**HUMAN BIOLOGY**

**Unit 3**

**Semester 1 Examination 2019**

**Marking Key**

**Section One: Multiple-choice 30% (30 Marks)**

|  |  |
| --- | --- |
| **Question** | **Answer** |
| **1** | **C** |
| **2** | **B** |
| **3** | **D** |
| **4** | **A** |
| **5** | **B** |
| **6** | **C** |
| **7** | **A** |
| **8** | **B** |
| **9** | **D** |
| **10** | **C** |
| **11** | **C** |
| **12** | **D** |
| **13** | **C** |
| **14** | **A** |
| **15** | **A** |
| **16** | **D** |
| **17** | **C** |
| **18** | **B** |
| **19** | **D** |
| **20** | **B** |
| **21** | **D** |
| **22** | **A** |
| **23** | **C** |
| **24** | **B** |
| **25** | **A** |
| **26** | **A** |
| **27** | **D** |
| **28** | **C** |
| **29** | **A** |
| **30** | **B** |

**Section Two: Short answer 50% (100 Marks)**

**Question 31**

(a) Identify the mode of transmission by which the backpacker contracted Dengue fever. (1 mark)

|  |  |
| --- | --- |
| **Identify** | **Marks** |
| Transmission by vector | 1 |
| **Total** | 1 |

(b) Explain why the doctor did not prescribe an antibiotic for the backpacker. (2 marks)

|  |  |
| --- | --- |
| **Explanation** | **Marks** |
| Dengue fever is cause by a virus | 1 |
| Antibiotics not effective/ have no effect on a virus | 1 |
| **Total** | 2 |

(c) If the backpacker came into contact with the same type of Dengue fever upon subsequent trips to South America, would he develop Dengue fever? Explain your answer. (3 marks)

|  |  |
| --- | --- |
|  | **Marks** |
| No | 1 |
| **Explanation** |  |
| Developed memory cells on first/ primary exposure | 1 |
| Secondary/ subsequent immune response rapid | 1 |
| **Total** | 3 |

(d) What type of immunity has the backpacker developed? (2 marks)

|  |  |
| --- | --- |
| **Identify** | **Marks** |
| Active | 1 |
| Natural | 1 |
| **Total** | 2 |

**Question 32**

(a) Name and describe the action which caused Mrs Smith to move her hand away from the hot tray. (6 marks)

|  |  |
| --- | --- |
| **Name** | **Marks** |
| Reflex (must state) | 1 |
| **Description** |  |
| Stimulus (of hot tray) detected | Any 5 in correct order |
| Sensory neuron transmits impulse to CNS |
| Interneuron receives impulse |
| Impulse passes to motor neuron |
| Motor neuron transmits to effector |
| Effector muscles in arm move the hand away from hot surface |
| **Total** | 6 |

(b) Explain why it took a few seconds for Mrs Smith to be aware of the sensation of pain. (2 marks)

|  |  |
| --- | --- |
| **Explanation** | **Marks** |
| Impulse must travel a greater distance to brain | 1 |
| Impulse reaches brain after response has been made | 1 |
| **Total** | 2 |

(c) (i) Describe what is happening to cause Mrs Smith’s thumb to become red, swollen and painful. (5 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Damage causes mast cells to release chemicals/substances | 1 |
| Histamine increases blood flow through area and causes capillaries to become more permeable (must say both) | 1 |
| Heparin prevents clotting in immediate area and thins blood  (must say both) | 1 |
| Phagocytes/Macrophages attracted to area and consume debris by phagocytosis | 1 |
| Pain receptors stimulated and person feels pain | 1 |
| **Total** | 5 |

(c) (ii) Explain the purpose of this process. (3 marks)

|  |  |
| --- | --- |
| **Explanation** | **Marks** |
| Reduce spread of pathogens | 1 |
| Remove damaged tissue | 1 |
| Begin process of repair | 1 |
| **Total** | 3 |

**Question 33**

(a) Write a suitable hypothesis for this study. (2 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Paracetamol plus Ibuprofen (Paracetamol/Ibuprofen) will result in the | 1 |
| lowest percentage of children with temperatures greater than 37.2oC (over a 24 hour period). | 1 |
| **Total** | 2 |

