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**Year 12 Human Biology**

**Unit 3: Extended Response – Specific Resistance (5%)**

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

Teacher Mrs Cunningham

**Task 4**

**TYPE:** Extended Response

**TIME:** 40 minutes

**YOUR TASK:**

**Answer ALL parts of the following question:**

**1.** John was not immunised against whooping cough when he was an infant. As a teenager he was exposed to the pathogen that caused the disease and became very sick. Jennifer was vaccinated as an infant and when exposed as a teenager she did not contract the disease.

1. Describe the processes that occurred in Jennifer’s immune system at the time of vaccination.

(15 marks)

1. Explain the difference between Jennifer’s response and John’s response when they were exposed to the pathogen as teenagers.

(5 marks)

**2.** A few years ago a superbug was discovered in the United Kingdom (UK). The micro-organism, ‘NDM-1’, is resistant to almost all antibiotics and is likely to spread worldwide. The superbug is even resistant to a class of antibiotics, known as Carbapenems, which are used when all other types of antibiotics have failed.

1. Explain what an antibiotic is. Identify what circumstances antibiotics are used in and describe the effects they have on micro-organisms.

(4 marks)

1. Discuss how microorganisms, such as NDM-1, become antibiotic-resistant.

(6 marks)

**Time allowed for completion of the task:**

40 mins in class

No notes permitted

**Task weighting**

5% of the school mark for this pair of units

**Total /30**

**Specific Resistance – Marking Key – (5%)**

1. John was not immunised against whooping cough when he was an infant. As a teenager he was exposed to the pathogen that caused the disease and became very sick. Jennifer was vaccinated as an infant and when exposed as a teenager she did not contract the disease.

1. Describe the processes that occurred in Jennifer’s immune system at the time of vaccination.

(15 marks)

|  |  |
| --- | --- |
| Any 15 points for 1 mark each |  |
| * An antigen is necessary to cause an immune response * Jennifer was given a (weakened / dead / acellular / toxoid) antigen preparation in the form of a vaccine. * Macrophage engulfs the pathogen / vaccine and * Displays/presents the antigen on its surface. * Specific B and T lymphocytes recognize the antigen. * Are sensitized and enlarged by mitosis / cloning occurs. * B lymphocytes produce plasma cells. * Plasma cells capable of producing antibodies. * Antibodies move throughout the bloodstream. * To inactivate antigens. * Antibodies destroy by: agglutination/ neutralization/ enhanced phagocytosis/ leakage/ dissolving (must have **at least 2** correct) * T lymphocytes produce Killer T cells * Killer T cells move to site of infection * To destroy antigen * Actions of Killer T cells sensitizes other lymphocytes/enhance phagocytosis * Memory B and T cells (must say **both**) are also produced for secondary response | 15 |

1. Explain the difference between Jennifer’s response and John’s response when they were exposed to the pathogen as teenagers.

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| --- | --- |
| Any 5 points for 1 mark each |  |
| * John did not have memory cells (due to lack of immunization). * It therefore took a lot longer for the immune response to occur causing him to contract the disease / display symptoms. * John has a primary response. Jennifer has a secondary response (must say **both**). * Jennifer had memory cells (due to immunizastion). * Therefore the immune response could occur more quickly. * Destroying the pathogen before it had a significant effect / sickness / major symptoms / disease. | 5 |

**2.** A new superbug was discovered early this year in the United Kingdom (UK). The micro-organism, ‘NDM-1’, is resistant to almost all antibiotics and is likely to spread worldwide. The superbug is even resistant to a class of antibiotics, known as Carbapenems, which are used when all other types of antibiotics have failed.

1. Explain what an antibiotic is. Identify what circumstances antibiotics are used in and describe the effects they have on micro-organisms.

(4 marks)

|  |  |
| --- | --- |
| * A chemical that inhibits the growth/kills micro-organisms. | 1 |
| * Antibiotics are administered when a bacterial infection is present. | 1 |

|  |  |
| --- | --- |
| Any 2 points for 1 mark each |  |
| * Antibiotics work on bacterial cell walls/cell membranes and metabolism. **Can they just say cell walls OR metabolism?** * Antibiotics block translation during protein synthesis. * Kill bacteria by changing the structure of the cell wall/membrane  OR disrupt the action of essential enzymes. | 2 |

1. Discuss how microorganisms, such as NDM-1, become antibiotic-resistant.

(6 marks)

|  |  |
| --- | --- |
| Any 6 points for 1 mark each |  |
| * Natural genetic variation within the bacterial population. * Due to high mutation rate of bacteria. * When treated with antibiotics, some of resistant bacteria survive by chance (small numbers). * These produce colonies of antibiotic resistant bacteria. * If same selection mechanism/antibiotic is used again. * Increased number of antibiotic resistant exist. * This antibiotic no longer effective and new antibiotic(s) needed. | 4 |
| * Using antibiotics for viral infections * Not completing the full course of antiobiotics * Overuse of antibioitics as a preventative not a treatment/farming example | 2 |