**HUMAN BIOLOGY**

**UNIT 1&2**

**EDWEST Semester 2 Examination 2017**

**Marking Key**

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

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

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

**Question 31**

(a) Explain how the stomach can both chemically and mechanically digest food. (3 marks)

|  |  |
| --- | --- |
| **Explanation** | **Marks** |
| Mechanical digestion achieved by stomach muscles | 1 |
| Muscles churn food mixing with digestive juices | 1 |
| Chemical digestion achieved by enzymes/ pepsinogen | 1 |
| **Total** | 3 |

(b) Bile is a fluid which is important in the digestion of fat. Describe the function of bile and explain its importance in fat digestion. (3 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Emulsifies fat/ breaks down large fat molecules into small fat molecules | 1 |
| **Explanation** |  |
| Increases the surface area for fat digestion | 1 |
| Increases the rate of fat digestion | 1 |
| **Total** | 3 |

(c) Describe four (4) features of the small intestine that allow it to carry out this function efficiently. (4 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Any 4 |  |
| Small intestine is very long/ 6m long | 1 |
| Folded surface | 1 |
| Contains villi | 1 |
| Contains microvilli | 1 |
| Highly vascular/ blood flow through capilaries | 1 |
| **Total** | 4 |

d) Describe three (3) differences between diffusion and active transport.

(3 marks)

|  |  |  |
| --- | --- | --- |
| **Description** | | **Marks** |
| ***Diffusion*** | ***Active transport*** |  |
| Passive process/ no energy required | Active process/ energy required | 1 |
| Movement of particles down the concentration gradient | Movement of particles against the concentration gradient | 1 |
| Movement from high to low concentration | Movement from low to high concentration | 1 |
| **Total** | | 3 |

**Question 32**

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

(must state both variable for the mark)

|  |  |
| --- | --- |
| **Hypothesis** | **Marks** |
| An increase in fluid consumption | 1 |
| Will lead to an increase in urine production | 1 |
| **Total** | 2 |

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

|  |  |
| --- | --- |
| **Variable** | **Marks** |
| ***Independent***- amount of urine produced | 1 |
| ***Dependent***- volume of fluid consumed | 1 |
| **Total** | 2 |

c) Was the experiment valid? Justify your answer. (2 marks)

|  |  |
| --- | --- |
| ***Validity*** | **Marks** |
| Yes | 1 |
| ***Justification*** |  |
| The experiment tested what the scientists set out to test | 1 |
| OR | OR |
| ***Validity*** |  |
| No | 1 |
| ***Justification*** |  |
| Non-random sample/ not representative of the entire population/ smple size too small | 1 |
| **Total** | 2 |

(d) Were the results gained from the experiment reliable? Justify your answer. (2 marks)

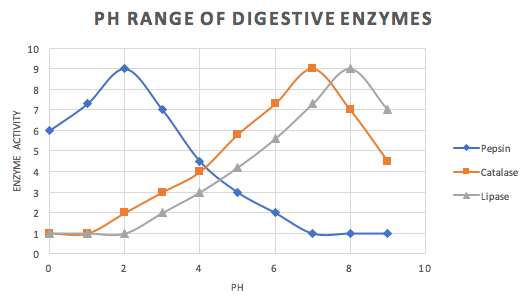
|  |  |
| --- | --- |
| ***Reliability*** | **Marks** |
| Yes | 1 |
| ***Justification*** |  |
| 30 volunteers took part, carried out over 5 matches (repeated) | 1 |
| **Total** | 2 |

(e) Identify two (2) areas of this investigation where the scientists may have breached the university’s ethical standard. (2 marks)

|  |  |
| --- | --- |
| **Identify** | **Marks** |
| Only discussed benefits/ did not discuss risks | 1 |
| Discussed the results with people other than those involved/ breached the volunteer’s privacy contract | 1 |
| **Total** | 2 |

**Question 33**

Activity of Digestive Enzymes Over pH Range



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

|  |  |
| --- | --- |
| **Description** | **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 conclusion for this investigation. (2 marks)

|  |  |
| --- | --- |
| **Conclusion** | **Marks** |
| The hypothesis was supported | 1 |
| Each enzyme is most active at its optimum pH | 1 |
| **Total** | 2 |

c) Explain the importance of bicarbonate ions in pancreatic juices. (3 marks)

|  |  |
| --- | --- |
| **Explanation** | **Marks** |
| Bicarbonate neutralises stomach contents entering small intestine | 1 |
| Provides correct pH for pancreatic enzymes | 1 |
| If pH not increased this would denature pancreatic enzymes | 1 |
| **Total** | 3 |