(b) Using the results table above, describe the trends of the data. (2 marks)

|  |  |
| --- | --- |
| **State** | **Marks** |
| Ibuprofen and paracetamol combined are more effective at reducing fever | 1 |
| Than using ibuprofen or paracetamol separately | 1 |
| **Total** | 2 |

(c) Describe the stages of a fever from its onset to crisis point. (4 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Hypothalamus resets body temperature abnormally high | 1 |
| Person feels cold and shivers | 1 |
| Vasoconstriction occurs | 1 |
| Body temperature rises | 1 |
| **Total** | 4 |

(d) Graph (5 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Title- must include both variables (no half marks)  Percentage of children with temperatures greater than 37.2oC taking paracetamol plus ibuprofen. | 1 |
| Both axis labelled (no half marks)  Y axis: Children with temperatures greater than 37.2oC X axis: Time | 1 |
| Units (no half marks)  Y axis: (Percentage/%) X axis: (Hours) | 1 |
| Plotting- accurate line graph | 1 |
| Appropriate scale | 1 |
| **Total** | 5 |

(e) Explain why a low-grade fever of 39.5oC may be beneficial during a time of infection. (2 marks)

|  |  |
| --- | --- |
| **Explanation** | **Marks** |
| Increase rate of immune response | Any 2 marks |
| Increase rate of healing |
| Inhibit growth of bacteria/virus |
| **Total** | 2 |

**Question 34**

1. These individuals experience an increase in core body temperature during this walk.
2. Complete the following based on this stimulus. (3 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| **Receptor:** Central thermoreceptors in hypothalamus | 1 |
| **Modulator:** Hypothalamus thermoregulatory centre | 1 |
| **Transmission:** Sympathetic nervous system for sweat glands | Any 1 |
| Parasympathetic nervous system for cutaneous arterioles |
| **Total** | 3 |

1. Name **one** physical heat exchange process that is being used by the body during the feedback loop for part (i), include where it is occurring. (1 mark)

|  |  |
| --- | --- |
| **Name and location** | **Marks** |
| Radiation/Convection from cutaneous arterioles | Any 1 |
| Evaporation of sweat from skin |
| **Total** | 1 |

1. Describe a problem that extreme humidity could cause for individuals walking the track. (2 marks)

|  |  |
| --- | --- |
| **Describe** | **Marks** |
| Heat stroke | 1 |
| The body is unable to lose heat by evaporation | 1 |
| **Total** | 1 |

1. Extreme heat can often lead to heat exhaustion, which results in the body being unable to maintain homeostasis.
2. Describe what occurs in the body to result in heat exhaustion. (2 marks)

|  |  |
| --- | --- |
| **Describe** | **Marks** |
| Extreme sweating/vasodilation | Any 2 |
| Leads to decrease in blood volume/very low blood pressure |
| This leads to collapse |
| **Total** | 1 |

1. Explain how the body would respond to combat this problem. (6 marks)

|  |  |
| --- | --- |
| **Explain** | **Marks** |
| (Stimulus) Increased osmotic pressure/decreased blood volume/ reduced blood pressure | 1 |
| (Receptor) Osmoreceptors in Hypothalamus | 1 |
| (Modulator) Hypothalamus stimulates the posterior pituitary via nerves to release ADH | Any 1  (must have **all** detail) |
| (Modulator) Hypothalamus releases ACTHrf to anterior pituitary via blood to release ACTH via blood |
| (Effector) Nephron/Kidney | 1 |
| (Effector) Adrenal cortex releases aldosterone |
| (Response) Distal convoluted tubule and collecting duct more permeable | 1  (must have **all** detail) |
| (Response) Increase reabsorption of sodium into blood and secretion of potassium into urine |
| (Feedback) More water reabsorbed/attempts to absorb more water (from urine) | 1 |
| **Total** | 6 |

Please note: students must continue with the same example   
ie. ADH in modulator and therefore must talk about the nephron as the effector

