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HUMAN BIOLOGY

UNIT 3 & 4 Semester Two 2020

Marking Key

Marking keys outline the expectations of examination responses. They help to ensure a consistent interpretation of the criteria that guide the awarding of marks.

**Section One: Multi choice (30%) 30 marks**

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

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

|  |  |
| --- | --- |
| **Question 31** | **(20 marks)** |

1. Compare two characteristics of bacteria and viruses. (4 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Any **two** of the following: (they must have a comparison to gain full marks) | |
| * Bacteria is a single celled organism/virus non-living containing DNA or RNA/genetic material * Bacteria surrounded by a cell wall/virus surrounded by protein coat * Bacteria reproduce by mitosis/cell division/viruses reproduce within other cells/uses cells to manufacture copies | 2-4 |
| **Total** | **4** |

1. Describe two modes of transmission of the virus that occurs from human to human and explain why these measures were so important to prevent the spread of the virus.

(4 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Any **two** of the following: | |
| * Transmission by contact via human or surface contact * Infection by droplets through sneezing or coughing * Airborne transmission when moisture in exhaled droplets evaporate | 1-2 |
| Measures important to:   * Prevent droplets containing virus to land on surfaces (where they survive for hours) decreasing risk of contact transmission * Prevent droplets from travelling through air to other people | 1-2 |
| **Total** | **4** |

1. Explain the reason for the Swedish government’s decision in terms of immunity.

(2 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| When exposed to the virus people should develop antibodies naturally | 1 |
| Hope to develop herd immunity naturally/before vaccine developed | 1 |
| **Total** | **2** |

1. Name and describe the specific immune response that would protect most people in Sweden from suffering from the symptoms of COVID-19 if they were reinfected.

(7 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Humoral/antibody mediated response | 1 |
| Antigen from virus is engulfed by macrophages and displays it on it’s surface | 1 |
| Specific B cells recognise and are sensitised to the antigen | 1 |
| B cells enlarge and divide | 1 |
| B cells produce plasma cells and memory cells | 1 |
| Plasma cells produce antibodies that eliminate the virus |  |
| Memory cells recognise the antigen quickly if re-exposed later | 1 |
| Person does not get COVID-19 symptoms and cannot spread the virus | 1 |
| **Total** | **7** |

1. Describe **three** ethical issues that are associated with the development of vaccines.

(3 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Any **three** of the following: | |
| * Treatment of animals as some vaccines require host tissue to grow * Use of human tissue/source of human tissue/use of embryo * Unethical testing of vaccines in groups of people who are not fully informed * Exploitation of people for testing for effectiveness * Testing of vaccines on animals/animal cruelty * People having the choice to be vaccinated | 1-3 |
| **Total** | **3** |
| Markers notes:Do not award marks for religion | |

|  |  |
| --- | --- |
| **Question 32** | **(7 marks)** |

1. State the name of the tool shown above. (1 mark)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Acheulian | 1 |
| **Total** | **1** |

1. Describe **two** other characteristics of the lifestyle associated with the species that made this tool. (2 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Any **two** of the following: | |
| * Use of fire * Evidence of shelters * Evidence of organized hunting | 1-2 |
| **Total** | **2** |

1. Explain the importance to archaeologists of these finds when studying human evolution.

(4 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| * Murals/types of tools (such as fishhooks) can show which animals were present during the time period * Show human lifestyle at the time (eg. Making nets/throwing sticks etc.) * Show hunting methods * Record the culture during the period | 1-4 |
| **Total** | **4** |

|  |  |
| --- | --- |
| **Question 33** | **(15 marks)** |

1. State the name of the gland that secretes thyroxine. (1 mark)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Thyroid gland | 1 |
| **Total** | **1** |

1. Describe the mode of action of hormones such as thyroxine. (4 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Is water soluble so cannot cross cell membrane | 1 |
| Attaches to the receptor on the membrane | 1 |
| Causes a secondary messenger to diffuse through cell/cytoplasm | 1 |
| Activates specific enzymes | 1 |
| **Total** | **4** |

1. State the name of the disease that results in too little thyroxine being secreted. (1 mark)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Hypothyroidism/Hashimoto’s disease | 1 |
| **Total** | **1** |

