**HUMAN BIOLOGY**

**UNIT 1**

**EDWEST Semester 1 Examination 2017**

**Marking Key**

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

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

**Section Two: Short answer 50% (105 Marks)**

**Question 31**

(a) Which of the model cells would have the greatest increase in mass after two (2 hours)? Give a reason for your choice. (3 marks)

|  |  |
| --- | --- |
| **Selection & Reason** | **Marks** |
| C | 1 |
| has greater concentration gradient | 1 |
| Water moves into the cell via osmosis | 1 |
| **Total** | 3 |

(b) Explain why dialysis tubing can be used to represent the cell membrane. (2 marks)

|  |  |
| --- | --- |
| **Explanation**  | **Marks** |
| Small pores in the dialysis tubing | 1 |
| Acts like a selectively permeable membrane | 1 |
| **Total** | 2 |

(c) Explain why it is important for the student to dry the model cells before each weighing. (2 mark)

|  |  |
| --- | --- |
| **Explanation**  | **Marks** |
| To gain an accurate weight | 11 |
| So that water on the outside of the ‘cell’ is not included in the weight |
| **Total** | 2 |

d) State one difference and two similarities between diffusion and osmosis.

 (3 marks)

|  |  |
| --- | --- |
| **Comparison**  | **Marks** |
| ***Difference*** |  |
| Osmosis ONLY refers to the movement of water/ movement of water across a selectively permeable membrane | 1 |
| ***Similarities*** |  |
| High to low concentration | 1 |
| Both passive processes/ no energy requirement  | 1 |
| **Total** | 3 |

**Question 32**

(a) Explain how structure A both mechanically and chemically breaks down food.

 (4 marks)

|  |  |
| --- | --- |
| **Explanation** | **Marks** |
|  |  |
| ***Mechanical***  |  |
| Teeth  | Any 2 |
| Chewing food |
| Breaking food down into smaller pieces |
|  |  |
| ***Chemical***  |  |
| Salivary amylase/ enzyme | Any 2 |
| Release salivary amylase |
| Breaks down starch to simple sugars |
| **Total** | 4 |

(b) Name and describe the process by which food passes down structure B into the stomach. (3 marks)

|  |  |
| --- | --- |
| **Name & Description** | **Marks** |
| Peristalsis (must state the name) | 1 |
| *Any two of the following* |  |
| Muscular contraction and relaxation of oesophagus  | 1 |
| Muscle behind the bolus contract | 1 |
| Muscle behind the bolus relax | 1 |
| **Total** | 3 |

c) Structure C is the stomach. The stomach contains gastric juices which aid in the process of digestion.

 Complete the table below by outlining the function of the named gastric juices.

 (2 marks)

|  |  |
| --- | --- |
|  | ***Function*** |
| ***Hydrochloric acid*** | Any one of:Kill/ destroy bacteria/ activate inactive enzymes |
| ***Digestive enzymes*** | Break down protein |

(d) Contrast the structure and function of E and D. (3 marks)

|  |  |
| --- | --- |
| **Comparison**  | **Marks** |
| Any three rows |
| ***Large intestine*** | ***Small intestine*** |  |
| Large diameter | Smaller diameter | 1 |
| Shorter length | Longer length | 1 |
| Reabsorption of water | Reabsorption of nutrients/ final digestion | 1 |
| Lack of villi | Villi present | 1 |
| No enzymatic digestion | Enzymatic digestion | 1 |
| **Total** | 3 |

**Question 33**

(a) Graph the data in the table. (5 marks)

|  |  |
| --- | --- |
| **Graph marks distribution** | **Marks** |
| Title appropriate with both independent and dependent variables included | 1-5 |
| Identify lines using keys/labels |
| Correctly constructs axes using appropriate scale |
| Correctly plots points to form a line |
| Labelling axes with correct name and unit |
| **Total** | 5 |