**Question 35**

(a) Explain why a person’s blood glucose would be lower during exercise than a time of no exercise. (2 marks)

|  |  |
| --- | --- |
| **Explanation** | **Marks** |
| Rate of respiration increases during exercise | 1 |
| Glucose used by cells for fuel/immediate use by cells, therefore decreasing blood glucose levels | 1 |
| **Total** | 2 |

(b) Describe how a person’s blood glucose is controlled while exercising. (5 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Blood glucose decreases | Any 5 |
| Detected by alpha cells in pancreatic islets |
| Alpha cells release glucagon |
| Glucagon increases breakdown of glycogen into glucose (glycogenolysis) |
| Glucagon increases production of glucose from non-carbohydrate sources (gluconeogenesis) |
| Blood glucose levels increase |
| **Total** | 5 |

(c) People who have been diagnosed with Type 2 Diabetes are advised to exercise as part of their treatment.

(i) Explain why health professionals may advise this treatment. (3 marks)

|  |  |
| --- | --- |
| **Explanation** | **Marks** |
| Type 2 is a lifestyle disease cause by poor diet and lack of exercise | 1 |
| Exercise causes increase in uptake of glucose by cells | 1 |
| Blood glucose levels decrease | 1 |
| **Total** | 3 |

(ii) Suggest a second treatment that may also be a suitable treatment for a person with type 2 diabetes. (1 mark)

|  |  |
| --- | --- |
|  | **Marks** |
| Diet low in carbs/ diet low in sugar/ increase fibre in diet (any reasonable treatment suggestion) | 1 |
| **Total** | 1 |

(iii) Explain why exercise alone would not be a suitable treatment for a person diagnosed with type 1 diabetes. (3 marks)

|  |  |
| --- | --- |
|  | **Marks** |
| Type 1 not a lifestyle disease | 1 |
| Person cannot produce insulin | 1 |
| Must receive regular insulin injections | 1 |
| **Total** | 3 |

**Question 36**

(a) Explain why blocking the entry of sodium into a nerve cell would prevent the patient from feeling pain while having dental procedures. (4 marks)

|  |  |
| --- | --- |
| **Explanation** | **Marks** |
| Sodium ions cannot enter cell | 1 |
| Depolarisation cannot occur | 1 |
| Nerve impulse will not continue down length of neuron | 1 |
| Patient will not feel pain | 1 |
| **Total** | 4 |

(b) Suggest two (2) reasons why the addition of adrenaline to a lidocaine injection would be useful during tooth extraction. (2 marks)

|  |  |
| --- | --- |
| **Suggest** | **Marks** |
| Blood vessels less permeable/constrict away from mouth region | Any 2 |
| Therefore less bleeding |
| (Slower release of lidocaine) increases the time anaesthetic lasts |
| **Total** | 2 |

(c) If the size of a nerve impulse is the same regardless of the size of the stimulus, explain why the patient experiences a range of sensations from mild discomfort to severe pain. (4 marks)

|  |  |
| --- | --- |
| **Explanation** | **Marks** |
| Mild pain due to only a few pain receptors being stimulated | 1 |
| Severe pain due to large number of pain receptors being stimulated | 1 |
| Increase/ decrease frequency of action potentials sent to brain | 1 |
| These are processed by cerebrum interpreted as increased/ decreased pain levels | 1 |
| **Total** | 4 |

(d) When a nerve impulse reaches the end of a neuron it it must cross to the adjacent neuron. Explain how the nerve impulse crosses from one neuron to the next. (5 marks)

|  |  |
| --- | --- |
| **Explanation** | **Marks** |
| Calcium released at presynaptic ending | 1 |
| Vesicle containing neurotransmitters travels to cell membrane | 1 |
| Neurotransmitters released via exocytosis | 1 |
| Diffuse across synapse | 1 |
| Bind to specific receptor on post synaptic membrane | 1 |
| **Total** | 5 |

**Question 37**

(a) Describe the structure of the pituitary gland and how it is connected to the hypothalamus. (3 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Hypothalamus and pituitary connected via infundibulum | 1 |
| Posterior pituitary connected via nerve fibres | 1 |
| Anterior pituitary connected via blood capillaries | 1 |
| **Total** | 3 |