1. Use a steady state model to describe the response of the body to the disease identified in part (c). (5 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Stimulus: low concentration thyroxine | 1 |
| Receptor: Hypothalamus which secretes TSHRF | 1 |
| Modulator/Control Centre: Anterior pituitary secretes TSH | 1 |
| Effector: Thyroid gland | 1 |
| Response: increased concentration of thyroxine secreted | 1 |
| **Total** | **5** |

1. Explain how the hypothalamus controls the release of Antidiuretic hormone. (4 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Hypothalamus is stimulated by decrease water concentration in blood/ increase osmotic pressure | 1 |
| Sends nerve impulses via nerve cell extensions/axons | 1 |
| Posterior pituitary is stimulated | 1 |
| Release stored ADH | 1 |
| **Total** | **4** |

|  |  |
| --- | --- |
| **Question 34** | **(19 marks)** |

1. Suggest a hypothesis for this experiment. (1 mark)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| The antiviral drug will decrease the viral load of people with HIV | 1 |
| **Total** | **1** |

1. Identify the dependent variable in the experiment. (1 mark)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| The viral load (1000s copies /mL blood) | 1 |
| **Total** | **1** |

1. Graph the results in the grid provided on the next page. (6 marks)

|  |  |
| --- | --- |
|  | |
| **Description** | **Marks** |
| Title – The effect on viral load of HIV patients of an antiviral drug versus a placebo | 1 |
| Correctly labelled axes | 1 |
| Correct scale | 1 |
| Units are correct | 1 |
| Legend or key for each of the lines | 1 |
| Correct/accurate plotting | 1 |
| **Total** | **6** |

1. Identify which of the groups is the control group, and explain why it is necessary to have a control group in an investigation such as this one. (2 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Control group = group B/placebo group | 1 |
| To be able to compare the results with the experimental group/ensure that the results are due to the independent variable | 1 |
| **Total** | **2** |

1. Describe **three** variables that should have been controlled by the researchers. (3 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Any **three** of the following: | |
| Same living conditions | 1 |
| Same stage of the disease | 1 |
| Other medications being used | 1 |
| Other diseases/infections | 1 |
| Same gender | 1 |
| **Total** | **3** |

1. Suggest **two** ways that this experiment could have been made more reliable. (2 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Larger sample size | 1 |
| More trials | 1 |
| **Total** | **2** |

1. Define the term “placebo” and explain the purpose of it. (2 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| A substance that has no therapeutic effect | 1 |
| Placebos are used  to find out whether or not the desired effect of a drug actually includes what it is used for or whether the effects produced by the drug might be related to psychological processes/prevent patient bias | 1 |
| **Total** | **2** |

1. State a suitable conclusion for this investigation. (2 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| HIV patients taking the antiviral drug had a decreased viral load compared with the placebo group | 1 |
| This data supports the hypothesis | 1 |
| **Total** | **2** |

|  |  |
| --- | --- |
| **Question 35** | **(15 marks)** |

Mutations are the ultimate source of variation introducing new alleles into populations. New alleles may be favourable or unfavourable to survival within the population.

1. Explain the difference between somatic and germline mutations. (2 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Somatic mutations occur in body cells and cannot be passed on to offspring | 1 |
| Germline mutations occur in sex cells/gametes/eggs and sperm and can be passed on to offspring | 1 |
| **Total** | **2** |

Down syndrome is caused by a chromosomal mutation.

1. Explain why chromosomal mutations have a greater effect on an individual compared with gene mutations. (2 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Chromosomal mutations affect a large part or all of the chromosome | 1 |
| Several genes are affected producing multiple issues | 1 |
| **Total** | **2** |

Cystic fibrosis is a life-threatening disease caused by a mutation to a gene that is inherited as a recessive allele. Researchers are investigating the use of gene therapy as treatment for cystic fibrosis.

1. Describe how gene therapy works. (2 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Treat or cure genetic disease by replacing faulty genes | 1 |
| With healthy genes | 1 |
| **Total** | **2** |

1. Explain why gene therapy could work successfully for a disease such as cystic fibrosis, but not for Down syndrome. (2 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| A single gene is much easier to replace as in cystic fibrosis | 1 |
| Down syndrome is a chromosomal mutation and would require several genes to be replaced | 1 |
| **Total** | **2** |

Medical scientists can detect hereditary diseases such as cystic fibrosis using various biotechnological techniques. PCR can significantly reduce the time taken to detect these diseases and ensures that multiple specimens to not have to be collected from patients.