(d) Name two (2) possible factors that she might investigate in a future experiment? (2 marks)

|  |  |
| --- | --- |
| **Name** | **Marks** |
| Specificity, temperature, concentration of enzymes, concentration of substrate, inhibitors (any two reasonable) | 2 |
| **Total** | 2 |

**Question 34**

(a) Name and describe the structure marked X. Briefly outline its function. (3 marks)

|  |  |
| --- | --- |
| **Name** | **Marks** |
| Glomerulus | 1 |
| **Description** |  |
| Knot of blood capillaries | 1 |
| **Function** |  |
| Filtration of blood | 1 |
| **Total** | 3 |

(b) Give two ways the nephrons improve efficiency by increasing surface area (2 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Long loop of Henle | Any 2 |
| Two convolutions |
| Over 1 million nephron per kidney |
| **Total** | 2 |

(c) (i) Identify one (1) substance which is present in glomerular filtrate but not normally present in urine. (1 mark)

|  |  |
| --- | --- |
| **Identify** | **Marks** |
| Glucose/ protein | 1 |
| **Total** | 1 |

(ii) What might the presence of this substance indicate. (1 mark)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Diabetes/ kidney disease | 1 |
| **Total** | 1 |

**Question 35**

(a) Complete the table below to correctly identify the name of the organelle or its function. (4 marks)

(1 mark per answer)

|  |  |
| --- | --- |
| ***Organelle*** | ***Function of organelle*** |
| ***Golgi body/ apparatus*** | Modification of proteins |
| Lysosome | ***Breaks down materials/ worn out organelles*** |
| Mitochondria | ***Involved in the function of aerobic respiration*** |
| ***Ribosome*** | Site at which amino acids are joined together to make proteins. |

(b) (i) Describe the structure of the cell membrane. (3 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Phospholipid bilayer/ two layers | 1 |
| Hydrophilic heads & hydrophobic tails | 1 |
| Embedded with proteins/ cholesterol | 1 |
| **Total** | 3 |

(ii) Outline three (3) functions of the cell membrane. (3 marks)

|  |  |
| --- | --- |
| **Functions** | **Marks** |
| Physical barrier/ separates the extra and intracellular space | Any 3 |
| Regulates movement of materials into and out of cell |
| Detects changes to the extracellular environment |
| Supports cell |
| **Total** | 3 |

**Question 36**

(a) Name the structures labelled A, B and C in the diagram. (3 marks)

|  |  |
| --- | --- |
| **Structures** | **Marks** |
| A- Spongy/ cancellous bone | 1 |
| B- Yellow bone marrow/ medullary cavity | 1 |
| C- Compact bone | 1 |
| **Total** | 3 |

(b) Compare and contrast the structures labelled A and C. (6 marks)

|  |  |
| --- | --- |
| **Compare** | **Marks** |
| Both connective tissue | Any 2 |
| Both contain osteocytes and lamellae |
| Both contain blood supply and nerve |
| **Contrast** |  |
| Compact bone arranged in concentric rings | Any 2 comparrisons @2 each |
| Spongy bone is irregular |
| Compact bone contains a central canal with blood vessels and nerves running through |
| Spongy bone has blood supply and nerves passing through irregular spaces |
| Compact bone is more dense/ stronger than spongy bone |
| Spongy bone contains red bone marrow |
| **Total** | 6 |

**Question 37**

(a) Name the joints labelled A and B and give an example of where they might be found in the body. (4 marks)

|  |  |  |  |
| --- | --- | --- | --- |
|  | **A** | **B** | **Marks** |
| **Name of joint** | Hinge joint | Ball and socket joint | 1 per name |
|  |  |  |  |
| **Example in body** | Knee, Elbow | Hip, shoulder | 1 per example |
| **Total** | | | 4 |

(b) Identify the type of cartilage found in the trachea. Describe its structure and its function. (3 marks)

|  |  |
| --- | --- |
| **Identify** | **Marks** |
| Hyaline | 1 |
| **Structure** |  |
| Condrytes embedded in cartilage matrix | 1 |
| **Function** |  |
| Keep the trachea open at all times/ prevent the trachea closing thus ensuring air flow into the lungs | 1 |
| **Total** | 3 |

(c) Describe what causes the pain felt by a person with osteoarthritis and suggest an appropriate treatment. (3 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Degeneration of articular cartilage | 1 |
| Bone rubs on bone | 1 |
| **Treatment** |  |
| Pain relief/ anti-inflammatory medication | Any 1 |
| Joint replacement (do not accept limb) |
| **Total** | 3 |