(b) Write a suitable hypothesis for this investigation. (2 marks)

|  |  |
| --- | --- |
| **Hypothesis**  | **Marks** |
| The closer the distance to the industrial plant | 1 |
| The more cases the of asthma reported | 1 |
| **Total** | 2 |

c) Identify the dependent and independent variables in this investigation. (2 marks)

|  |  |
| --- | --- |
| **Variables**  | **Marks** |
| ***Independent***- distance from industrial plant (km) | 1 |
| ***Dependent-*** number of reported cases | 1 |
| **Total** | 2 |

(d) One of the scientists involved in the investigation stated that the results were unreliable. Explain why the scientist could be correct in making this statement. (2 marks)

|  |  |
| --- | --- |
| **Explanation** | **Marks** |
| Results should be the same each time/ consistent results | Any 2 |
| Study lacks a control |
| Sample size is unknown/ sample size may be too small |
| **Total** | 2 |

(e) What is a placebo? (2 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Inactive substance given to a control group | 1 |
| Cannot be distinguished from the real medication | 1 |
| **Total** | 2 |

**Question 34**

(a) (i) Identify Stage 1 (1 mark)

|  |  |
| --- | --- |
| **Stage 1** | **Marks** |
| Glycolysis | 1 |
| **Total** | 1 |

 (ii) Name product Y from stage 1 (1 mark)

|  |  |
| --- | --- |
| **Product** | **Marks** |
| Pyruvic acid | 1 |
| **Total** | 1 |

 (iii) What other substance must be present in order for Stage 2 to occur? (1 mark)

|  |  |
| --- | --- |
| **Reactant** | **Marks** |
| Oxygen  | 1 |
| **Total** | 1 |

 (iv) In which organelle does Stage 2 take place? (1 mark)

|  |  |
| --- | --- |
| **Organelle** | **Marks** |
| Mitochondria  | 1 |
| **Total** | 1 |

 (v) How many molecules of ATP are formed from each glucose molecule during both Stage 1 and Stage 2 combined? (1 mark)

|  |  |
| --- | --- |
| **Number of ATP** | **Marks** |
| 38 ATP | 1 |
| **Total** | 1 |

(b) Describe the process of anaerobic respiration. (4 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Respiration without oxygen | 1-4 |
| Takes place in the cytoplasm |
| Glucose broken down into two pyruvic acid molecules |
| Pyruvic acid converted into lactic acid |
| 2 ATP produced |
| **Total** | 4 |

(c) Give an example of a situation where anaerobic respiration would become very important. (1 mark)

|  |  |
| --- | --- |
| **Example** | **Marks** |
| Sprint events (any reasonable) | 1 |
| **Total** | 1 |

**Question 35**

(a) Put one of the letters B to E into each box to show the events in the correct order. The first one has been done for you. (2 marks)

|  |  |
| --- | --- |
| **Correct sequence** | **Marks** |
| A C E B D | 2 |
| **Total** | 2 |

(b) (i) Identify blood vessels A and B. (2 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| A- (superior) vena cava | 1 |
| B- pulmonary artery | 1 |
| **Total** | 2 |

 (ii) Describe one (1) similarity and three (3) differences between blood vessels A and B. (4 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| ***Similarity***  |  |
| Both carry deoxygenated blood | 1 |
| ***Differences***  |  |
| Vena cava into heart pulmonary artery away from heart | 1 |
| Vena cava is a vein while pulmonary artery is an artery | 1 |
| Vena cava takes blood from the body pulmonary artery takes blood to the lungs | 1 |
| **Total** | 4 |

(c) Explain why is the muscle on the left side of the heart thicker than the muscle on the right. (4 marks)

|  |  |
| --- | --- |
| **Explanation** | **Marks** |
|  | 22 |
| Left side pumps blood through aorta to the body |
| Needs great force |
| Right side pumps to lungs |
| Short distance |
| Needs less force |
| **Total** | 4 |

(d) Identify one (1) function of the valves in the heart. (1 mark)

|  |  |
| --- | --- |
| **Valve Function** | **Marks** |
| Prevent backflow | 1 |
| **Total** | 1 |