(b) Outline four (4) differences between hormones and neurotransmitters. (4 marks)

|  |  |
| --- | --- |
| **Outline** | **Marks** |
| *Must complete line for mark* |  |
| Hormones released via endocrine system while neurotransmitters released of the nervous system | 1 |
| Hormones travel in blood neurotransmitters travel across synapse | 1 |
| Hormones produced by endocrine glands while neurotransmitters produced by neurons | 1 |
| Hormones are slower acting than neurotransmitters | 1 |
| **Total** | 4 |

(c) A person develops a pituitary tumour which causes the over-secretion of Thyroid Stimulating Hormone (TSH). Describe the effect this will have on the person and suggest what condition they may be diagnosed with. (4 marks)

|  |  |
| --- | --- |
| **Explanation** | **Marks** |
| Increase stimulation of thyroid gland | 1 |
| Increased production of thyroxine | 1 |
| Unexplained weight loss/ fatigue (any reasonable symptom) | 1 |
| Diagnosed with hyperthyroidism | 1 |
| **Total** | 4 |

**Question 38**

a) Identify the functional type of neuron pictured above. (1 mark)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Sensory neuron | 1 |
| **Total** | 1 |

(b) Name structure X and briefly describe its function. (2 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Myelin sheath | 1 |
| Increase speed of nerve transmission | 1 |
| **Total** | 2 |

(c) Explain how the degeneration of structure X would affect a person who has been diagnosed with Multiple Sclerosis. (2 marks)

|  |  |
| --- | --- |
| **Explanation** | **Marks** |
| Slow the speed of nerve transmission | 1 |
| Persons body would become slow to respond | 1 |
| **Total** | 2 |

(d) Name and describe two (2) structures that protect the nervous system from damage. (2 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Must name AND describe for mark (any two) | |
| Cerebrospinal fluid - acts as a shock absorber to protect CNS | Any 2 |
| Bone (skull/vertebrae)- hard outer shell to protect CNS |
| Meninges- physical barrier to absorb shock and protect soft tissue of CNS |
| **Total** | 2 |

**Question 39**

**(a)** Describe how cortisol is released into the blood and explain why it may be a contributing factor in John’s weight. (9 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Hypothalamus releases Adrenocorticotropic (ACTH) releasing factor | 1 |
| Through blood vessels | 1 |
| To anterior pituitary gland | 1 |
| Anterior pituitary releases ACTH into bloodstream | 1 |
| ACTH targets Adrenal cortex | 1 |
| Adrenal cortex releases cortisol | 1 |
| **Explanation** |  |
| Cortisol increases gluconeogenesis (fats or proteins to glucose) / glycogenolysis (breakdown glycogen into glucose) | Any 3 |
| Increase glucose in blood |
| This results in weight loss (**must** write 1/more of marks above) |
|  |
| Excess glucose in blood not needed for use in body |
| Excess glucose stored as fat |
| This results in weight gain (**must** write 1/more of marks above) |
| **Total** | 9 |

(b) Explain why John’s breathing rate has increased while he runs. (7 marks)

|  |  |
| --- | --- |
| **Explanation** | **Marks** |
| Increase in rate of aerobic respiration | Any 7 |
| Increase in carbon dioxide in blood |
| Increase in hydrogen ions in blood |
| Decrease in blood pH |
| Detected by chemoreceptors |
| Respiratory centre in medulla |
| Nerve impulses sent to diaphragm and intercostal muscles |
| Increase in breathing rate |
| **Total** | 7 |

(c) Identify the division of the nervous system that would be in control during a relaxing yoga session and describe three (3) other effects it would have on the body. (4 marks)

|  |  |
| --- | --- |
| **Identify** | **Marks** |
| Parasympathetic division | 1  Any 3 |
| **Any 3 of the following:** |
| Pupils constrict |
| Stimulate saliva production |
| Stimulate activity of stomach |
| Inhibit release of glucose |
| Stimulate activity of intestines |
| Contract bladder |
| **Total** | 4 |