1. State the function of PCR and provide one use for the process. (2 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| To produce large amounts/copies of DNA quickly | 1 |
| Duplicate small amounts of DNA for forensic/paternity/evidence for evolution/genetic disease identification | 1 |
| **Total** | **2** |

1. Describe the process of PCR. (6 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Students should name the stages for full marks | |
| **Denaturing** involves heating the DNA | 1 |
| Causing the strands to separate/separates complimentary strands | 1 |
| **Annealing** occurs at a lower temperature | 1 |
| Adding primer (single strand of DNA) to bind to complimentary base sequences | 1 |
| **Extension** DNA polymerase/taq polymerase added | 1 |
| Makes a copy of DNA strands through repeated series of process | 1 |
| **Total** | **6** |

|  |  |
| --- | --- |
| **Question 36** | **(7 marks)** |

1. Using the phylogenetic tree, state which of these species are most closely related:

*H. habilis* and *H. ergaster* or *H. habilis* and *H. rudolfensis*. Justify your answer. (2 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| *H. habilis* and *H. rudolfensis* | 1 |
| They have the closest and most recent ancestor | 1 |
| **Total** | **2** |

1. Explain how non-functional DNA, such as endogenous retroviruses, could be used to develop this phylogenetic tree. (2 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| ERVs are incorporated into cells that are passed on to next generation | 1 |
| The more ERVs in common the closest and most recent ancestor | 1 |
| **Total** | **2** |

1. State the number of differences in amino acid sequence for cytochrome C between a rhesus monkey and a cow. (1 mark)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| 9/nine | 1 |
| **Total** | **1** |

1. Describe the significance of the number of differences between humans, chimpanzees and gorillas in terms of evolution of the species. (2 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| There are no/zero differences | 1 |
| Humans, chimps and gorillas have a common and more recent ancestor (compared to the other species) | 1 |
| **Total** | **2** |

|  |  |
| --- | --- |
| **Question 37** | **(10 marks)** |

1. Name and describe the phenomena that resulted in these changes in the Dunkers gene pool compared with the population in Hesse. (3 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Random genetic drift | 1 |
| Random non-directional change in allele frequencies | 1 |
| Occur in small populations that have been isolated | 1 |
| **Total** | **3** |

1. Explain how the allele frequencies in the traits studied in the Dunker population differ so much from the original population and the surrounding American population, despite the environment being very similar. (3 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| When Dunkers left Germany the allele frequency in their gene pool differed by chance | 1 |
| They are isolated from both original population and surrounding American population | 1 |
| Due to only marrying within the group thus passing on those alleles | 1 |
| **Total** | **3** |

1. Describe how natural selection results in changes to allele frequency in a gene pool. (4 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Variation within any species/gene pool of species | 1 |
| New variations occur due to mutation | 1 |
| If these new alleles result in characteristics that promote survival | 1 |
| Those alleles will be passed on to the next generation | 1 |
| **Total** | **4** |

|  |  |
| --- | --- |
| **Question 38** | **(6 marks)** |

1. Identify which skull is *Homo erectus*. (1 mark)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Skull B | 1 |
| **Total** | **1** |

1. Describe **three** structural differences between the skulls shown above. (3 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Any **three** of: (must state the difference so mention at least one skull label) | |
| Larger cranial capacity/cranium much larger SKULL B | 1 |
| No sagittal crest in SKULL B | 1 |
| Less prognathism SKULL B | 1 |
| Sloping forehead SKULL B | 1 |
| Cheekbones less robust SKULL B | 1 |
| **Total** | **3** |

1. Describe the likely position of the foramen magnum in skull B, and explain how this would enable bipedal locomotion. (2 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Directly underneath the skull, centrally located | 1 |
| Allows for the head to balance on top of the vertebral column without the need for large next muscles | 1 |
| **Total** | **2** |

**End of Section Two**

|  |  |
| --- | --- |
| **Section Three: Extended answer** | **20% (40 Marks)** |

**Question 39 (20 marks)**

* + - * 1. Describe the processes that occur in the liver once glucose has been transported to it from the small intestine via the hepatic portal vein. (3 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| * The liver cells uses some of the glucose as an energy source | 1 |
| * It is converted into glycogen/glycogenesis | 1 |
| * Glycogen is stored for times when blood glucose levels are low | 1 |
| **Total** | **3** |