**Question 36**

(a) Using the information from figure 1 above, identify the optimum pH value for lactase. (1 mark)

|  |  |
| --- | --- |
| **pH** | **Marks** |
| 6.4 | 1 |
| **Total** | 1 |

(b) Would it be possible for lipase to break down lactose? Explain your answer. (4 marks)

|  |  |
| --- | --- |
| **Explanation** | **Marks** |
| No  | 1 |
| Enzymes are specific | 1 |
| Enzymes work on only one substrate | 1 |
| Enzymes are complementary to one substrate | 1 |
| **Total** | 4 |

(c) The optimum temperature for enzymes in the human body is 37oC. Explain what would happen to enzyme action if a person’s body temperature increased to 45oC. (3 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Enzymes would |  |
| Denature/ change shape | 1 |
| Can no longer carry out reaction | 1 |
| No longer complementary to substrate | 1 |
| **Total** | 3 |

(d) Some enzymes require a cofactor in order to combine with their substrate. Briefly outline the role of a cofactor in the efficient functioning of an enzyme. (2 marks)

|  |  |
| --- | --- |
| **Role**  | **Marks** |
| Changes shape of active site | 1 |
| Allows enzyme and substrate to combine | 1 |
| **Total** | 2 |

(e) Explain why the reaction rate does not continue to increase after the substrate concentration reaches 4 on the graph. (2 marks)

|  |  |
| --- | --- |
| **Explanation**  | **Marks** |
| Active sites full/ occupied/ saturated | 1 |
| Not possible for further reactions to take place | 1 |
| **Total** | 2 |

**Question 37**

(a) What role does each of the following formed elements play in the body.

 (2 marks)

 ***White blood cells*** immunity (1)

 ***Platelets*** blood clotting (1)

(b) The function of red blood cells is to transport oxygen around the body.

 (i) Identify the substance that increases the oxygen carrying capacity of the red blood cell. (1 mark)

|  |  |
| --- | --- |
| **Substance**  | **Marks** |
| Haemoglobin | 1 |
| **Total** | 1 |

 (ii) Describe two (2) other features of red blood cells which increase their oxygen delivery capacity to cells. (2 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Biconcave shape/ disc | 11 |
| No nucleus |
| **Total** | 2 |

(c) (i) What is the function of the lymphatic system? (3 marks)

|  |  |
| --- | --- |
| **Function**  | **Marks** |
| Collect fluid that escapes from capillaries | 111 |
| Return fluid to circulatory system |
| Defend against pathogens |
| **Total** | 3 |

 (ii) Identify two (2) locations in the body where lymph nodes can be located. (2 marks)

|  |  |
| --- | --- |
| **Locations** | **Marks** |
| Groin/ neck/ under arm (any two) | 2 |
| **Total** | 2 |

(iii) Explain why lymph nodes can become larger when you have an infection. (2 marks)

|  |  |
| --- | --- |
| **Advantage**  | **Marks** |
| Increase number of white blood cells | 11 |
| To defend body from infection/ fight off infection |
| **Total** | 2 |

(iv) What is the advantage of lymph passing through several lymph nodes before returning to the circulatory system? (2 marks)

|  |  |
| --- | --- |
| **Name of structure** | **Marks** |
| Filter debris | 11 |
| Trap bacteria/ pathogens |
| **Total** | 2 |

Question 38

(a) (i) Identify structures X and Y in the diagram above. (2 marks)

|  |  |
| --- | --- |
| **Products** | **Marks** |
| X- blood vessels/ capillaries | 11 |
| Y- lacteal |
| **Total** | 2 |

 (ii) Which of the products of digestion are absorbed into the structures labelled X and Y in the above diagram? (2 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| X amino acids and glucose | 11 |
| Y- fats/ fatty acids and glycerol |
| **Total** | 2 |

(b) Describe two (2) features of the villi which makes them an efficient surface for nutrient absorption. (4 marks)

|  |  |
| --- | --- |
| **Feature Description** | **Marks** |
| Thin walls – allow for rapid/efficient diffusion/active transport | 222 |
| Large surface area – maximises uptake area |
| Microvilli – finger like extensions of the epithelial cells/ “ “ “ |
| **2 x Feature = 1 Description =1 Total** | 4 |

(c) Coeliac disease is caused by an allergy to gluten. The disease causes the villi to be destroyed.

