**SOUTHERN RIVER COLLEGE**

**Human Biological Science**

**Unit 3 & 4**

**TASK 5 – Test 2**

**Homeostasis & Immunity**

**MARKING KEY**

**Time: 60 mins**

Multiple Choice: 15 marks

Short Answer: 20 marks

Extended Answer: 20 marks

TOTAL 55 MARKS

**Weighting: 5%**

**Do not write on this question booklet**

**Do not turn page until instructed to do so**

**Section A: Multiple Choice (15 Marks)**

Answer all questions by placing an X through the most correct answer on the multiple choice answer sheet.

1. The concentration of the mumps antibody in the blood of a person was measured over a period of 90 days. The results are shown on the graph below.

concentration

of antibodies

(arbitrary units)

0 30 60 90

Time (days)

30

A

It is reasonable to conclude that the graph represents the concentration of the mumps antibodies in

1. a newborn baby whose mother had been vaccinated against mumps.
2. a newborn baby whose mother had a mumps antibody injection before becoming pregnant.
3. an adult who became infected with mumps at time A on the graph.
4. a child who had been vaccinated against mumps at time A on the graph.
5. During exercise, the heart rate increases
6. due to the decreased carbon dioxide in the blood
7. to increase the supply of blood to alimentary organs
8. and the blood vessels in the muscles dilate
9. due to high oxygen levels in the blood.
10. Suffocation victims are usually given a mixture of 95% oxygen and 5% carbon dioxide rather than pure oxygen, because the carbon dioxide:
11. decreases the danger of choking by dilating bronchiole tubes
12. increases the speed with which gases pass through the alveoli of the lungs
13. directly stimulates the diaphragm to produce the breathing action
14. acts on the respiratory centre to stimulate breathing
15. Which of the physiological responses below occur when core temperature increases above 37.5 0C?
16. Blood circulation to the skin increases
17. Sebaceous gland activity increases
18. Radiation of heat increases
19. Blood circulation to the brain decreases
20. Superficial blood vessels dilate
21. Sweat gland activity increases
22. i, ii, iii, v
23. i, iv, v, vi
24. i, ii, iv, vi
25. i, iii, v, vi

**The following information relates to Questions 5 and 6.**

Measles is an infectious disease caused by a virus. Symptoms usually appear 6–10 days after exposure to the virus and include a rash, headache and fever. In a proportion of cases the patient is affected by secondary bacterial infections, especially of the lungs. Antibiotics are often prescribed.

1. Antibiotics are likely to
2. decrease the rate of DNA synthesis by the measles virus.
3. reduce fever by resetting the body’s thermostat.
4. disrupt the synthesis of new bacterial cell components.
5. do all of the above.
6. When suffering from measles and a secondary bacterial lung infection, antibodies are produced by the patient’s immune cells. Which of the following statements is true of these antibodies?
7. The same antibody is capable of attacking the measles virus and the bacteria infecting the lung.
8. The antibodies which attack the virus are produced by helper T cells, whereas the antibodies which attack the bacteria are produced by B cells.
9. Viral antibodies and bacterial antibodies are produced by the same plasma cells.
10. Large quantities of antibodies specific to the measles virus remain in the circulation for a short time.
11. Steady state control systems involve a flow of information through a cycle in which there is five separate functional components. When the pituitary gland secretes hormones to control other endocrine glands it is acting as:
12. A receptor
13. A modulator
14. An effector
15. A stimulus
16. Insulin controls the metabolism of
17. fats
18. proteins
19. Carbohydrates/ Sugars
20. hormones
21. The process of converting glycogen to glucose is called:
    1. Glycogenolysis
    2. Lipogenesis
    3. Glucagon
    4. Glycogenesis
22. ADH is released by the pituitary to:
    1. Regulate water content in the kidneys
    2. Control calcium and phosphate levels in the blood
    3. Control the production and release of hormones from the adrenal cortex
    4. Promote normal metabolism and resistance to stress
23. After the removal of gland X, a patient was unable to regulate body temperature effectively. Gland X was the:
24. Thyroid
25. Pancreas
26. Thymus
27. Adrenal Glands
28. If osmotic pressure in the blood increases, then:
    1. the water content of the blood has increased
    2. the ADH levels in the blood is the same
    3. the water content of the blood has decreased
    4. the ADH levels in the blood have reduced
29. Homeostatic control of water content of blood occurs in the nephron when the filtrate reaches the:
    1. Proximal convoluted tubule
    2. Loop of Henle
    3. Distal convoluted tubule
    4. Glomerulus
30. Substances that stimulate the production of antibodies are called:
    1. antipathogens
    2. antitoxins
    3. antigens
    4. antibacterials
31. Immunity to disease that is acquired by an infant from its mother’s breast milk is an example of what type of immunity?
    1. Natural active immunity
    2. Natural passive immunity
    3. Artificial passive immunity
    4. Artificial active immunity