**Question 38**

(a) Compare DNA and RNA molecules. (4 marks)

|  |  |  |
| --- | --- | --- |
| **Comparison** | | **Marks** |
| DNA double helix | RNA single strand | Any 4 |
| DNA contains deoxyribose sugar | RNA contains ribose sugar |
| DNA adenine pairs with thymine | RNA adenine pairs with uracil |
| DNA cannot leave nucleus | RNA can leave the nucleus |
| DNA and RNA are both made up of nucleotides | |
| **Total** | | 4 |

(b) Outline the process of translation. (6 marks)

|  |  |
| --- | --- |
| **Outline** | **Marks** |
| Ribosome binds to mRNA | Any 6 |
| Ribosome begins reading mRNA codons |
| A group of three bases is a codon |
| tRNA anticodons code for amino acid |
| Ribosome matches tRNA anticodons to complementary codon |
| Peptide bond binds amino acids together |
| Forming a polypeptide/ protein |
| **Total** | 6 |

(c) Explain why mtDNA is only inherited from the mother’s lineage. (2 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| mtDNA of father contained in tail of sperm | 1 |
| Tail of sperm cell is destroyed at fertilisation/ does not enter ovum | 1 |
| **Total** | 2 |

**Question 39**

(a) In the space below, draw a punnet square to show the chance of these new parents having a child with DMD. (2 marks)

XD Xd 1 mark for gametes

XD XDXD XDXd 1 mark for offspring

Y XDY XdY

(b) As a percentage, what is the chance that their child will have DMD. (1 mark)

|  |  |
| --- | --- |
|  | **Marks** |
| 25% | 1 |
| **Total** | 1 |

(c) What is their son’s genotype? (1 mark)

|  |  |
| --- | --- |
| **Genotype** | **Marks** |
| XDY | 1 |
| **Total** | 1 |

(d) Is there a chance that their son will go on to have a child with DMD? Justify your answer. (3 marks)

|  |  |
| --- | --- |
|  | **Marks** |
| No | 1 |
| if he has a child with a woman who is not a carrier | 1 |
| there is a 0% chance that he will have a child with DMD | 1 |
| OR | OR |
| Yes- | 1 |
| if he has a child with a woman who is a carrier | 1 |
| there is a 25% chance that he will have a child with DMD | 1 |
| **Total** | 3 |

**Question 40**

(a) Explain how a cancerous mass forms. (2 marks)

|  |  |
| --- | --- |
| **Explanation** | **Marks** |
| Uncontrolled cell division of abnormal cells | 1 |
| Mutated genes | 1 |
| **Total** | 2 |

(b) Some cancers are caused by carcinogens. Give an example of a carcinogen. (1 mark)

|  |  |
| --- | --- |
| **Example** | **Marks** |
| x-rays, UV light, tobacco smoke, asbestos (any reasonable example) | 1 |
| **Total** | 1 |

(c) Lifestyle choices can help prevent some types of cancer. List three ways in which a teenager can reduce their risk of developing skin cancer. (1 mark)

|  |  |
| --- | --- |
| **List** | **Marks** |
| Apply sunscreen, wear a hat / protective clothes, stay out of the sun (all three (3) for 1 mark) | 1 |
| **Total** | 1 |

(d) Identify one type of cancer that woman are routinely screened for after the age of 40 and state the screening method that is used. (2 marks)

|  |  |
| --- | --- |
| **Identify** | **Marks** |
| Breast cancer/ cervical cancer | 1 |
| **Screening method** |  |
| Mammogram/ pap smear | 1 |
| **Total** | 2 |

(e) Explain why a weak flow of urine might be experienced by men who have developed prostate cancer. (4 marks)

|  |  |
| --- | --- |
| **Explanation** | **Marks** |
| Prostate gland located under the bladder and surrounds the top of the urethra | 1 |
| Enlarged gland due to tumour growth | 1 |
| Reduces the diameter of/ presses on the urethra | 1 |
| Less urine can be passed out of the body/ may have a weak urine flow and urinate more frequently | 1 |
| **Total** | 4 |

**Question 41**

(a) Discuss the structural similarities shared by the villus and the alveoli and explain how these structures increase the surface area of the lungs and the small intestine. (7 marks)

|  |  |
| --- | --- |
| **Discussion** | **Marks** |
| Both only 1 layer of cells thick/ thin walls | 1 |
| Both are microscopic structures | 1 |
| Both are found in large numbers in the body | 1 |
| Both are in direct contact with a large capillary network | 1 |
| **Explanation** |  |
| Alveoli are tiny air sac inside the lungs and villi are tiny projections of the small intestine | 1 |
| The smaller the structure, the larger the surface area to volume ratio | 1 |
| The larger the surface area to volume ratio the more efficient diffusion becomes | 1 |
| **Total** | 7 |