* + - * 1. Use a steady state control model to explain how blood glucose homeostasis is maintained following a three course meal. (7 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Stimulus | |
| increased blood glucose levels | 1 |
| **Subtotal** | **1** |
| Receptor | |
| beta cells in Islets of Langerhans (in pancreas) | 1 |
| **Subtotal** | **1** |
| Modulator | |
| beta cells secrete insulin | 1 |
| **Subtotal** | **1** |
| Effectors | |
| Body cells/ liver andskeletal muscles | 1 |
| **Subtotal** | **1** |
| Response (any 2 of the following) | |
| Uptake of glucose into cells | 1 |
| Glycogenesis | 1 |
| Promotes fat storage | 1 |
| Promotes protein synthesis | 1 |
| **Subtotal** | **2** |
| Feedback | |
| decreases/maintain blood glucose levels | 1 |
| **Subtotal** | **1** |
| **Total** | **7** |

* + - * 1. Compare and contrast the two types of diabetes, describing the cause, symptoms and treatments of each. (10 marks)

|  |  |  |  |
| --- | --- | --- | --- |
| **Description** | | | **Marks** |
|  | **Type 1** | **Type 2** |  |
| Cause – Any **one** of the following | | | |
| Cause | * Autoimmune disorder affecting the beta cells in Islets of Langerhans | * Lifestyle disease eg obese, physically inactive | 1-2 |
| * No insulin produced | * Insulin produced but cells don’t respond to it | 1-2 |
| Symptoms - Any **two** of the following but must include at least **one** comparison | | | |
| Symptoms | * Excessive thirst and hunger | * Excessive thirst and hunger | 1-2 |
| * Large volumes of urine containing glucose/sugar | * Large volumes of urine containing glucose/sugar |
| * Fatigue | * Fatigue |
| * Weight loss | * Weight loss |
| Treatment - Any **two** of the following | | | |
| Treatments | * Insulin replacement | * Medication that slows the absorption of glucose from the digestive system | 1-2 |
|  | * Diet management involving less processed foods/sugary foods | * Diet management involving less processed foods/sugary foods | 1-2 |
|  | * Regular physical activity | * Maintaining healthy weight with regular exercise | 1-2 |
| **Total** | | | **10** |

**Question 40 (20 marks)**

1. Explain why, despite the damage to his brain, Phineas’ vital functions such as breathing and digestion were unaffected. (5 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| * The damage to the brain occurred in the cerebral cortex | 1 |
| * Which is responsible for memory, personality and thought processes | 1 |
| * These functions are not vital to life | 1 |
| * Vital processes are controlled by areas of the brain including the hypothalamus and medulla | 1 |
| * These are situated in the lower part of the brain or the brain stem and were not affected | 1 |
| **Total** | **5** |

1. State the specific subdivision of the nervous system that would cause such a reaction, and describe the nervous and hormonal changes that would be taking place, and their consequences on the body. (7 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Subdivision name | |
| Sympathetic nervous system | 1 |
| **Subtotal** | **1** |
| Nervous changes | |
| Noradrenaline is released (at axonal terminals) | 1 |
| Any **three** of the following: | |
| * Pupils dilate to enhance peripheral vision * Bronchioles/airways dilate to allow more air/oxygen to enter the lungs * Vasoconstriction in internal organs such as digestive system organs * Vasodilation of blood vessels in skeletal muscles * Decreases activity of digestive system * Increases glycogenolysis/release of glucose in the liver * Salivary secretions reduced * Relaxation of bladder muscles | 1-3 |
| **Subtotal** | **4** |
| Hormonal changes | |
| Adrenal medulla secretes adrenaline | 1 |
| Causes similar effects to the nervous changes | 1 |
| **Subtotal** | **2** |
| **Total** | **7** |

1. Describe how a nerve impulse passes along an unmyelinated nerve fibre. (8 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Nerve fibre resting membrane potential is -70 mV | 1 |
| When the cell membrane is at rest sodium ions accumulate on the outside of the membrane/membrane impermeable to sodium | 1 |
| The membrane is stimulated and the threshold reached/ voltage is -55 mV /Slow depolarisation of the membrane brings the potential to the threshold. | 1 |
| Sodium channels in the membrane open and sodium ions flood into the cell. | 1 |
| Depolarisation occurs | 1 |
| Sodium channels close (and Potassium channels open) | 1 |
| The membrane becomes repolarised. | 1 |
| The membrane is hyperpolarized. | 1 |
| Na/K pump transports Na out of the cell and K into the cell | 1 |
| The membrane returns to the resting state. | 1 |
| **Total** | **8** |