 Explain why a person suffering from coeliac might struggle to gain weight. (2 marks)

|  |  |
| --- | --- |
| **Explanation** | **Marks** |
| Cannot absorb nutrients | 11 |
| Passes nutrients out of the body  |
| **Total** | 2 |

**Question 39**

(a) (i) Which muscle would be the agonist and which would be the antagonist.

 (2 marks)

|  |  |
| --- | --- |
| **Muscle** | **Marks** |
| ***Agonist***- biceps | 11 |
| ***Antagonist***- triceps |
| **Total** | 2 |

(ii) Explain why having muscles arranged in antagonistic pairs is an advantage. (2 marks)

|  |  |
| --- | --- |
| **Explanation** | **Marks** |
| Allows for intermediate/ fine movement to take place | 11 |
| Contracted muscle carries out movement while relaxed muscle restores to original position upon its contraction |
| **Total** | 2 |

(b) (i) Identify the two myofilaments pictured in the diagram. (2 marks)

|  |  |
| --- | --- |
| **names** | **Marks** |
| A- Actin  | 11 |
| B- Myosin  |
| **Total** | 2 |

 (ii) The sliding filament theory has been proposed to explain muscular contraction. Briefly describe the sliding filament theory. (5 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Any five of: |  |
| Actin and myosin slide over one another | 1-5 |
| Filaments overlap |
| Myosin heads attach to actin – cross bridges |
| Myosin heads move to draw Z lines closer |
| Z lines draw closer together |
| Sarcomere shortened |
| Actin and myosin stay the same length |
| Requires ATP |
| **Total** | 5 |

**Question 40 (20 marks)**

(a) Describe the process of deamination and explain its importance in the removal of waste. (6 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
|  |  |
| Removal of amino group from amino acids  | 4Any 2 |
| Enzyme controlled process  |
| Once amino group removed amino acid converted to ammonia  |
| Ammonia (quickly) converted to urea |
| **Importance** |
|  |
| Excess protein cannot be stored |
| Ammonia highly toxic |
| Must be removed from the body or cell death occurs |
| **Total** | 6 |

(b) Starting with the afferent arteriole, explain how glomerular filtrate becomes urine under the headings of filtration, reabsorption and secretion. (14 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
|  |  |
| ***Filtration***  | 1-51-511-3 |
| Blood enters glomerulus via afferent arteriole |
| Fluid forced out of blood into glomerular capsule/ Bowman’s capsule |
| Blood in glomerulus under high pressure |
| High pressure caused by afferent arteriole diameter wider than narrow efferent arteriole  |
| Water and dissolved blood components enter capsule to form filtrate |
| Filtrate does not contain blood cells & protein |
| Blood cells & protein are too large to be forced through membranes |
| Filtrate mainly contains water, sodium and other ions, glucose, urea and amino acids |
|  |
| ***Reabsorption***  |
| Substances removed from filtrate into peritubular capiliaries  |
| Substances of use to the body are reabsorbed throughout the tubule |
| Long tubule provides large surface area for reabsorption |
| Almost all water is reabsorbed  |
| All glucose reabsorbed |
| All amino acids reabsorbed |
| Most urea not reabsorbed |
|  |
| ***Secretion***  |
| Unwanted substances removed from blood into filtrate |
| Can be active or passive |
|  |
| ***Urine composition*** |
| Urine contains mainly water |
| Sodium and other ions not required by body are in urine |
| No glucose or protein should be in the urine |
| Urea and other waste products are removed from the body in urine |
| **Total** | 14 |

**Question 41 (20 marks)**

(a) Explain the process of blood clotting that has just occurred. (8 marks)

|  |  |
| --- | --- |
| **Explanation**  | **Marks** |
|  | 1-8 |
| Blood vessels constrict |
| Reducing blood flow to the injured area |
| Internal walls of blood vessels become rough |
| Platelets stick to internal surface of blood vessels |
| Plug forms |
| Soluble plasma proteins (clotting factors) initiate clotting |
| Fibrin threads form a mesh |
| Mesh traps blood cells, platelets and plasma |
| Clot forms and blood loss stopped |
| **Total** | 8 |