(b) Red blood cells play an important role in the body. Describe the structure of red blood cells and explain why this structure allows the red blood cells to carry out its function efficiently. (6 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Biconcave disc | 1 |
| No nucleus | 1 |
| Contain haemoglobin | 1 |
| **Explanation** |  |
| Biconcave structure increases the surface area | 1 |
| No nucleus increases the available space for haemoglobin molecules | 1 |
| Haemoglobin increases the oxygen carrying capacity of red blood cells | 1 |
| **Total** | 6 |

(c) Discuss how gas exchange takes place as a red blood cell reaches the alveoli. (7 marks)

|  |  |
| --- | --- |
| **Discussion** | **Marks** |
| RBC is low in oxygen upon reaching the alveoli | Any 7 |
| RBC is high in carbon dioxide upon reaching alveoli |
| Alveoli is high in oxygen |
| Alveoli is low in carbon dioxide |
| Oxygen diffuses from the alveoli into the RBC |
| RBC has high affinity for oxygen due to the presence of haemoglobin |
| Carbon dioxide diffuses into the alveoli from the RBC |
| Concentration gradient maintained by constant airflow and movement of blood in capillaries |
| **Total** | 7 |

**Question 42**

(a) Name and describe four (4) ways in which variation is brought about during the formation of gametes. (12 marks)

|  |  |
| --- | --- |
|  | **Marks** |
| **Random assortment of chromosomes/ independent assortment** | 1 |
| Separation of homologous pairs | Any 2 |
| Occurs at random |
| Over 8 million combinations possible in humans due to 23 pairs of chromosomes |
| **Crossing over** | 1 |
| Chromatids break and reattach to different homologous chromosomes | Any 2 |
| Takes place at chiasma |
| New combinations of alleles produced/ recombinant |
| **Non-disjunction** | 1 |
| Failure of homologous pairs to separate at anaphase | Any 2 |
| Can result in one too many or one too few chromosomes in each gamete |
| Can results in Down’s syndrome/ Turner’s/ Kleinfelter’s |
| **Random fertilisation** | 1 |
| One of millions of sperm will fertilise an egg | Any 2 |
| Unique egg is released |
| No possible way to determine which egg will be fertilised or which sperm will fertilise the egg |
| **Total** | 12 |

(b) Epigenetics is the study of factors that affect gene expression without changes being made to the genetic code of that organism.

Explain why the study of identical twins important in the understanding of epigenetics. (4 marks)

|  |  |
| --- | --- |
| **Explanation** | **Marks** |
| Identical twins are genetically identical | Any 4 |
| One sperm fertilised one egg and the egg split at an early stage |
| As they age, differences appear despite identical genome |
| Environment impacts the genes that are expressed |
| Factors such as diet, lifestyle, stress |
| Therefore, despite being genetically the same, difference will be apparent due to epigenetics |
| **Total** | 4 |

(c) Embryonic stem cell research has huge potential in the treatment of human diseases. Give two (2) arguments for and two (2) arguments against embryonic stem cell research. (4 marks)

Accept reasonable arguments for and against

|  |  |
| --- | --- |
| **For** | **Marks** |
| Can produce new tissues and organs without fear of rejection | Any 2 |
| The blastocysts are often surplus from IVF which would be destroyed and therefore using for research gives them value |
| Have the potential to reduce human suffering |
| No difference between using for research and the morning after pill |
| **Against** | Any 2 |
| Destroying embryos during research devalues human life |
| Very expensive |
| Benefits are still only potential |
| Other sources of stem cells available- IPS, Adult |
| **Total** | 4 |

**Question 43**

(a) Using the bicep and triceps as an example, explain why these muscles are referred to as antagonists and describe how they work together to bring about the movement of the radius and ulna. (8 marks)

|  |  |
| --- | --- |
| **Explanation** | **Marks** |
| They produce opposite movements to one another | Any 1 |
| Referred to agonists because they move in opposite directions |
| **Description** | Any 7 |
| Bicep is attached to the shoulder (scapula) and the radius |
| Triceps is attached to the shoulder (scapula) and the ulna |
| Muscles attached to bone by tendons |
| Bicep contracts causing the arm to bend |
| Triceps is relaxed when arm is bending |
| Triceps contracts causing the arm to straighten |
| Bicep is relaxed when arm is straight |
| Muscle becomes short and think while contracted |
| Muscle becomes long and thinner when relaxed |
| Bending arm- bicep is the agonist and triceps is the antagonist |
| Straightening arm- triceps is agonist and bicep is antagonist |
| **Total** | 8 |