**END OF SECTION A**

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

Teacher\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

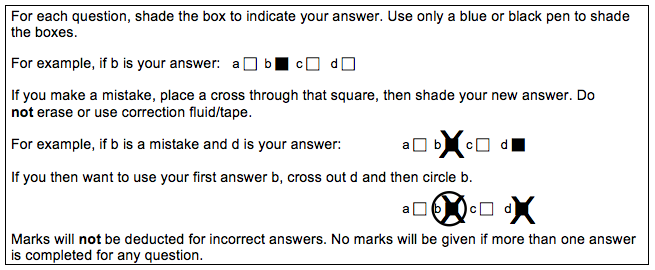
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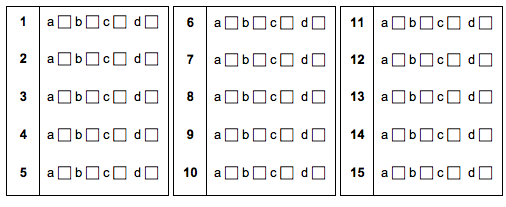
**Human Biological Science Unit 3 & 4**

**TASK 5 – Test 2 Homeostasis & Immunity**

TOTAL 55 MARKS

**Multiple choice & answer booklet**





**Section B: Short Answer (20 Marks)**

Answer all questions in the spaces provided.

**Question 1 (4 Marks)**

Question 1 refers to the graph below, showing the immune response of a person injected with two doses of an antigen.

1. Name and describe the type of cell that directly results in the response which occurs between day 0 and 10 on the graph above. (2 marks)

|  |  |
| --- | --- |
| Explain | Marks |
| Plasma Cells | 1 |
| Secrete antibodies which causes their numbers to rise. | 1 |

1. Explain how, and why the shape of the graph is different after the second injection of antigen compared with the first exposure. (2m)

|  |  |
| --- | --- |
| Explain | Marks |
| More rapid response due to memory B cells being present | 1 |
| Plasma cells form quickly and antibody levels raise much faster, for a longer period of time. | 1 |

**Question 2 (6 Marks)**

The balance of gas concentrations within the body are controlled by a stimulus response mechanism.

1. Name the receptor/s of low oxygen concentration.

(1 mark)

Carotid and Aortic bodies

**MUST have all (peripheral chemoreceptors is not enough detail)**

1. Explain the relationship between carbon dioxide, hydrogen ion concentration and pH levels in the blood.

(3 marks)

|  |  |
| --- | --- |
| **Explain** | **Marks** |
| CO2 increases,increases H+ concentration, decreases pH/increases acidity | 1 |
| CO2 dissolved in blood plasma forms carbonic acid | 1 |
| Breaks down to form H+ and HCO3- | 1 |

1. Which one - carbon dioxide, oxygen or pH levels in the blood, results in the most immediate response by the peripheral chemoreceptors?

(1 mark)

pH levels

1. What is the mode of transmission to relay the information to the respiratory centre?

(1 mark)

Nervous system (somatic nerves)

**Question 3 (6 marks)**

To investigate the effects that air temperature has on body temperature, a naked subject stood in a room especially designed for controlling air temperature. The subject was exposed to 480C to monitor the body’s response to dry heat. After a rest period, the same subject was then exposed to 50C to monitor the body’s response to dry cold. The data recorded are shown on the graphs below. Use the graphs to answer the following.



1. List two physiological adjustments the body is making to cope with the situation at point A in the graph, and explain how these may be of benefit. (4m)

|  |  |  |
| --- | --- | --- |
|  | Physiological Adjustment | Benefit |
| (i) | Vasoconstriction of peripheral blood vessels (must be specific about location) | Decreased heat loss/ Increased heat conservation |
| (ii) | Shivering | Increased heat gain |
| OR | Increased thyroxine/increased adrenaline | Increased heat production (from cellular respiration) |

1. Using the information in the graphs alone, did the most efficient temperature regulation occur when the subject was exposed to heat or cold? Give one reason for your answer. (2m)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Cold | 1 |
| Any one of the following:   * Variation of body temperature from 37 degrees/starting temperature is not as great (as with heat exposure) * Body temperature remained constant for longer | 1 |

**Question 4 (4 marks)**

Meningococcal disease is caused by the bacterium *Neisseria meningitides. N. meningitides* are found in the **throat and nasal passages** of about 10% of the population. These carriers of *N. meningitides* suffer no disease symptoms. In susceptible individuals, however, the bacteria can pass into the bloodstream and cause disease.

