control. The **brain stem** controls **involuntary reflexes** such as breathing, heart beat and blood pressure. The midbrain and the spinal cord function as the integrations centres for many reflexes. Reflexes are rapid, involuntary responses to stimuli which are mediated over simple nerve pathways called reflex arcs. Involuntary reflexes are very fast.

**Reflexes** serve as primitive responses that protect the human body from danger and help it to adjust to the surroundings. For example, humans cough when an irritant enters the wind pipes and needs to be expelled through the mouth. We blink when danger threatens the sensitive tissues of the eye and when we need to moisten and clean the cornea (this reflex occurs 900 times an hour). When we put a finger on a hot stove, we immediately remove the finger before the message, ‘my finger is on a hot stove burning stove’ , arrives in the brain.

**Reflex testing** is an important diagnostic tool for the assessing the condition of the nerve system. Distorted, exaggerated or absent reflex responses may indicate degeneration of pathology of portions of the nervous system, often before other signs are apparent. If the spinal cord is damaged, then reflex tests can help determine the area of the injury.

**Sense Receptors in the Skin – Investigation of heat and cold receptors**

**METHOD**

1. Half fill one beaker with ice water (0°C), the second beaker with water at room temperature (25°C) and the third beaker with hot water (50°C). Arrange in a row from coolest to hottest.
2. Have the subject put their right forefinger into the cold water and their left forefinger into the warm water. Leave the fingers immersed for one minute.
3. After one minute, have the subject quickly immerse both forefingers in the room temperature beaker.
4. Ask subject what sensation they feel in each finger. Record in table below.

**RESULTS**

|  |  |  |  |
| --- | --- | --- | --- |
| Finger Used | Sensation felt [ Hot, Warm or Cold] | | |
| **Cold water** | **Room Temperature** | **Hot water** |
| Right forefinger |  |  |  |
| Left Forefinger |  |  |  |

**ANALYSIS – You can make reference to background information from first page in your responses.**

1. Describe how the subject felt when the right finger was immersed in: [1 mark]  
   1. Cold water:
   2. Room Temperature:
2. Describe how the subject felt when the left finger was immersed in: [1 mark]  
   1. Hot water:
   2. Room Temperature:
3. What is the name given to temperature receptors in the skin? [1 mark]
4. Explain:
   1. The reason for this discrepancy by the receptors in the fingers in feeling the correct temperature. [2 marks]
   2. Why this would be useful in a person’s everyday life. [2 marks]

**Reactions – Measuring the speed of a nerve impulse and the reaction time**

**METHOD**

1. Subject sits with forearm resting on table surface. Hand to extend over the edge of the table.
2. Experimenter to stand holding the top of a 1 meter ruler.
3. The zero end of the ruler should be between the subject’s forefinger and thumb (not holding the ruler).
4. Experimenter releases ruler.
5. Subject to catch as quickly as possible. Record distance of ruler catch in table.
6. Complete four times for both dominant and non-dominant hands.

**RESULTS** [1 mark]

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Trials | Distance of drop (cm) | | | | | |
| **1** | **2** | **3** | **4** | **Average** | **Reaction Times (ms)** |
| Dominant hand |  |  |  |  |  |  |
| Non-dominant hand |  |  |  |  |  |  |
| Tap head |  |  |  |  |  |  |
| Tap hand |  |  |  |  |  |  |
| Tap foot |  |  |  |  |  |  |

1. Repeat drop experiment but this time the subject to close eyes and experimenter to tap subject’s head prior to release of ruler. To be completed four times.
2. Repeat drop experiment but this time the subject to close eyes and experimenter to tap subject’s non-catching hand prior to release of ruler. To be completed four times.
3. Repeat drop experiment but this time the subject to close eyes and experimenter to tap subject’s foot prior to release of ruler. To be completed four times.

Use the table below to calculate the average reaction times of the subject for each hand.

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Distance of catch (cm) | 5 | 10 | 15 | 20 | 25 | 30 | 43 | 61 | 79 | 99 |
| Reaction time (sec) | 0.10 | 0.14 | 0.17 | 0.20 | 0.23 | 0.25 | 0.30 | 0.35 | 0.40 | 0.45 |

**ANALYSIS**

1. Did the reaction time of the subject decrease or increase over the 4 trials? [1 mark]
2. What do you notice about difference between the dominant hand and non-dominant hand reaction time? Explain. [3 marks]
3. How did the reaction speeds compare for the three experiments where the subject’s eyes were closed? [3 marks]
4. Is the reaction for catching a ruler voluntary or involuntary? Explain. [3 marks]
5. How does repetition of a task (practice) affect reaction time? What happens to neural pathways in the brain? [3 marks]

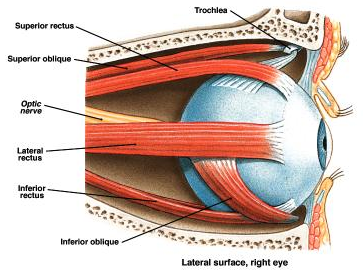
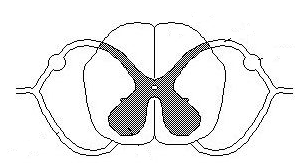
**Reflexes – Investigating the blink reflex**

**METHOD**

1. Subject to hold clear plastic sheet in front of face, ensuring eye area is covered.
2. Experimenter to gently throw cotton ball at plastic sheet, aiming for the subject’s eyes.
3. Record observations of what occurs in table.

|  |  |
| --- | --- |
| Reflex measured | Observation |
| Blink reflex |  |

**ANALYSIS**

1. What did the subject do when the cotton ball was thrown at their eyes? [1 mark]
2. Why do you think you made the observations you did? Included in your response should be the purpose of reflexes to the human body. [3 marks]
3. Using the images below, draw and label the possible reflex arc, to and from the eye, that a nerve impulse would have taken when the cotton ball was thrown at the subject’s eye. [4 marks]
4. Why is reflex testing an important diagnostic tool in physical examinations of patients by physicians (doctor)? [1 mark]

**CONCLUSION**

1. How does the brain:
   1. Receive messages from sense organs (eyes, ears, skin, etc)? [1 mark]
   2. Send messages back to muscles? [1 mark]
2. Imagine you are driving at night. Lights from the oncoming traffic ‘hit’ your eyes. Why are you not ‘blinded’ by the intense lights from the oncoming traffic? [3 marks]
3. Alcohol is a depressant, meaning it ‘slows down’ the nerve cells/neurons in the Central Nervous System. Explain why it is not recommended for drivers of vehicles to consume alcohol or high amounts of alcohol before getting behind the wheel? [5 marks]