(b) The sliding filament theory was proposed to explain the movement described in part (a) of this question on a microscopic level. Briefly describe the sliding filament theory. (5 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Any five of: |  |
| Cross bridge formation | 1-5 |
| Actin filaments and slide over myosin due to myosin head movement |
| Filaments overlap |
| Z lines draw closer together |
| Sarcomeres shorten causing muscle contraction |
| Actin and myosin stay the same length |
| Requires ATP |
| **Total** | 5 |

(c) Compare and contrast aerobic and anaerobic respiration. Include in your answer where they take place within the cell and the products produced by each process. (7 marks)

|  |  |  |
| --- | --- | --- |
| **Both** | | **Marks** |
| Require glucose as the main respiratory substrate | | Any 3 |
| Fats and proteins can also be used as respiratory substrate | |
| Produce ATP | |
| Both processes begin with glycolysis | |
|  | |
| **Aerobic** | **Anaerobic** | Any 4 |
| Takes place in the mitochondria | Takes place in the cytoplasm |
| Only takes place in the presence of oxygen | Takes place without the need for oxygen/ low oxygen |
| 36-38 ATP produced | 2 ATP produced |
| Carbon dioxide and water are the end products | Lactic acid is the end product |
| Complete oxidation of glucose | Incomplete oxidation of glucose due to lack of oxygen |
| **Total** | | 7 |

**Question 44**

(a)Name and describe the most likely assisted reproductive technology that the doctor suggested to the couple. Explain why this method could result in pregnancy despite the woman’s’ blocked fallopian tubes. (8 marks)

|  |  |
| --- | --- |
| **Name & Description** | **Marks** |
| **In-vitro Fertilisation (IVF)** | 1 |
| Eggs are removed from the woman’s ovary | Any 4 |
| Sperm is obtained from the male |
| The sperm is used to fertilise the woman’s egg (in a glass dish) in a laboratory |
| After fertilisation, the cells are monitored for signs of cell division |
| Once the cells are dividing, they are transferred into the woman’s uterus |
| **Explanation** |  |
| By removing the sperm and egg and fertilising outside of the woman’s body, the blockage is bypassed | Must state  1 |
| The woman and man have healthy eggs are sperm | Any 2 |
| The sperm would not reach the egg due to the blockage |
| The eggs would not be able to travel down the fallopian tube due to the blockage |
| **Total** | 8 |

(b)Suggest two (2) lifestyle choices that she could adopt to promote a healthy outcome from her pregnancy. You must give an explanation for the suggestion you have made. (6 marks)

|  |  |
| --- | --- |
| **Suggestion and explanation** | **Marks** |
| **Healthy maternal diet** | 1 |
| Folic acid for healthy brain development | Any 2 |
| Adequate calcium for bone growth |
| An adequate supply of nutrients to fuel the mother and allow her growing baby to develop |
| OR |  |
| **Do not drink alcohol** | 1 |
| Malformation of foetus if drinking while pregnant | Any 2 |
| Foetal alcohol syndrome |
| Low birth weight linked to alcohol consumption during pregnancy |
| OR |  |
| **Do not smoke while pregnant** | 1 |
| Smoking is linked to low birthweight babies | Any 2 |
| Smoking also linked to increased chance of miscarriage |
| Respiratory issues in the newborn linked to smoking during pregnancy |
| Increased chance of sudden infant death syndrome |
| OR |  |
| **Prescription medication and other pharmaceuticals** | 1 |
| Must be taken under the advice of a doctor as these can cause malformation in an unborn baby | Any 2 |
| They can cross the placenta and cause birth defects in unborn babies |
| Thalidomide as an example |
| **Total** | 6 |

(c) The two (2) screening techniques that will be used are ultrasound and amniocentesis. Describe these screening techniques and state what information can be collected on the growing foetus to show that it is developing as it should. (6 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| ***Ultrasound*** |  |
| High frequency sound waves used to produce an image of foetus | Any 3 |
| Sound waves reflected off of the foetal tissue |
| Image produced on computer screen |
| Physical abnormalities can be detected |
| Measurements of limbs, brain and head can be taken to show that the baby is growing and developing normally |
| ***Amniocentesis*** |  |
| A sample of amniotic fluid is removed | Any 3 |
| The fluid contains foetal cells |
| A karyotype (picture of the foetal chromosomes) can be produced |
| Missing/ additional/ abnormal chromosomes can be detected. |
| Down’s syndrome, cystic fibrosis, spina bifida are example of disorders that can be detected using amniocentesis |
| **Total** | 6 |