(b) Why is it important for him to advise the hospital staff of his blood type before receiving a transfusion? (4 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
|  | Any 4 |
| The man is type A and has antigen A on the surface of his red blood cells |
| People with Type A blood produce B antibodies |
| People with Type A blood DO NOT produce A antibodies |
| Therefore it is possible for the man to receive a blood type that reacts against his own blood type  |
| such as B or AB that contain B antigens |
| Mixing blood types can lead to clumping/ agglutination |
| **Total** | 4 |

(c) Name and give a brief description of four (4) types of blood transfusion that a person may have. (8 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| **1 mark per name of transfusion****1 mark per description**  |  |
| 1-8 |
|  |
| **Whole blood** |
| Blood as it is taken from donor |
| Anti-clotting agents added |
| Used in severe blood loss |
| OR |
| **Red blood concentrate** |
| Most common type of transfusion |
| Blood is centrifuged to allow cells to be separated from plasma |
| Used in cases of severe anaemia |
| OR |
| **Platelet concentrate** |
| Given to patients with low platelets |
| Given to prevent bleeding |
| OR |
| **Plasma**  |
| Liquid part of blood |
| Given to people who may have trouble clotting |
| Given to people with liver disease |
| OR |
| **Immunoglobulins**  |
| Given to patients who have no immunity to disease |
| Used for people who need particular antibodies |
| **OR** |
| **Autologous transfusion** |
| Patients own blood |
| Blood taken before surgery in case it is needed |
| Prevents transmission of disease |
| Reduce cultural issues involved with blood donation |
|  |
| **Total** | 8 |

**Question 42 (20 marks)**

Bone and cartilage are two types of connective tissue.

(a) Describe the microscopic structure of bone. (8 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
|  | Any 8 |
| **Compact bone** |
| Contains osteons/ Haversian systems |
| Central/ Haversian canal in the centre of each |
| Central canals contain blood vessels and nerves |
| Concentric rings named lamellae surround central canal |
| Lacunae- small spaces in the lamellae |
| Lacunae contain osteocytes/ bone cells |
| Canaliculi run between lacunae (for exchange of materials) |
| **Spongy/ cancellous bone** |
| Irregular network of trabeculae  |
| Bone cells occupy spaces in trabeculae |
| Lamellae not in concentric layers |
| Blood and nerves run through spaces |
| **Total** | 8 |

(b) There are several different types of cartilage found in the body. Briefly discuss the main functions of cartilage and explain why cartilage may take longer to heal than bone. (4 marks)

|  |  |
| --- | --- |
| **Function** | **Marks** |
|  |  |
| Reduce friction | Any 2Any 2 |
| Provide structural support  |
| Shock absorption |
| Flexibility  |
| **Explanation** |
|  |
| Cartilage is avascular |
| Receives nutrients via diffusion |
| Slow process therefore healing slow |
| **Total** | 4 |

(c) As we age, our bones can deteriorate. Name and describe two (2) conditions that affect our bones as we age.

 Include in your answer the name of the condition, the cause, symptoms and an appropriate treatment for each. (8 marks)

|  |  |
| --- | --- |
| **Name & Description** | **Marks** |
| **Osteoporosis**  | 1Any 1Any 1Any 11Any 1Any 1Any 1 |
| **Cause** |
| Loss of bone density |
| Bones become brittle |
| Increased risk of fracture |
| **Symptoms** |
| Fracture often first symptom/stooped posture |
| **Treatment** |
| Increase calcium intake/ increase exercise/ increase vitamin D |
|  |
| **Osteoarthritis**  |
| **Cause** |
| Cartilage deteriorates |
| Surfaces have no protection |
| Bony spurs develop at the ends of bones |
| **Symptoms** |
| Patient feels pain in affected joint/s |
| Patient feels stiffness/ difficulty moving joint  |
| **Treatment** |
| ~~M~~edication: anti-inflammatory & pain |
| Surgery to replace joint |
| **Total** | 8 |