**Question 41 (20 marks)**

1. Describe the conditions required for speciation to occur, outlining the process that would have led to the evolution of *Homo sapiens*. (10 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Mutations cause variation | 1 |
| Variation exists within a population that shares a common gene pool | 1 |
| Barriers form causing isolation of the populations | 1 |
| No interbreeding occurs so each population has a separate gene pool | 1 |
| Different selection pressures act on each population | 1 |
| Individuals with favourable characteristics are selected/natural selection occurs | 1 |
| Those individuals survive longer | 1 |
| Reproduce and pass the genes to the next generation | 1 |
| This leads to changes in the frequency of alleles in the gene pool | 1 |
| Changes in gene frequencies prevent the production of fertile offspring thus a new species has evolved | 1 |
| **Total** | **10** |

1. Describe the features of the skeleton of humans, from the pelvis to the foot, that enable bipedal locomotion. Explain how these features assist with the ability to walk bipedally with a striding gait. (10 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Pelvis | |
| Broad and short creating carrying angle | 1 |
| Bowl shaped supports abdominal organs | 1 |
| Broad bones/large surface area for attachment of large muscles to support bipedal locomotion | 1 |
| **Subtotal** | **3** |
| Femurs | |
| Head of femur is very large creating a strong ball and socket joint with the pelvis/acetabulum | 1 |
| Long bones allow stride | 1 |
| **Subtotal** | **2** |
| Knee | |
| Very robust/strong hinge joint enables weight bearing/ Outer hinge larger and stronger to weight bear | 1 |
| **Subtotal** | **1** |
| Feet | |
| Large heel bone/calcaneus bone fro strength | 1 |
| Toes are aligned | 1 |
| Metatarsals form a transverse arch as well as longitudinal arch | 1 |
| Big toe very robust and not prehensile | 1 |
| **Subtotal** | **4** |
| **Total** | **10** |

**Question 42 (20 marks)**

1. Name the specific method of dating that would have been used to determine the age of these fossils, and describe how the process works. (5 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Name of technique | |
| Potassium argon | 1 |
| **Subtotal** | **1** |
| Process | |
| Based on decay of radioactive/isotope of potassium to form calcium and argon | 1 |
| Only in volcanic rocks such as those at Laetoli | 1 |
| Decay takes place at a very slow constant rate/half life 1.3 billion years | 1 |
| Calculate the amount of K40 compared with Ar40 to determine the age | 1 |
| **Subtotal** | **4** |
| **Total** | **5** |

1. Describe the advantages of bipedal locomotion and erect stance to the ancestors of *Homo sapiens.* (5 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Process | |
| An increased range of vision for detecting prey and predators at a greater distance | 1 |
| Increased size deterring predators | 1 |
| Hands free for carrying food/children/tools | 1 |
| Higher reach for picking fruit from trees/food from nests | 1 |
| Better cooling of the body/less surface area struck by sunlight/UV radiation | 1 |
| **Total** | **5** |

1. Explain the relationship between the geographical incidence of malaria and sickle cell anaemia in terms of natural selection. (6 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| People who inherit one normal blood cell allele and one sickle allele/are heterozygous for sickle cell anaemia | 1 |
| Tend to have resistance/protection from malaria (Note-they are NOT immune to it) | 1 |
| Geographically the incidence of malaria somewhat coincides with the a high frequency of sickle cell disease | 1 |
| Malaria is a selection pressure in these areas | 1 |
| Those who have the allele/are heterozygous have a survival advantage | 1 |
| Thus reproducing and passing the allele for the disease on to the next generation | 1 |
| **Total** | **6** |

1. Name one population that has a high incidence of Tay-Sachs disease and explain why it continues to be inherited by these people. (4 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Population with high incidence – Ashkenazi Jews/Cajuns/French Canadians/Eastern Europeans | 1 |
| Tay sachs provides resistance to/protection from tuberculosis (NOT immunity) | 1 |
| These populations are at high risk of contracting TB due to close proximity | 1 |
| Those with the allele survive and reproduce/the allele is inherited | 1 |
| **Total** | **4** |

**End of Question**