1. Outline **two specific** external defence mechanisms which have failed to stop this bacterium from entering the body. (2 marks)

|  |  |
| --- | --- |
| **Outline** | **Marks** |
| Cilia line the nose/trachea/throat which act to trap microorganisms | Any 2 marks |
| Mucus membranes secrete mucus which stops microorganisms from growing/traps microorganisms |
| Lysozymes: an enzyme that kills bacteria found in secretions of nose/mouth/throat |

MUST have specific defences (relating to the question).

The disease may take the form of:

•Meningitis (an infection of the membranes covering the brain and spinal cord)

• Septicaemia (a blood infection).

There are many strains of meningococci, but the strains that cause almost all disease in Victoria are called serogroup B and serogroup C.

Children and young adults are now routinely vaccinated against one strain of *N. meningitides*. Meningococcal C vaccine is effective in providing protection against bacteria of serogroup C. An effective vaccine against serogroup B has not yet been produced. In serogroup B bacteria, the key polysaccharide is identical to polysaccharides found in the body and so is recognised as self by the body’s immune system.

1. Explain two ways in which routine immunisation for meningococcal C may cause a decrease in the incidence of the disease in Victoria.(2m)

|  |  |
| --- | --- |
| **Explain – must say name and description** | **Marks** |
| Herd immunity – decrease the spread since fewer people are available for infection (unimmunised) | Any 2 marks |
| Invididuals are vaccinated – produce memory cells which reduces risk of future infection (active immunity - secondary response is much faster acting) |
| Mother protecting baby - by having vaccine and antibodies passing to baby via umbilical cord and breast milk |

**END OF SECTION B**

**Section C: Extended Answer (20 Marks)**

Answer all parts of ALL questions on the lines provided.

**Question 1**

In 1960, Australian Sir Frank MacFarlane Burnet (a Virologist) was awarded the Nobel Prize for medicine for correctly predicting how the body’s immune system responds to infection. He investigated the “Bundaberg Distaster”, in which twelve children in Queensland were given a diphtheria vaccine contaminated with *Staphylococcus aureus* bacteria (Golden Staph).

1. Describe the children’s humoral immune response when faced with the invading Staphylococcus pathogen (6 marks)

|  |  |
| --- | --- |
| **Describe** | **Marks** |
| 1. Foreign antigen enters lymphoid tissue 2. Specific B-cells are stimulated to undergo rapid cell division 3. B-cells become either plasma cells or memory B-cells 4. Plasma cells produce specific antibodies and release them into the blood and lymph 5. Antibodies combine with specific antigens and inactivate pathogen 6. Memory cells are stored for future exposure to the same pathogen/antigen | 1-6 |

1. Describe 3 ways in which antibodies can act on the pathogens to help fight infection (3 marks)

|  |  |
| --- | --- |
| **Describe – any 3 of the following** | **Marks** |
| * Agglutination clump / stick together particles * Coat with antibodies and attract macrophages * Dissolve organisms * Binding to viral sites/ bacterial antigens to increase phagocytosis * React to make soluble antigens insoluble | Any 3 marks |

1. Give four differences between humoral and cell-mediated immunity

(4 marks)

Any 4 differences explained.

|  |  |  |
| --- | --- | --- |
|  | Antibody mediated | Cell mediated |
| Cell type involved | B-cell | T-cell |
| Maturation of cells | Bone Marrow | Thymus |
| Action location | Extracellular | Intracellular |
| Action against | Bacteria | Virus  Infected cells  Cancer cells  Transplanted tissue |
| Clone cell differentiation | Plasma cell  Memory cell | Killer t cell  Helper T cell  Memory cell  Suppressor cell |
| Action | Production and secretion of antibodies into plasma | Killer T migrate to infection site |
|  | Formation of antibody-antigen complex | Produce cytokines that destroy pathogens |

**Question 2**

Louise is a 43-year old female who has type 1 diabetes.

1. Describe how her body responds after eating a meal high in carbohydrates.

(4 marks)

|  |  |
| --- | --- |
| **Describe** | **Marks** |
| * Stimulus: high blood glucose * Receptors: would be the Beta cells of the islets of Langerhans (Pancreas) * Beta cells are damaged/destroyed and do not produce insulin (must have both) * Glucose remains in the blood (no negative feedback) | 1-4 |

1. What does Louise have to do in order to manage her condition and how does her body respond to this?

(3 marks)

|  |  |
| --- | --- |
| **Describe** | **Marks** |
| * Insulin injections/syringes/pump/pen * Effector: Liver and somatic or skeletal cells respond to insulin * Response: Glycogenesis/increased glucose uptake/lipogenesis occurs | 1-3 |