**Question 40**

(a) Describe the sequence of events that take place in the body during a cell mediated response. Include in your answer the name and description of the four (4) types of cell that are developed through this process. (14 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Foreign antigen enters the body | 1 |
| B cell/ macrophage presents foreign antigen to T cells | 1 |
| Specific T cell sensitised | 1 |
| T cells enlarge and divide | 1 |
| Clones produced | 1 |
| **Memory cells produced** | 1 |
| Memory cells recognise foreign antigen upon subsequent exposure | 1 |
| **Killer T cells produced** | 1 |
| Attach to invading cells and secrete substances which destroy antigens | 1 |
| **Helper T cells produced** | 1 |
| Intensify activity of lymphocytes | Any 2 |
| Attract macrophage to site of infection |
| Intensify phagocytosis |
| **Suppressor T cells produced** | 1 |
| Inhibit activity of T and B cells | Any 1 |
| Slow the immune response |
| **Total** | 14 |

(b) Discuss the social and cultural reasons for and against vaccination. (6 marks)

|  |  |
| --- | --- |
| **Discuss** | **Marks** |
| **For** |  |
| None of the major religions are opposed to vaccination | Any 3 reasonable |
| Internet can provide information on the benefits of vaccination programmes |
| Peer pressure |
| Negative side effects do not happen often |
| **Against** |  |
| A person’s religious beliefs often prevent them from vaccinating their child | Any 3  reasonable |
| Traditional medicine/ faith healers practiced instead of vaccination |
| Misinformation often from social media/ internet sites on risks and side effects |
|  |  |
| **Total** | 6 |

**Question 41**

(a) Describe how the cause of Alzheimer’s and Parkinson’s differs and explain how cell replacement therapy may be a suitable treatment for people who suffer from these disorders.

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Alzheimer’s is caused by the plaques in the brain which prevent nerve cells from communicating | 1 |
| Alzheimer’s is caused by the tangles in the brain prevent tissue from receiving nutrients/cause nerve cells to die | 1 |
| Alzheimer’s is also caused by a decrease in acetylcholine | 1 |
| Parkinson’s is caused by the degeneration of neurons which produce dopamine in the brain (basal ganglia) | 1 |
| **Explain** |  |
| Cell replacement therapy involves replacing dead/dying cells with healthy ones | 1 |
| Central nervous system cannot regenerate its own neurons | 1 |
| Embryonic STEM cells are pluripotent and so can differentiate into any cell except umbilical cord and placenta | 1 |
| Induced pluripotent STEM cells are genetically engineered to act like embryonic STEM cells | 1 |
| Use of STEM cells to replace neurons destroyed by plaques/tangles with Alzheimer’s | 1 |
| Use of STEM cells to replace neurons which produce dopamine in those with Parkinson’s | 1 |
| **Total** | 10 |

(b) Provide another name for the condition which results in these symptoms and

use your understanding of the functioning of the thyroid gland to explain how these symptoms are bought about. (10 marks)

|  |  |
| --- | --- |
| **Name** | **Marks** |
| Hypothyroidism | 1 |
| **Description** |  |
| Thyroid gland is not producing enough thyroxine | Max 1 mark  Each point worth 2 marks (take first 4 students describe) – max of 8 |
| Thyroxine is used to increase metabolic rate/body metabolism |
| Regulates reactions where molecules broken down to release energy |
| Regulates reactions where simple molecules joined to make complex molecules |
| **Explanation** |
| Weight gain – decreased metabolic rate means food is not used to produce energy (1) Glucose converted to fat/protein (glycogenesis/lipogenesis) which results in weight gain (1) |
| Fatigue – food is being stored as fat (1)  Cells are not undergoing cellular metabolism when energy needed so feel tired(1) |
| Increased sensitivity to cold – decreased metabolic rate means decreased heat production (1)  Body’s thermoreceptors identify small decreases in temperature (1) |
| Muscle weakness – decreased metabolic rate means not enough energy is being produced (1)  Leads to less muscle contractions and therefore weakness(1) |
| Depression/Low mood – body lacking energy all the time (1) Causes decreased brain activity leading to depression/low mood (1) |
| **Total** | 10 |